Cities, Growth and Housing: Essays on Urban Political Economy

by

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Abstract

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This dissertation explores changes in cities at the onset of a new millennium from different planning prisms, perspectives and geographies. Planning is about accommodating to–even shaping–long term political-economic trajectories. Cities grow, bringing challenges to managing infrastructures, politics and even neighborhoods as they are affected by new waves of infill development, encouraged by state-level policies critical of the sprawl paradigm as it evolved in the post-war years. Other cities lose population due to complex changes in the economy and beyond. Chapter 1 engages with urban modeling knowledge, from the perspective of a regional planning agency charged with making sense of the changing region. Chapter 2 examines the potential for spillovers of new market rate housing on local prices for ownership housing, while Chapter 3 studies a change in how housing subsidies are assessed for voucher holders for rental housing. Lastly, Chapter 4 engages the conceptual debate of shrinking cities, arguing for appropriate analytical clarity.

Chapter 1 engages growth projections as a piece of planning practice. Carrying out growth projections decades into the future is often a highly technical exercise involving models based on complicated econometric relationships, estimated based on observed data for the region in question. At the same time, the future of a region is not exclusively a quantitative exercise but a decidedly *normative* one related to the core of the planning discipline: looking forward, setting design parameters, anticipating challenges and addressing them, or *making* the future more than just *describing* it. Thus the core dilemma of the projections work: between describing the world such as it is and how it might evolve, and the world such as it should be, in a normative-planning sense. Questions of urban epistemology abound: How to make “objective“ projections when the future is so much of a normative, design driven exercise?

Based on review of historical documents as well as observation from within the agencies charged with preparing projections, we analyze the long term shift in projections as a planning practice for the San Francisco Bay Area. We characterize the projections work as straddling different knowledge domains, and highlight key analytical dilemmas in their preparation, particularly as the role of projections has transitioned from being a standalone

informational report to being part of a state-mandated regional planning process with higher stakes and visibility. We identify different styles between the agencies working to prepare them, themselves caught between quantitative modalities and more design-driven sensibilities. The work of projecting, while having substantial technical features, cannot be reduced to a technical exercise alone, and must embrace the complications of being neither purely technical or purely design-focused, but a complex hybrid knowledge product requiring buy-in from a large number of stakeholders.

Chapter 2 focuses on housing spillovers. California is in the midst of a state-driven redirection of regional planning with a joint focus on realigning the state's urban regions towards more infill development as a way to handle transportation demand and reduce greenhouse gases. As infill is encouraged and envisioned as a way to solve planning challenges, questions arise about what the impact of infill on those areas will be: As displacement and gentrification concerns are voiced by many, will the new additions to the housing stock help lower housing prices in those neighborhoods, or might it conversely be a contributor to gentrification through theoretically plausible spillover effects? Empirically, I focus on spillovers, seeking to measure the effect of new supply on sales of the existing multi-family housing stock. Using data from 20 years of arms-length home sales, I examine the San Francisco Bay Area housing market using a series of hedonic regressions relating sales prices to characteristics of not just transacting properties and neighborhoods in general, but with an emphasis on access to new housing in particular. Employing both continuous and discrete difference-in-differences estimators I find support for the conventional view that more housing production leads to a modest decrease in nearby prices, with some exceptions when assessing heterogenous effects of different price tiers of development. Findings suggest new housing is critical, but much caution will be needed to ensure neighborhood price stability of the existing stock.

Chapter 3 engages rental markets following a change in U.S. Department of Housing and Urban Development's (HUD) technical process for determining rent subsidies. The transition from metro-scale to the detailed Small Area Fair Market Rent (SAFMRs) holds great promise in offering subsidies to voucher holders that can better match prices in actually existing housing markets, with much local variation. This potentially opens up more high-opportunity areas to the program's users. A large-scale assessment of this key rental housing policy has been difficult due to paucity of current national yet sufficiently local, datasets describing rental housing markets. Using recent and spatially comprehensive rental data from Craigslist, a listing website that includes housing, I analyze HUD data for 2,600 FMR areas nationwide and show rental gaps between the actual cost of rentals and the subsidy ceiling. I report on both the areas selected for the SAFMRs as well as those not selected. Based on our findings, I argue that more areas should be included in the program if appropriate safeguards can be instituted.

Chapter 4 engages critically with the concept of shrinking cities. Shrinking cities on several continents beset with sustained population losses have been the focus of a number of studies in the past decade, marking an increasing awareness that growth should not be the only preoccupation of planners. Since the Great Recession of 2006-2008, research has widened the map and shown shrinkage even in the Sun Belt cities of California in connection with the recession, leading some researchers to conclude new geographic fault lines for shrinkage. While these works, which have provided such information, are welcome additions to the literature, in this study I will proceed from the observation that the term "shrinkage" has been used for cities as diverse as Flint, Michigan and San Francisco and San Jose in California. Consequently, I will examine the concept of shrinkage and argue that, while the term's heterogeneity and flexibility are crucial to the productive employment of the concept, we must, nevertheless, tighten its definition and its application. Otherwise, we risk watering it down to the point where it is no longer useful to describe the vastly different trajectories of differing cities. The study will conclude with reflections on the appropriateness of local scale to address shrinkage.

To Sylvie, Maren and Ellery,

whom I will finally get to see a bit more,

and to Lency,

who made them possible.

Abbreviations

ABAG	Association of Bay Area Governments
ACS	U.S. Census Bureau American Community Survey
CBSA	Core-Based Statistical Area
FMR	Fair Market Rents
HUD	U.S. Department of Housing and Urban Development
MAFMR	Fair Market Rents (Metro Area)
MTC	Metropolitan Transportation Commission
PDA	Priority Development Area
PHA	Public housing authority
SAFMR	Small Area Fair Market Rents (ZCTA Area)
SB375	California Senate Bill 375 (2008, Steinberg)
VMT	Vehicle Miles Traveled

Acknowledgments

Planning is a wonderfully conflicted activity at the borderlands of action and reflection. It is an inherently practical endeavor of observing, analyzing, understanding and, for the lucky ones, influencing the world at large, even if a small bit. My years at Berkeley have reminded me of this connection at countless times.

My time in Copenhagen, Denmark, and before that, the smaller town of Slagelse whetted my appetite for understanding cities in all their wonderful complexity better, as places to live, work, gather and to get around. My mother let me roam my own smaller town early on, letting me experience it as it should be, by bicycle and foot. My Danish family, and particularly my brother Andreas was often there with me pedaling next to me, in more ways than one. Thanks for always being there.

I am grateful for the Department of City and Regional Planning for their support throughout my time at UC Berkeley. In particular, I want to thank my Dissertation Chair Paul Waddell, who inspired me to seek and grow my interest at the borderlands between the conceptual, the technical and the practical each representing different, though connected parts of my academic and professional life the past decade and a half. He managed to pull me back when I strayed too far from the large umbrella of planning research to planning practice in my daytime job, reminding me there would be plenty of time for that *after* finishing the dissertation. I am glad he persisted.

Karen Chapple offered advice and instructive GSI work which had me coming back for more the next year. I learned a great deal both from her vast knowledge of the economic development field as well as, as importantly, how she engaged the students in the classroom, thoughtfully probing them to ask the right questions. I also appreciated her tongue in cheek comments, typically related to me delaying our meetings.

Carolina Reid encouraged my housing and HUD analyses, offered analytical insights, and always appreciated the dilemmas of working in the borderlands between academia and practice, something that struck a chord with me.

My outside member Enrico Moretti broadened my view to yet another discipline, urban economics, and assured me in so many words that for all the formalism of economics, there were great questions to be tackled, including by non-economists. I appreciated that cross-disciplinary spirit.

One of the great joys at Berkeley was my student colleagues, companions on the journey. My writing group, most frequently featuring Jesus Barajas, Lisa Rayle and Miriam Solis, was a great catalyst both to get me to think about fledgling urban arguments as well as how to sort out how to set coordinate systems and transformations on shapefiles in R. Both were equally welcome. Other partners in crime included cohort members Jesus Barajas, Heather Arata, Keith Lee, Alice Sverdlik, Ariel Bierbaum and particularly Matt Wade. The ongoing encouragement, discussions and partnerships will be remembered warmly. Other graduate students (Fletcher Foti, Geoff Boeing and Sam Maurer) made it all a bit more fun when lunch time came.

This work was also in many ways a product of my professional life which I never quite managed to put in the background, always beckoning me away from my academic pursuits. I began the program while working at San Francisco Planning Department where I had initially learned the ropes of U.S. planning practice, and where Scott Edmondson kept me inspired, Teresa Ojeda kept me busy, Neil Hrushowy kept me company and Mike Webster kept me equipped with uncanny GIS data. My next stop was the Association of Bay Area Governments in Oakland, just as it was finding itself saddled with changing mandates but not authority, and most recently, at the Metropolitan Transportation Commission in San Francisco, where we are in a true sense busy making strategies for the regional future. Much thanks is due to Cynthia Kroll for keeping me engaged with Berkeley priorities even as the daily work tasks related to the region's development kept my mind away from them. I feel fortunate to have enjoyed these intellectually stimulating environments to focus on core regional challenges, and how we can measure, model and ameliorate them.

Lastly, as this project has grown slowly, my family has overtaken it. When I started, Sylvie was ta toddler and forced me to think of planning and neighborhood walkscores on our trips to the park, the library, and the bakery. Three months into the program, Maren came along and put the geography of child care on my radar. Quite a few more years later than I'd like to admit into the program, baby Ellery came knocking, and the question of adequate housing became rather acute in a two-bedroom house, hence upgraded, but alas, with a downgrade in walkability. Trade-offs abound in housing.

Through it all, Lency was there, doing dishes more times than was fair, encouraging me when the grade seemed steep, and the journey frivolous. For that and much more I am indebted to her: *Jeg elsker dig!* I hope I can pick up the slack in earnest now.

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Introduction

> It is evident that each great movement of population, in sum, presents a new opportunity and a new task, and wisdom consists in taking advantage of the movement while it is still fluid. Lewis Mumford, *The Fourth Migration*, 1925.

Lewis Mumford's wisdom, per the above quote, rings eternally true. Flows of population remake cities and regions, even nations, responding to difference in living conditions, expectations for the future, and economic opportunities. These flows have moved millions from the "rustbelt" to "the sunbelt" as the economic geography of the country has changed in a complicated dance of chicken and egg (Muth, 1971)–did people move because of jobs, or did jobs move because of people? Irrespective of causes, both took place, likely in a way that was mutually co-determined (Storper, 2013b). Challenges abound for planners on both the sending end where population is lost, but also, perhaps equally, where it is gained. In some of the more economically fortunate regions, such as the San Francisco Bay Area, extraordinarily skilled workers are available, sourced from afar, but housing is scarce and expensive, neighborhoods are transformed in tandem with new influx of talent and money, and displacement competes with traffic as being the most talked about colloquial "planning" issue receiving daily headline in major newspapers and on the minds of residents (EMC Research, 2017b, 2017a). Faced with increased difficulty of finding workers willing to accept job offers in the costly, supply limited San Francisco Bay Area, tech companies are getting into the bread-and-butter planning issues of housing and transportation provision: funding housing directly with a $1Bn grant in the case of Google (Min, 2019), and seeking to restore rail to a bridge across the bay, to access a larger catchment area of workers in the case of Facebook (NBC Bay Area staff, 2019).

As population and employment flows take place, we observe considerable variability on the growth and decline of regions. How do we as planners, often charged with the development and well-being of one community through mostly bland policy tools such as zoning, help shape it–if afforded the opportunity? How do we as planners come to grips with the cities and the mostly invisible economic and political processes that grow and on occasion shrink them under the influence of changing fortunes of cities in the larger global urban political economy (Sassen, 2018)?

Considerable numbers moving to the city for new opportunities creates new urgency, just like it did 100 years ago (Glaeser, 2011a). In mature cities, new flows of population means re-mapping existing neighborhoods, or sprawling on the edges, often both at the same time, requiring careful management and a path between what was and what could be. Concerns of gentrification and displacement abound in the hot coastal housing markets (Zuk, Bierbaum, Chapple, Gorska, & Loukaitou-Sideris, 2018). At the same time it has been suggested that a bigger challenge is the decline and stagnation of countless more neighborhoods across the country (Cortright & Mahmoudi, 2014). Both directions of change present vexing planning problems; managing transitions and spillovers where new housing goes up, and affordable housing availability for residents in general and Section 8 voucher holders in particular.

As regions change, housing looms large as a special long term product defining markets for generations. In shrinking cities, the durability of housing contributes to the busts during downturns as the supply curve is sticky, leading to less reduction and a sharper price response which may exacerbate declining market conditions while making investments in it more risky (cf. Glaeser & Gyourko, 2005).

On the growth side of the market, where economies boom and the supply is conversely inelastic, the lack of housing contributes to above-average price increases for those regions. As well paid younger workers with urban preferences at the same time appear on the scene, increased pressures are put on the housing stock, difficult to adjust quickly in an infill context with time consuming planning reviews and ever-more complicated neighborhood politics thwarting development in general and affordable housing in particular (Scally & Tighe, 2015). Nonetheless, the rise of "smart growth" and state-driven, regionally led planning processes seeking to reduce vehicle miles traveled, particulate matter along with greenhouse gas emissions had led to a new round of regional visioning and thinking, where models do much of the talking, representing processes of neighborhood change at the regional scale, while representing detailed neighborhood dynamics. Changes at the neighborhood scale as well as how planners envision change more generally with models, between quantitative approaches and more vision-based practices call for analytical scrutiny.

This dissertation grapples with questions under that wider umbrella–either on the *cause* side, or *covariate* side, or *consequence* side. Essay 1, *Growth Projections as Planning Practice: Growing the San Francisco Bay Area between the Technical and the Political* focuses on projections work, seeing it as part of planning practice related to *knowing* growth, coming from a procedural standpoint. The planning literature straddles a divide over the quantitative aspects of projections and the more design or vision-focused of the work of estimating the future. Such work can be focused on econometrics or design. In an analysis of the San Francisco Bay Area, the region is changing, but how do planners "know" how cities evolve over the long term, and it is it mainly an aesthetic exercise by regional planners, identifying the equivalent of regional "finger plans," per the more design and diagrammatic focused facets of planning education, or is it more of an econometric exercise?

The chapter traces the longer term development of growth projections, framing them as an important window into planning practice. Projections have become a more prominent and visible knowledge product, with more explicit policy assumptions built in to them. As California has re-imagined regional planning more in line with the smart growth discourse, the policy role of projections in the regional conversation has only increased. This makes the stakes higher for the projections work insofar as they may help frame expectations and anticipations of possible and less possible futures.

The second essay equally takes as a point of departure the renewed focus on regional planning as important to solving state goals. In the context of the State through regional agencies seeking to move more urban growth back to the centers in the form of infill rather than growing at the fringes, fears of induced displacement are prevalent. In the essay 2, *Does New Multifamily Housing Lead to Higher Nearby Prices? On the Localized Effects of Infill Development*, I discuss concerns related to infill-induced gentrification, and the question of the geographies of new housing supply and demand. Building on a longer lineage of studies examining spillovers of mostly affordable housing and a few studies documenting positive spillovers (Ooi & Le, 2013), I estimate empirically different models to capture potential spillover effects on prices in the immediate vicinity of new development. From a policy standpoint, as infill becomes more prevalent as a way to manage farmland conversion, transportation demand and greenhouse gas emissions, knowing more about effects at the neighborhood scale will be critical to political and practical success of such state-driven strategies.

The geography of housing costs is made up of changes beyond spillovers. Essay 3, *Examining the Transition to HUD Small Area Fair Market Rents Using Craigslist Data* examines housing markets with respect to a change in federal policy related to the subsidies available to housing voucher recipients. A recent HUD rule adjustment changed the geography of within-region subsidies, reshaping the affordability map for present and future voucher holders. As Chetty, Hendren, and Katz (2015) has documented the impact of living in higher opportunity areas, the stakes are high for planners to look to ways of increasing access for a large range of households, as well as to improve declining neighborhoods more generally.

Finally, Essay 4, *Shrinking Cities: Fuzzy Concept or Useful Framework?* focuses on cities characterized by the *absence* of growth, recognizing this increasingly important topic in urban political economy and planning. A mostly conceptual critique, the essay engages with the limits and possibilities of shrinking cities as a planning concept, pointing to limitations where it becomes too fuzzy, too inclusive, and too little able to distinguish cities with short term cyclical losses from the more long term structural declines. Absent such a distinction, the concept, I argue, will have little analytical or practical relevance.

Planning insight from foresight: Projecting the region

Carrying out growth projections decades into the future is often a highly technical exercise involving models based on complicated econometric relationships, estimated from observed data for the region in question. At the same time, the future of a region is not exclusively a quantitative exercise but a decidedly *normative* one related to the core of the planning discipline: looking forward, setting design parameters, anticipating challenges and addressing them, or *making* the future more than just describing it, or as Isserman (2014) put it, having planners who actually *dare to plan*. Thus the core dilemma of the projections work: between describing the world such as it is and how it might evolve, and the world such as it should be, in a normative-planning sense. This dilemma makes projections work an important window into planning practice; one that affords the opportunity to understand the dilemmas of looking forward in time. Questions of urban epistemology abound: How to make "objective" projections when the future is so much of a normative, design driven exercise? Projections straddle domains of the technical, the aesthetic and the political.

Based on review of historical documents as well as participant observation within the agencies charged with preparing projections, we analyze the long term shift in projections as a planning practice for the San Francisco Bay Area, an area where unique circumstances of institutional divides have been the background condition for doing forward-looking projections work. We characterize the projections work as straddling different knowledge domains: the technical, (relatively) disinterested analytical work, and the political-normative work *also* inherent in the planning discipline of making forward-looking assumptions, asserting strong preferences for a particular trajectory, while foreclosing others. As a piece of urban planning epistemology, the projections practice tells us about how knowledge is co-constituted and how projections have in turn changed as the State of California have changed the planning practice to be more focused on statewide goals of infill development and more efficient transportation systems. We also find different working styles between different agencies working to prepare them, themselves caught between quantitative modalities and more design-driven sensibilities. The work of projecting, while having substantial technical features, cannot be reduced to a technical exercise alone but must embrace its role as part of a wider regional planning conversation.

Planning insight from neighborhood scale housing markets: Adding supply, changing neighborhoods

Another aspect of regional planning practice relates to state-driven directions to realign the state's urban areas as a way to handle transportation demand and reduce greenhouse gases. Regional planning practice has changed considerably, sitting at the intersection of state-level statutory direction to both curb greenhouse gas (GHG) emissions and achieve housing equity goals on the one hand, and a decidedly locally empowered planning regime where decisions are made not by regional entities but by local officials. As the economy has come back from the Great Recession and the appetite for greenfield development has stalled with the full blessing of the state, housing production has shifted to more of a multifamily and infill form. This suits conservationists well, as it helps preserve farmland and green corridors. At the same time, worries about high housing prices are plaguing the state's large and dynamic urban regions.

This leads to a renewed focus on neighborhoods in the urban core where much of the infill capacity is. As concerns over gentrification are pronounced in many places, much policy focus is on stabilizing neighborhoods and limiting displacement. A question arising from the substantial shift to infill development is what the impact on those areas will be: will the new additions to the housing stock help lower housing prices in those neighborhoods, or might it conversely be a contributor to gentrification? The answer depends, in part, on how new housing stock interacts with the neighborhoods in which it is introduced and how it is perceived to change the neighborhood by new residents.

We discuss some of the ways new supply are thought to impact prices, such as filtering and spillovers. Empirically, we focus on the latter. While much research has examined whether affordable housing negatively impacts prices of nearby market rate single family homes, less attention has been paid to the potential for localized *positive* spillovers of new market rate housing, even if the same spillover channels could be presumed to be operative as with affordable housing.

While the study is agnostic as to the specific channels of spillovers, presumed mechanisms of include a) a demonstration effect of providing a new housing type may signal success to other developers and would be buyers in their price discovery process; b) new developments may, depending on what they replace, be seen as increases in local amenities if a project is coupled with the removal of under-utilized or vacant properties that may hitherto have been seen as local dis-amenities; c) compositional changes, hereunder the attraction of new residents to the area from outside the jurisdiction interested in a new, regionally unique product type (i.e. "Downtown Living" may be a new option); and related, d) gentrification and associated changes in the residential composition.

While the positive spillover effect was recently demonstrated in Singapore (Ooi & Le, 2013) and Hong Kong (Tang & Wong, 2018), to our knowledge no similar effect has been examined for market-rate housing in a multifamily context in the United States, though Schwartz, Ellen, Voicu, and Schill (2006) have documented positive effects from affordable developments in New York City.

Using data from 20 years of arms-length home sales, I examine the San Francisco Bay Area housing market using a series of hedonic regressions relating sales prices to characteristics of not just transacting properties and neighborhoods in general, but with an emphasis on access to new housing in particular. I employ two approaches to measure the effect of new housing development on sales prices of existing multifamily properties: In the first one I use a continuous measure of new housing developed near each sales transaction, and this specification generally produces negative coefficients, supporting the interpretation that more housing all other things equal leads to lower local prices. To control for the fact that developers may just be skillful market participants picking the most appreciating neighborhoods, I supplement with a difference-in-difference estimation, capturing pre- and post-build temporal effects. Controlling for these, I isolate the contribution of new development projects from wider area changes. I also look to heterogeneity in effects by size and price tier of development projects. Findings will be relevant to planners and policy makers working on local area housing policy.

Planning insight from big data: Using Craigslist data to understand HUD policy changes

Local maps of housing affordability are influenced not just by local housing markets, but by federal housing policy as set and administered U.S. Department of Housing and Urban Development (HUD). This is particularly true for the 2.4 million households receiving housing choice vouchers, letting them receive a subsidy to move to neighborhoods otherwise unreachable to them. Implementation details of the program, however have a big bearing on the types of neighborhoods available to residents, as subsidies are generally set at the metropolitan scale. The challenges associated with metro-scale, American Community Survey (ACS)-driven annual Fair Market Rent (FMR) estimates are familiar to local housing officials. Each year, scores of comment letters are received by HUD as FMRs are updated and implications for local housing markets become known. The recently implemented transition to Small Area Fair Market Rent (SAFMRs) for 24 regions holds great promise in mitigating key shortcomings of using areawide geography, offering a much more submarket-specific variable payment standard for use by public housing authorities (PHAs). This potentially opens up more high-opportunity areas to the program's users.

A more formal, large-scale assessment of this key rental housing policy, however, has been difficult due to paucity of current national yet sufficiently local, datasets describing rental housing markets. Using recent and spatially comprehensive rental data from Craigslist, a listing website that includes housing, we analyze HUD data for FMR areas nationwide and show rental gaps between the actual cost of rentals and what PHAs will pay per the FMR payment standard. We analyze how a shift to SAFMRs changes the potential availability of units, focusing on both the 24 HUD rule areas and the nation at large. Based on our findings, we argue that more areas should be included in the program if appropriate safeguards can be instituted.

Planning insight from 10,000 feet: Views on shrinking cities; a conceptual critique

Shrinking cities on several continents beset with sustained population losses have been the focus of a number of studies in the past decade, marking an increasing awareness that growth should not be the only preoccupation of planners. This shrinkage owes to a host of economic and demographic processes, and the separate effects of these processes are often compounded when combined. In Eastern Europe the transition to market regimes coincided with declines in fertility and negative migration balances. In the United States, on the other hand, many manufacturing jobs have left the central cities and, at times, the regions in which those cities are situated. In both cases, the dislocations in the former industrial heartlands have been profound. More recently, research has widened the map and shown shrinkage even in the Sun Belt cities of California in connection with the Great Recession of 2006-2008, leading some researchers to conclude new geographic fault lines for shrinkage. While these wider apertures of the conceptual and practical map of shrinkage are welcome additions to the literature, I proceed from the observation that the term ”shrinkage” has been used for cities as diverse as Flint, Michigan and San Francisco and San Jose in

California. Consequently, I will examine the concept of shrinkage and argue that, while the term's heterogeneity and flexibility are crucial to the productive employment of the concept, we must, nevertheless, tighten its definition and its application. Otherwise, we risk watering it down to the point where it is no longer useful to describe the vastly different trajectories of differing cities. I conclude with reflections on the appropriateness of local scale to address shrinkage.

These essays move around the urban map, dealing with ways of knowing, ways of analyzing and ways of conceptualizing. They engage with planning questions as they are formed in the conversation with models, and they seek to understand slivers of the much bigger questions of both how cities function, and how planners work, too.

A note on essays

Essay 1, *Growth Projections as Planning Practice: Growing the San Francisco Bay Area between the Technical and the Political* builds on an earlier conference paper titled, "*Projecting Growth in the San Francisco Bay Area: Achieving a Balance of Academics, Policy and Politics*" jointly authored with Cynthia Kroll, presented at the American Collegiate Schools of Planning in Portland, November 2016.

Essay 3, *Examining the Transition to HUD Small Area Fair Market Rents Using Craigslist Data* is forthcoming in the November 2019 issue of the Journal *Cityscape*, published by the U.S. Department of Housing and Urban Development.

Essay 4, *Shrinking Cities: Fuzzy Concept or Useful Framework?* was previously published early in my graduate school career as Olsen, A. K. (2013). Shrinking Cities: Fuzzy Concept or Useful Framework? Berkeley Planning Journal, 26(1), 217–220. https://doi.org/10.5070/BP326115821.

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Essay 1
Growth Projections as Planning Practice: Growing the San Francisco Bay Area between the Technical and the Political

1.1 Introduction

> Planners seek not to merely predict but to create better futures. . . . Yet for all the ostensible future-orientation in current planning practice, most efforts to plan for the future ring hollow. (Myers & Kitsuse, 2000)

Planning and projections are intrinsically related: Planning by design means looking ahead; planning for tomorrow means making guesses about the future population. In California, billions of dollars are spent on transportation projects each year. As federal spending on transportation infrastructure was on the ascent in the postwar years, federal transportation planners realized that when building transportation networks, regional coordination was essential to system functioning as well as to avoid redundancy. Such ideas of coordination became codified in the *Federal Highway Act of 1962*. Per this, Regional Transportation Plans (RTP) would set priorities for regional road systems, offering medium to long term blueprints for regional transportation networks (Sciara, 2017). These blueprints, in turn, would be heavily dependent on the location and amount of future housing and job centers, making the development of such land use specific forecasts highly relevant to the disbursement of federal transportation funds. While there is a considerable literature on different aspects of the planning processes that *produce* RTPs, along with various aspects of its outcome (Innes & Gruber, 2005, 2001; Sanchez & Wolf, 2007; Barbour, 2016; Pfeffer, Wen, Ikhrata, & Gosnell, 2002; Sciara, 2017; Sciara & Handy, 2013; Wachs, 2004; Wachs & Dill, 1999), and even on modeling history itself (Nijkamp & Reggiani, 2012; Gross, 1982; Wegener, 2014; Simmonds, Waddell, & Wegener, 2013; Wegener, 1994; S. K. Smith, Tayman, & Swanson, 2013) there has been comparatively less in focus on the planning interfaces with and importance of growth projections that underpin such transportation– and more recently, land use planning efforts at the regional scale.[1] Yet, the projections, while a fairly technical product, form the analytic underpinnings of and preconditions for the performance of the transportation projects analyzed in regional transportation plans. Beyond the relevance for transportation planning, they also form the future map of the whereabouts of sometimes millions of new residents, which, even if they are non-binding to local jurisdictions, could help *frame expectations* of local governments, business planners as well as the news media. As such, they are arguably a consequential systematic guessing game, recognized as "one of the most important activities performed by professionals in support of public policymaking" (Wachs, 1990) about the future, but, we think, not commensurately analyzed, both from a production perspective as well as from a usage perspective. How do such forward-looking knowledge products come together, and how do they fit into the wider planning context of a region?

[1] Notable exceptions include (Isserman, 1984; Isserman & Fisher, 1984; Isserman, 1985; Rayer, 2008; Tayman, 1996; Skaburskis & Teitz, 2003)

This study analyzes assesses growth projections not in a quantitative or retrospective sense of whether they were right or wrong, but rather from the perspective of how they have changed over a 40+ year time period as part of planning practice. The planning conditions themselves changed from decentralized governance to a stronger state role in managing the growth of and within regions. Using the San Francisco Bay Area as a case, we examine the projections process, showing both how the process of *producing* them as well as the *role* projections played has changed over time. The projections process went from being a largely disinterested technical practice driven by federal requirements, to what we now argue is an increasingly hybrid knowledge product crafted in the cross-currents of technical staff, policy planners, and outside interest groups and advocates with specific state-mandated planning goals to achieve, with technical, policy-focused and advocacy aspects of their production weighted differently at different points in time.

We trace the projections work though four decades and organize it into distinctive phases based on internal commonalities. We argue that the explicit joining of the relatively technical processes of crafting growth projections with a regional planning process raises the stakes and visibility of the otherwise obscure technical production process leading to growth projections. Whereas in the past, projections arguably mostly "recorded" a relatively hands-off business-as-usual scenario heavily influenced by local general plans, the current approach is much more explicitly *normative-prescriptive* in that it sets overall goals and performance targets for (sub-)regional development.

We find that growth projections are not crafted in a time-invariant technical vacuum, but are part of a wider institutional, financial and legislative context, subject to legal challenges on technical grounds. As the context changed, so did the projections. We see the projections in the context of a wider, though partial state-driven "re-scaling" (Jonas & Pincetl, 2006) of statewide planning *goals*–but notably not the *implementation powers*-away from the local level to more explicit environmental performance goals at the regional level, culminating with the groundbreaking California Senate Bill SB 375 (2008), requiring for the first time an explicitly coordinated regional land use and transportation planning process. In the San Francisco Bay Area, the first integrated regional plan to follow this statutory change was *Plan Bay Area*, adopted by the regional agencies in 2013 (Association of Bay Area Governments & Metropolitan Transportation Commission, 2013b). The second installment was adopted in 2017 (Association of Bay Area Governments & Metropolitan Transportation Commission, 2017a) by the regional agencies' governing boards and commissions.

While the change in state law in some ways can be seen as *empowering* regional planners to conceive regional planning policies, it at the same time leaves the core regulatory structure of *local* land use planning intact, potentially pitting regional planners against local political sensibilities, a potential fault line the new planning process has exposed. This all increases the importance and visibility of projections. Indeed this conflict became apparent during the first plan to be produced following the change in state law: Once formal talks of a coordinated regional planning process emerged around 2010, the process of producing growth projections, and with them expectations for local jurisdiction's long term growth, became much more contested (cf. Trapenberg Frick, 2013), open to differences of both *technical* opinion as well as the politics of *outcome*–on different components of the model system, requiring a careful triangulation of policy goals and technical capabilities and limitations. From a projections standpoint, the novelty is not in having increasingly normative projections *per se*, but having them determined by a regional agency as part of a regional planning process.

This state level change has implications both on the *policy side* (e.g. what sort of growth in what sort of places?) as well as on the *technical side* (e.g. what land use assumptions are made about the future within the model system?). A key consequence of this has been that it opens up the very question of which components of the model system are within the domain of the "*technical*" (e.g. regional trends in personal income) and which are in the domain of the "*political*" (e.g. zoning policy assumptions determining development capacity for the future), and that the implementing agencies have some power to assert where that line is drawn within the context of their institutional structures.

As regional agency staff draw that line, the process of triangulating knowledges and perspectives necessarily entails a complex bridging of different knowledge types, expertises, and preferences of differently situated stakeholders. This involves reconciling, in turn *technical* aspects of the model system with assumptions integral to the model system which have not only *technical* components but at the same time clear *policy aspects* to them such as future public investment decisions, land use policy, possibly leading to tensions between different "expert" groups, not just relative to external stakeholders, but also on the *internal* working groups preparing projections, namely modeling staff and planning policy staff as they each bring their expertises to bear on the work of describing the future in the context of a model system itself inserted into a larger planning process.

The literature has long recognized the existence of different "modes" of producing planning projections, with a clear span between the more vision-based approaches closely tied with the design tradition in the planning field, on the one hand, and more technical approaches on the other (cf. Couclelis, 2005; Bartholomew, 2007). A common distinction is between normative, "active" forecasts asserting planning goals (Tayman, 1996) and more passive ones without such assertions. Insofar as many technical variables have policy aspects to them as noted, this distinction often fails to capture the many nuances of actual projections work in which active and passive projection approaches more often than not exist on a continuum where it is not always clear cut whether a decision is merely "technical" (i.e. nominally policy blind) or policy-focused (i.e. what to assume, for, say, rent control in a model framework).

At the same time, planning as a discipline is itself caught between on the one hand positivist impulses of measurement and objectivity, and on the other the more visionary imperatives coming from the design transition, per Isserman (1985), along with process-focused impules from the collaborative planning approaches (Healey, 2003). We found this dilemma at the core of the profession to be alive and well in daily practice. What to measure? For what end?

Finally, the transition from projections-as-technical-exercise to projections-as-politically-embedded-practice also mirrors a longstanding transition of the view of the role of planners themselves among planning theorists. The view of planning as a practice has moved from the rational planning paradigm in which planners were largely seen as disinterested technical accountants of urban land, to a more post-positivist, purpose driven view of planners as socially conscious stewards of the public realm and wider functioning of urban areas (Forester, 1982; Innes & Gruber, 2005). While prominent planning theorists have argued for the need for a more situated analysis of planning practice relative to influences of power (Healey, 2003; Flyvbjerg, 1998) or foregrounding planning studies relative to plans themselves (Friedmann, 2004), the focus here is not on the political economy of *how* planning decisions are made (Flyvbjerg, 2003) as much as characterizing key features of the *projections work*, interfaces with planning, the tension between the "technical" and "visionary," and how those have changed with the times.

We note in passing, but don't directly engage with the longer standing debate on the accuracy of large models, with Wachs (1987) noting that in a competitive funding environment, modelers tend to overestimate transit ridership benefits per dollar spent. Flyvbjerg, Holm, and Buhl (2002) later noted that such over-estimates were too systematic to be innocent errors and should rather be seen as a case of "strategic mis-representation, that is, lying." Skaburskis and Teitz (2003) offer less damning alternative interpretations. We distinguish these more short term, domain specific ridership forecasts or benefit-cost studies connected with specific pieces of infrastructure such as bridges from the more general purpose regional long term projections that are the focus of this study.

Ultimately, this study has two purposes.

- First, to trace the evolution of the role of projections from "passive" to "active" components of the regional self-understanding, taking place in the wider political economy of state law.
- Second, to analyze growth projections as an open ended, non-deterministic knowledge generating process with many possible outcomes and stakeholders. This serves to illustrate how projections went from being a relatively disinterested technical exercise based on "technical-bureaucratic" knowledge (Innes and Gruber's (2005) term), with limited practical import[2] to one with much political visibility during the current planning climate where projections and plan are now tightly coupled and part and parcel of the same knowledge generating and planning process.

[2] To be fair, in the past, regional transportation plans were still based on the growth projections, but since they were "status quo-projections" and not policy driven the main fight was over transportation funding formulas and not so much the land use map itself.

The balance of the study is organized as follows. Next, we describe the approach used in conducting this research. Then, in Section 1.3, *Background: Situating Projections in Regional Analysis, Planning Context, and Multiple Sources of Knowledge*, we introduce the basic discussion around the role of different types of knowledge in informing the planning processes. Section 1.4, *Case Background and Planning Context* sets the stage by providing the big picture view of the transition of the growth projections in context. Section 1.5, *The Regional and Small Area Projection Process over Time*, describes the genealogy of the projections, and approaches that have been applied to projections in the Bay Area. Next, Section 1.6, *Key Themes in the Current Phase*, describes the tension between organizational interests, professional practices and political requirements, and the tools used for subregional distribution of the forecast in the approach to geographic distribution. Lastly, Section 1.7, *Conclusion: The Bay Area Transition in Perspective*, draws together issues uncovered and lessons learned.

1.2 Research Approach

While this study is mainly a long-line view of how modeling has existed in two agencies with different analytic and institutional purviews, the author's employment as a planner in both agencies has necessarily shaped the reading of the most recent phase of this work. The work reflects this sort of participant observation in the spirit of Flyvbjerg's (2002) anecdote on his pre-Aalborg assistant planner forays, assigned to analyze decentralization and centralization but ultimately learning about the planning praxis and with it its relationship with power as an added, if unwitting and unforeseen benefit.

This work was written while the author was a staff planner at first the Association of Bay Area Governments and later, after the two agencies went through a staff consolidation during the summer of 2017, at the Metropolitan Transportation Commission. The author was part of the group working on the forecast from the ABAG side, interfacing with initially MTC staff in the crafting of the projections suite. This positioning offers both a unique view into the perspectives and views of staff related to the projections work, offering access to a long institutional history, the understanding of what the organizations have been doing and where it may be going, along with challenges and opportunities, under the influence of organizational constrains and opportunities.

We are interested in projections as an exemplar of a slice of planning practice, both from a longer term perspective of how they and their role have changed with the times, but also the unique dilemmas raised as that work product is prepared in the borderlands between two regional organizations with different genealogies, expertises, governance structures and key focal points, with one being mainly focused on the transportation side of the equation, the other on land use. The particularities makes it a compelling case study, and though it is unusual in the sense that the organizational split is unique to the Bay Area region in the state, we think it encapsulates more general dilemmas of planning knowledge as it is crafted in the space between vision, policy and technical capacities and institutional requirements. We approach the questions of planning projections epistemology as a single case study (Yin, 2009), and while the dilemmas between the technical and the political will exist in any region, the Bay Area case, given the institutional divides, offers a compelling window through which to inspect these. Yin (2009) suggests cases that are sufficiently unusual may call for documentation and analysis. We approach the subject in that spirit. The Bay Area is in many ways an unusual case as the core regional planning functions have been straddling separate agencies each with their own institutional leanings since the founding of the Metropolitan Transportation Commission by the State in 1970.

Though unusual, it is instructive insofar as it places the differences as it pertains to modeling knowledge in sharper relief, making the case stand out with all the more clarity than had been the case for a more integrated modeling and projections planning practice.

Flyvbjerg (2011) characterizes a critical case as one which has particularly exemplary traits with respect to demonstrating hypothesized sets of relationships: If events hold true in a particularly challenging environment, then they can be thought to hold true in other environments, too. The Bay Area case can be seen as critical in this sense: If the dilemmas between the technical and the political can be bridged *between* organizations as we posit has happened in the Bay Area, it could well happen in other places with simpler institutional arrangements, too.

At the time of drafting, the author had been with the organization of interest for about two years, which offers both some time to appreciate the culture and history of the work, while being short enough to not lead to the development of too many blind spots with respect to the organization. In this sense, the perspective is a blend of the "insider" perspective Merton (1972) discussed, but at the same time, still somewhat of an outsider perspective. Labaree (2002) explicitly rejects the dualism insider / outsider as artificial, opting instead for more hybrid forms of interpreting positionality. He discusses the "hidden dilemmas" and indeed limits of being an insider, even as it may offer some amount of "epistemological privilege," though placing the insider in a sensitive position of trust relative to the organization and the history being interpreted.

The perspective from within an organization helps with perspective and even raising questions which might otherwise not have been obvious. Familiarity with board structures and organizational governance helps with the interpretation of work programs and organizational priorities. Certainly, it means that the view is much clearer of contemporary events which is a challenge for all work seeking to understand how a practice has changed over time. For these sections, we relied on the library and documentary record coupled with informal conversations with planners who have been in the organization for decades. These conversations were not formal interviews in any sense as much as quotidian work conversations seeking to understand what was in a collegial setting with senior planners, and were an organic part of the work of preparing growth projections for the regional plan. Accordingly, no record of such conversations have taken place except insofar as they otherwise had a work purpose. They are mainly taken as informative background, helping with interpretation of planning practice, past and current.

Finally, the study is not primarily about the regional organizations themselves but more a reading of a particular work product through the prism of planning epistemologies and what constitutes them. The work is certainly not ethnography, even the organizational kind (Yanow, 2009; Moeran, 2009), though there is a kinship in that we are interested in the work of organizations and particularly the complexities of what constitutes technical planning knowledge.

1.3 Background: Situating Projections in Regional Analysis, Planning Context, and Multiple Sources of Knowledge

This section will trace changes in urban landscapes as they grew in a more suburban form in the postwar years. Changes in urban form then was part of the physical impetus for a new knowledge of cities and their trajectories. Another impetus was the federal government's large outlays for transportation funding, which came with strings attached for regions to sort out spending priorities in a systematic fashion. Just as the need for regional analysis was perhaps most pronounced as cities were reshaped by the interstate system and their social geographies were changed by planners through urban renewal programs along with white flight, the very expertise at the basis of such analytical efforts were the subject of external and internal critiques. The former related to planning knowledge and skepticism of planners and their role in processes of urban renewal. The internal critique had to do with modeling limitations, raised by the very experts in the field. A split became apparent between the more normative analytical work with particular aims, and the more detached, "value free" work thought to be happening in regional agencies. As model complexity in some quarters were seen as suspect, simpler models were proposed in their stead, and a segmentation into technical and normative components of model work became more apparent, laying bare the distinctive knowledge bases for each. Models retained their technical parts, but normative choices and assumptions started to become more explicit.

The changing urban landscape

The urban landscape experienced profound changed in the postwar years on mainly two accounts: First, from 1950-1990, metropolitan areas saw population growth of some 72 percent, fundamentally redefining many regions in the process. In the case of the Bay Area, one million people was added each decade from 1940-1970 as part of a historic migration to the Western US since–and during–World War II (Fligstein, 1981).

Second, this overall growth masked a shift *within* regions; central cities shed some 17 percent of their residents, reflecting wider locational and behavioral shifts, as the full effect of the automobile on cities began to take hold (Muller, 2004). Considerable federal monies were being spent on transportation infrastructure, with the interstate system affording regions the chance to grow in tandem with additional access from emerging suburbs located around newly built interchanges (cf. Muller, 2004). Suburbanization as an urban template become the dominant mode of urbanization as (often) new residents would avail themselves of newly built freeway access to move further away from their place of work to not infrequently segregated suburbs with the tacit blessing of the Federal Government's Homeowners Loan Corporation through its real estate appraisal guides explicitly etching racial geographies into the metropolitan landscape (K. T. Jackson, 1980). One historian described suburbanization [as part and parcel to underdevelopment of cities] as "[t]he most significant political, economic, and spatial transformation in the postwar united states" (Self, 2003).

In an analysis of what caused the loss of population from the centers, Baum-Snow (2007) found that freeways caused as much as a third of the central city decline. As both contrast and complement to such infrastructure-driven explanations of decentralization stand accounts from historians emphasizing a longstanding trend of suburban on cultural grounds (K. T. Jackson, 1985), while suburbanization could be seen as a way of acting on preferences in a diverse population, with wealthier residents "voting with their feet" (Tiebout, 1956) to reach the emerging suburbs, offering their tax dollars and often getting good schools in return. Irrespective of causes and analytical frames, modeling of cities was made more complex for the very reason it was alluring: cities and their regions were changing fast, and according to a complex and little coordinated process of local entitlements with little overarching logic as to development intensity and location. The sunbelt was growing as the rustbelt shed jobs and population, but the sunbelt was changing internally, too, and planners were trying to make sense of it and to some extent direct it.

A federal impetus to modeling knowledge

As cities grew in the postwar years and the Federal Government assumed a substantial role in funding the infrastructure to enable this growth, the analytic and political stakes were high for getting the analysis of emerging growth patterns "right." Since the 1960s, when the Federal Government ushered in a devolution of control for local infrastructure spending by way of conditioning federal funding on regional planning efforts, regional planning agencies have been faced with addressing practical and analytic challenges related to transportation provision, land use patterns, housing development, open space protection and solid waste disposal in complicated political environments with many stakeholders. Over time, the increasing scale and complexity of the growing metropolitan landscape led to calls for systematic analyses of how regions would fare under different transportation investment scenarios. The construction of complex transportation and land use models by regional agency staff and consultants became an important way of doing this work.

An important impetus for developing full metropolitan scale models came from the transportation planning process, and thereby the federal appropriations process. In part pursuant to the Federal Highway Act of 1962's requirement that transportation planning be "continuous, comprehensive, and cooperative" (McNally, 2007), regional transportation planners began to model the transportation system in four discrete steps: Based on a fine-grained zone system with counts of households and jobs, the model began with trip *generation* as a function of household demographics. Second, a trip *distribution* module would match origins and destinations. Third, a mode choice module provided mode-specific trip tables, and finally, a route choice module allocated trips to the transportation network (McNally, 2007). This model has been predominant in the transportation planning community for nearly half a century, only recently challenged by the appearance of more behaviorally explicit, household-focused tour based models (Bowman & Ben-Akiva, 2001). With these newer models as much as the old ones, a key input was information on land uses with sufficient detail to provide information on trip origins and destinations, typically derived from a separate model system (Goldner, 1968).

To run this model thus required a detailed representation of land use patterns, present and future, for the nation's changing metropolitan landscapes. This in turn raised a number of questions about the functioning of the urban environment and the relative current and future whereabouts of population and industry. Before long, a generation of modelers of different stripes reported for duty to answer them, aided by the rise of mainframe and later micro-computers, enabling increasingly complex, though often arcane, black box models of urban land use, which, even for all the complexity, were often extraordinarily reductioninst in the relationships modeled and represented (D. B. Lee, 1973).

At times inspired by the monocentric city models, a separate modeling effort was more practical than academic (even if often developed by academic experts and consultants) and was focused on spatially detailed forecasting within a larger urban area, often referred to as large scale urban models. Inspiration and to some extent language came from physics and the notion of gravity, as perhaps best embodied in Waldo Tobler's First Law of Geography ("everything is related to everything else, but near things are more related than distant things" (Tobler, 1970). In an urban model context, this was translated to a framework in which the location of employers would largely pre-determine the probabilities of location of workers as a function of distance to work sites, as in the Lowry model (e.g. Lowry, 1964), and derivatives (Goldner, 1968). While this was convenient to privilege employment location, White

(1999) notes that this assumption in urban models of primacy of employment as a spatial determining factor is not borne out by neither theory nor empirics.

For large scale urban models, concerned with much more spatially disaggregate geographic units the focus was less on theoretical or even practical elegance, but on providing a practical system for estimation and prediction where the “client” is not a research audience, but rather a planning process where the focus is on land use patterns as an *intermediate* step to understanding transportation patterns rather than as an end in and of itself. For this purpose, the most theoretically meaningful models were not necessarily the most operationally tractable. In writing about a Bay Area implementation of the Lowry model, Goldner (1968) offered a sharp distinction between “production models” and “experimental models,” quoting a researcher imploring modelers to “shake loose from their honeymoon with sophisticated theoretical techniques” and adopt a framework that instead is “operationally meaningful” (Goldner, 1968). Not least for data reasons, a large number of theoretically relevant and economically significant variables were left out from the earliest operational models.

This was a defensible approach in the aggregate, but it largely resulted in models not sensitive to a number of other theoretically meaningful factors of urban location, such as amenities which could impact both residential location choices, and, per some accounts, therefore also business location (Gottlieb, 1995). As policy questions related to behavioral realism continued to present themselves, the seed was planted for later generations of urban models operating with increasingly detailed spatial and conceptual resolution (P. A. Waddell, 2002; Zhong, Hunt, & Abraham, 2007), and regional agencies were keen to explore this space in great detail.

Projections and the limits of planning expertise

> The development of computerization does not make planning easier, in the sense that it somehow becomes more automatic. There may be many automatic aids to smooth out tedious processes, such as detailed calculations; but they do not diminish the area of human responsibility – the responsibility to take decisions. (Hall, 2002)

Projections, and more generally planning support systems, an umbrella term for software designed to aide planners and policy makers more generally in many aspects of their analytic and collaborative work, offer the promise of ready information at the planner’s finger tips, but the *role* of information, just as planners themselves has been subject to considerable change during the time frame projections have been around. During the 1960s, there was much optimism in planning and the social sciences more broadly related to the ability of computers to optimize allocation of resources and identify the best of all worlds, indeed reduce it to a matter of algorithms (cf. Klosterman, 1997). That was also the heyday of the expert analytic model predominant in planning practice, with the steps of 1) identifying the problem and setting goals, 2) the preparation of analysis and policy alternatives and 3), picking an alternative and implementing it. Planning, and models, were the perfect embodiment of this ethos.

In part in reaction to this optimism, the 1960s and 1970s was also a time of much revisionism across many practical and scholarly fields. The 1970s offered more skeptical views of the benevolent planner, as cities were torn by racial strife, riots and disinvestment in what would become referred to as the urban crisis (Sugrue, 2005). Jane Jacobs (1961) had delivered her contemporaneous broadside against the planning profession at large as planners were complicit in razing neighborhoods, and with it leaving few pieces of the modern planning edifice intact: their goals, their methods of analysis and flawed reading of the existing landscape, their planning processes, their implementation.[3]

[3] Whether it was more or less damaging that it came from largely an outsider to the discipline is unknown, but her influence remains strong 50 years later.

As the quantitative evolution took shape, planning expertise itself increasingly was seen as suspect, particularly when expertise was used in the service of harming particular communities. Famously, the view of planning expertise wasn't helped by mostly black communities devastated by urban renewal at the hands of perhaps well meaning planners declaring "blight", yet whose bosses couldn't be bothered with re-housing those displaced (Hartman, 1979; Hartman & Kessler, 1973).

Further, experts often disagreed on *values* as much as on *facts* (cf. Innes, 1998). All said, facts and knowledge was recognized to be more partial and provisional than fixed and certain, with Healey (2008) observing on the role of academic expert knowledge in planning, acknowledging that "the knowledge used "in practice is not necessarily the systematized, objective, knowledge that science once privileged" (p. 862) but the use of such knowledge may be interactive, subject to refinement, or even heuristically developed.

A similar skeptical view of planner's expertise in practical day-to-day terms is expressed by Forester, noting that "planners do not have time to learn through sustained research, and [yet] they have to make value judgments and set priorities, so they must learn not just from scientific inquiry but also through a process that is akin to learning from friends" (Forester, 1999, as cited in Throgmorton, 2003).

In arguing expertise, planners were not always on sure footing. This was true when it came to the act of producing plans, but also when it came to analytics: Critiques of expertise in general and modeling in particular also came from modelers themselves, addressing both technical and usage flaws. One leading critic charged that the large scale urban models emerging in the 1960s and 1970s lent themselves to a “command-and-control”-style top down planning where the analyst retained control of the information and assumptions, while substantially models were seen as intrinsically unable to provide meaningful answers given their complexity and “wrongheadedness” (D. B. Lee, 1973, 1994). While the critique was noted in academia, including in a review issue 20 years after its initial publication, the practical reliance of models remained and expanded.

Knowledge and collaborative planning

While the technical component of planning practice remains widely practiced and features prominently on planning education curricula (Innes, 1998), the view of planning has shifted somewhat away from the technical expert model. Marty Wachs notes how at the turn of the century, ”the reigning metaphor among planning theorists is collaborative planning.” (Wachs, 2001). Per this, planning is increasingly seen through the prism of a collaborative practice, somewhat decentralizing the planner’s monopoly on “expert” knowledge, seeing her instead as a mediator or process enabler among stakeholders with different stakes and interests in the planning process (Booher & Innes, 2002). Here the approach is less linear than the old rational model of problem definition - identification-of-alternatives - choice-of alternatives. In particular Innes (1998) has argued forcefully that planners work mainly through dialogue and discursive framing of issues, and that the framing itself is most effective when invoking stories or narratives, or what could be referred to as anecdotal information. Planning, all of a sudden, seems like an open source process, with increasing recognition of a multiplicity of knowledges and voices in the planning process, operating along more complex, open ended networked activity, often tackling “wicked problems” characterized by little consensus on ends let alone means among key stakeholders (Innes & Booher, 2018).

> The successful processes we have observed included methods in which experts, lay people, and people with unique local knowledge engaged to jointly create an understanding of the challenges they faced and of the potential of the options they considered (Innes & Booher, 2018).

From a collaborative planning perspective, projections-as-a-planning-practice would be most effective if married with insights from local stakeholder’s perspectives as to what is relevant to include in models in the first place, and what sort of policy questions it should be specified in relation to. Planning, including projections, in this paradigm, works better when the basket of what is represented in the model system is meaningful to a wide group of stakeholders, each with different perspectives and knowledges of the subject matter. Per this, a good model is one in which technical information is ”seasoned” or complemented with other types of information or input in modeling choices, either as a way to improve the usefulness of the model itself by making it sensitive to all the relevant policies of interest (which may be as much a policy call as an expert one), and / or as a way to improve procedural legitimacy and validity as it moves through the planning or public policy process. While expertise is indispensable to set up the modeling system and collect and prepare the databases, however, it is effective only to the degree that it is part of an ”interactive model [that] requires extensive and reciprocal communication between experts and the wider public” (Bohman, 1999, p.597). This emphasizes the procedural importance of finding a way to incorporate more than one type of information in planning decisions. Overall, insofar as the collaborative turn extends to the modelers, collaboration entails more transparency in *how* models are developed, the key planning processes they are a part of, and how well those processes in turn map on to key planning goals in the first place.

A question invariably prompted by the collaborative turn is how far to take the relativism and which types of modeling decisions should be sourced collaboratively. One commentator suggests modelers would be served by a division of labor if they could focus strictly on the technical, leaving value decisions to others:

> Model builders would have an easier task in that they could concentrate on assumptions, data, and relationships specified by the stated goals of the user, and since policies and values would be explicit, the model builder’s values and policies would no longer be inadvertently built into the method. (Moen, 1984)

Projecting between the “technical” and the “normative”

The production of projections in regional agencies has long been the province of technical, ostensibly disinterested practitioners, focused on accounting properly for the main forces thought to influence regional development. Conversations around projections have focused on the context of *production* (Wachs, 1990; Isserman, 1985; Alexander, 2001) as well as their retrospective accuracy (Keyfitz, 1982), or, not infrequently, lack of it, along with potential reasons for the imprecision (Flyvbjerg et al., 2002; Wachs, 1990; Sanderson, 1998; Naess, Andersen, Nicolaisen, & Strand, 2015; Rayer, 2008; Chi, 2009; Skaburskis & Teitz, 2003). Critiques of projections work have been presented along at least two main dimensions, one focused on context and one on technical limitations:

First, an *external* political economy perspective focused on the wider landscape in which they are prepared may perceive projections as tainted insofar as they serve the strategic purpose of securing funding for large infrastructure projects that might not otherwise have been funded (Flyvbjerg et al., 2002; Wachs, 1990). Even absent incentives related to infrastructure funding, Skaburskis and Teitz (2003) noted that planners frequently overstate the projections outcome, citing reasons such as the wish to generate interest rather than indifference, saying "[w]ho notices predictions of the status quo?"

A second line of critique is not on the politics of projections, but rather on *internal technical* limitations of models. This critique came at the heyday of large scale urban models from within their ranks, with D. B. Lee (1973) offering a particularly scathing critique of large scale urban models, enumerating their "seven deadly sins." He states that much effort had been wasted due to poor alignment of goals and resources and the sometimes unwillingness to look for simpler solutions to answering substantive questions. One of his main contentions was that effort spent on urban models unfortunately did little to improve understanding of cities from either a theoretical or a practical perspective, and goals kept getting revised as earlier ones were not met, leading to perpetual development cycles in need of increasing amounts of federal funding.

While much of the older line of critique was valid and largely reiterated some 20 years later (D. B. Lee, 1994), models remain in active development and use, although increasingly outside the United States (Batty, 1994). The rise of big data in recent years, along with search engines, have contributed to an increasing appetite for web-based access to model details, bringing models a bit closer to the horizon of the public's imagination.

A variant of the internal / technical critiques pertain to projections that may be not even be carried out in a structured modeling framework but with more ad-hoc tools and conceptual representations and data, typically prepared in spreadsheets. Heuristic models may be set up by a single analyst for a more narrow scope purpose, absent the resources to establish more formal models, with the purpose of simply "getting it done," grabbing a few variables of interest for prediction, without a clear, or overly simplistic, sense, of what might drive them going forward, or what meaningful bounds of the variables of interest might be. For example, Skaburskis and Teitz (2003) cite the risk of being seduced by outliers reported in the press as indications of emerging trends on which to base a growth scenario. Models are subject to errors, but so are heuristic models with less obvious structures, made quickly with little transparency.

> At times the predictions are made with reference to conventional wisdom, unquestioned belief, anecdotal evidence, limited information, wishful thinking or strategic myopia. At times they are produced by analysts thoughtfully examining

> current conditions and extrapolating past trends with models supported by theory identifying and explaining the key determinant. (Skaburskis & Teitz, 2003)

Similarly, some of the more vision-focused planning processes and vision-based models can be critiqued on the basis that their assumptions may be entirely unrealistic (sometimes intentionally, for the purpose of exposition), and any associated numbers may be entirely make-believe, casting doubt on the whole reasoning for visioning in the first place. This could be a problem if such numbers were to be used to make decisions about large infrastructure projects. Accordingly, some researchers focus on how visioning processes should not *replace* modeling, but rather serve as a *complement*; suggesting visioning helps identify goals and build support, while models may provide some validation of certain policy strategies (Lemp, Zhou, Kockelman, & Parmenter, 2008).

> Testing the stability of the ILUTE model is also an important consideration as multiple model runs (in cases where random effects exist) might result in significantly different end results. (Salvini, 2005)

Modeling directions

From a productions standpoint, some researchers have stressed the flaws in the forecasting process borne by the most complex models as a reason to go, conversely, to the most parsimonious models possible, letting instead ”planning models and methods . . . serve as prostheses for the mind” (Klosterman, 2013), somewhat downplaying their overall importance. Rogers (1995) asks the question if simple models outperform complex ones, while Sevcikova, Raftery, and Waddell (2007), Sevcikova, Simonson, and Jensen (2015) gets around the issue of forecasting precision and accuracy by appropriately acknowledging the inherent uncertainty in this work by creating confidence intervals around predictions. Even sympathetic observers sound warnings. Marty Wachs noted that “[f]orecasting is almost the opposite of visionary thinking,” yet forecasting is typically seen as ”appropriate and useful because they are the products of scientific or mathematical models that encapsulate empirical truths instead of our subjective ideals” (Wachs, 2001). He warned against their misuse, hidden assumptions and unknown sensitivities to changes in input parameters. He suggests the subjective choices in modeling be presented along with numbers, and getting beyond the absurd belief that there is just *one* right forecast:

> ”Rather than thinking of a forecast as a defined and invariant input upon which to base a plan, it is far more realistic to see it as an enumeration of the consequences of a *particular*

set of assumptions that can be varied to reflect the competing interests of contending parties." (Wachs, 2001, p.371, my emphasis)

This call for much more explicit treatment of assumptions and purposes has been around for at least a generation. Isserman, in two seminal and still relevant pieces(Isserman, 1984, 1985)[4] assessing the practice of the planning and projections practice noted the long-standing distinction between "projections" (conditional *what-if* statements making weak assumptions about the future) and "forecasts" (representing a statement of the *most likely* future). The implication is that projections, relative to forecasts, are more "mechanical" in nature, with less judgment applied as to future changes to model parameters. He notes that planners most often "project" rather than "forecast," and called for and end to what he referred to as "uncritical reliance" on projections of current trends, and a deeper engagement of the planning profession with its erstwhile business of *imagining* futures and setting out to find ways to "lead from the present to the future" (Isserman, 1985). He argued that the planning profession, when producing forecasts, has been "mechanically producing numbers that cannot be considered forecasts" (p.10), mainly because planners "ape social scientists," (i.e. focusing on the analytic rather than interventionist mode of the profession) The key missing piece, per Isserman, is the willingness to "dare to plan," to be part of the actually visionary work that he argues lay in the profession's past, when it was more closely aligned with architecture and design disciplines. This critique, while aimed at planners relying on modest technical assumptions, was as much a critique of the planning practice itself and particularly the context that drives projections work.

[4] *Town Planning Review* recently recognized the *Dare to Plan* piece's significance by re-publishing it in full (Isserman, 2014).

This highlights the hybrid, almost paradoxical nature of the projections: they come with an air of scientific accuracy (Wachs, 2001), due to the often extensive data assembly efforts and technical modeling skills required to produce them. Yet, they are often coupled with a decidedly *normative* planning process with strategic goals pertaining to local change and intervention into the *status quo* of an urban society (cf. Forester, 1993, ch.2). Healey (2009) notes how much planning work deals with managing and conserving *stable parameter* local environments, constrasts it with more assertive strategic planning "aimed at responding to *changing contextual parameters* and at making a *contribution* to those parameters, as an enduring piece of public infrastructure." Tayman (1996) talks about "active" forecasting as Moen (1984) talks about "normative" forecasting: "This 'active' approach to forecasting involves first deciding what future outcome is desirable and, then, designing policies". This tension is squarely–and at times uncomfortably–at the heart of the planning profession (planning-as-analysis vs planning-as-intervention) and is shared with policy analysis and a number of other action-oriented social theorists (Fischer, 2007). A forecaster can try to capture the behavior of the system to be modeled, but to do so scientifically may require often heroic assumptions about the parameters in the model, not quite borne out by any technical analysis about the direction or trend of those parameters.

This does not mean projections do not have considerable strictly technical aspects but even "the technical" is riddled with judgment calls–which concepts and relationships to model, which to ignore (and on what grounds), with what data, what types of models, which years to use, etc. In this way, the projections work is arguably beyond technical, even in the most hands-off cases where the analyst merely wishes to step back and let the models and data "speak for themselves" without any further assertions as to outcome, insofar as values enter the modeling process through the qualitative and quantitative choices of inclusion and exclusions and assumptions made.

When coupled with planning processes, making assumptions about the future state of the modeling system is typically not the job of the analyst alone, but must involve a wider set of knowledges about the component of the system (e.g. how migration trends are changing; the competitiveness of local industries, household formation rates, as well as geographically specific planning assumptions). These types of decisions, per Isserman (1984), go beyond the "lone analyst" (p.215). Regardless of how those types of "knowledges" are sourced into the projections process, it invariably makes them hybrid knowledge products, even if individual analysts may tend to "hide behind technical analyses" (Myers, 2001).

While from an epistemological standpoint, knowledge in projections can be said to have many sources and claims to validity, two typical generative approaches are identified in the literature for forecasted planning information at the local level (S. K. Smith et al., 2013; Klosterman & Pettit, 2005). These approaches include, on the one hand, methodology-focused, quantitatively heavy urban systems models of the urban economy with its land use interactions, such as UrbanSim (P. A. Waddell, 2002) or PECAS (Zhong et al., 2007), and to some extent the rule-based cellular automata approach (Clarke, Hoppen, & Gaydos, 1997). On the other, planning processes focused on envisioning futures, or scenarios, focusing on the desired end point by community members, planners or both (Chakraborty, Kaza, Knaap, & Deal, 2011) draw on very different knowledges and emerging narrative tradition within planning practice, in which planners are seen as *story tellers* framing the *status quo* in terms of challenges and solutions (Throgmorton, 2003; Myers & Kitsuse, 2000). Between these endpoints, there are a number of rule-based, *what-if*-type approaches with a more collaborative focus and slightly different purpose and use case (Klosterman, 1999).

Scenario planning came from management science as a way to handle future uncertainties in a structured way that didn't require mere assertion: Scenarios embraced the uncertainty and incorporated it into the strategic discussion of the future (Schoemaker, 1995). The scenario planning processes are at the core playing with the open ended nature of growth and its principal assumptions, allowing for a dialogue of any and all of these. While these more collaborative approaches arguably embrace the more open ended, future oriented aspects of planning, the former, more technical projections process, inhabits a more complicated space where the evaluation is both "internal" to the model itself (i.e. data and specifications) as well as on the "external" assumptions for the future. The internal space and the performance of models is "knowable" to some extent, and typically pursued over the course of deliberate validation efforts.[5] Conversely, an evaluation of the external dimensions concerning the more vision-focused, value driven assumptions about the future, is not subject to quantitative evaluation, nor *could* it be. This indeterminancy perhaps makes more open ended, visioning effors more suitable for structured simulation models than black box spreadsheet. As Barbour and Teitz (2006). noted, "An important best practice at the visioning stage is the use of urban simulation computer modeling has represented a way to reconcile "pro-growth" and "anti-growth" forces and attitudes."

[5]But such reviews are rare, per Agarwal, Green, Grove, Evans, and Schweik (2002).

Per Myers (2001), projections are marked by what he refers to as the "twin hazards of uncertainty and disagreement," characterizing the future guessing work, where directions and means are unknown, while stakeholders may hold "markedly different valuations of key factors." The disagreement comes from opening up the process to more voices, and, per Isserman's terminology, is associated with forecasting rather than projecting. If we take his claim–that planners have more often than not been "forecasting" rather than "projecting"–as well as his admonition–that planners should get more into the forecasting business–the increased reliance on scenario planning (e.g. Wilson, 2016; Barbour & Teitz, 2006; Chakraborty et al., 2011) can be taken as a sign of that transition, where values and norms of what should be changed are solidly embedded into the forecasting process.

Figure 1.1 diagrams an approach to a projections recognizing the hybrid nature of the process. We see the boundary between the "technical" and the "normative" as a fluid and contingent element of the planning practice, subject to different interpretations on the role of technical and policy making staff, under general direction of policy-setting boards. There are *external requirements* (a catch-all for influences from advocates to and requirements per state law), and there are *institutional arrangements* pertaining to the agencies charged with carrying out the task with the assumption that such structures will have a bearing on the work product produced by these organizations.

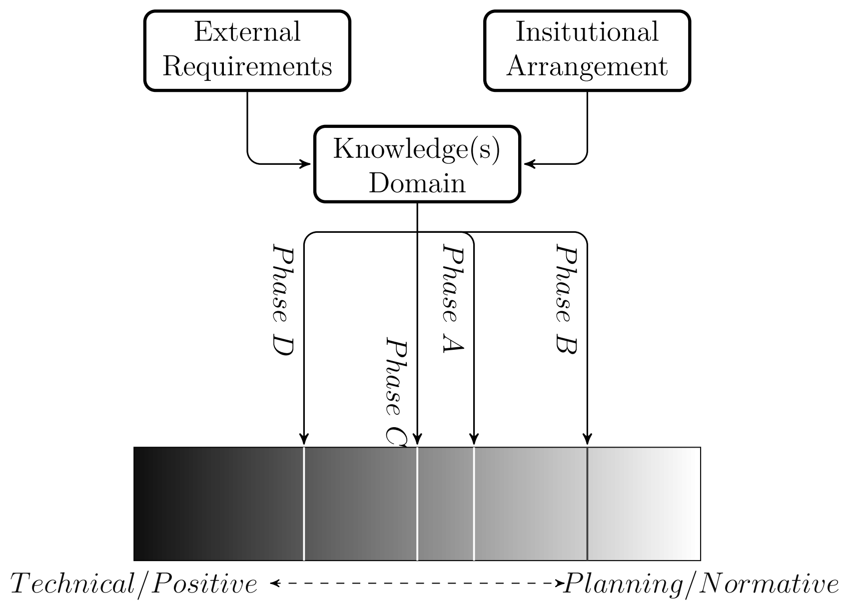

Figure 1.1: Continuum between the technical and political in forecasting work. The institutional, economic, political and legal context influence the type of modeling work carried out at any one point in time. The vertical lines denote hypothetical points in time characterized by a particular balance between the technical and the normative.

These in turn coalesce through a wider cognitive process focused on representing the future through projections work, where there are many different outcomes, each with its own division of labor in the spectrum between the technical/positive and the planning/normative, imagined as a continuum without clear boundaries, but where different balances might be struck at different times for different reasons. The knowledge domain contains technical elements but it may encompass a wider scope of ideas on policy and legitimacy grounds, sourcing both external experts (external requirements) as well as other, at time "local" knowledge. It is here worth noting that "local" as a scalar qualifier of knowledge can arguably include other "experts" external to the planning process proper, such as community groups experiencing gentrification pressures, real estate investors, and other outside parties.

Such sourcing of assumptions and input to the technical process can be described as a "seasoning process," or an acknowledgement that the first run is usually not the best one: The seasoning process ultimately includes, and processes, feedback from a range of stakeholders, to use Corburn's (2003) terms, relying on co-production, inclusion of complementary knowledge to make the projection, and in effect its local allocation, a more useful exercise. This is true for both the regional and local area forecast. At the level of the local area forecast, the many endogeneities related to local land use policies need thorough accounting over a 25 year period. To the degree that a projection incorporates some changes to *status quo* policies makes the process more complicated in terms of charting areas of change. Policy based projections, based on a combination of technical analysis and engagement, may become more subject to critique by those taking exception to planning objectives (Trapenberg Frick, 2013), as well as those merely unhappy about local ramifications of such objectives, in the form of congestion, or neighborhood change in particular places.

Practically speaking, preparing a projection for a 30 year time frame involve parameters and modeling architecture, but, importantly, they also embody value judgments and indeed policy choices about which changes to make to the model system, which housing policies the model system should be sensitive to (rent control, displacement). These are part of the core design parameters of the model, and fall outside the "technical" domain proper.

1.4 Case Background and Planning Context

Before we turn to the phases of the projections work, it is instructive to briefly go over key developments in the planning context in which those projections were done. This section anchors the projections work in that wider frame of reference.

Early beginnings of San Francisco Bay Area reluctant regionalism

The California Dream was alive and well, with millions heading to the sunbelt in general (Glaeser & Tobio, 2007). The Bay Area was no exception. In each of the three decades following the beginning of the Second World War, the San Francisco Bay Area saw its population grow by close to a million people, for a total of 2.9 million new residents, starting from 1.7 million in 1940, reaching 4.6 million by 1970 (tabulated from California Department of Finance, 2011). Jobs were plentiful, and while orchards gave way to offices, entire new industries were born in short order, in some cases buoyed by not so much transportation dollars but defense dollars, spurring much R&D work in the south bay both *during* the Second World War, as well as the years–and wars–that followed (Saxenian, 1985). Soon, Santa Clara County's erstwhile national food basket, the *Valley of Heart's Delight* lured dreamers from across the nation to its booming economy of game changing technical inventions (County of Santa Clara Planning Department, 1967).

Federal call and answer

As noted earlier, this time of rapid expansion across the country, including in the Bay Area, required substantial public and private investments, and guidance was needed in order to allocate funds and resources in efficient and acceptable ways to local, but also to state and federal decision makers. At the same time, the *Federal*

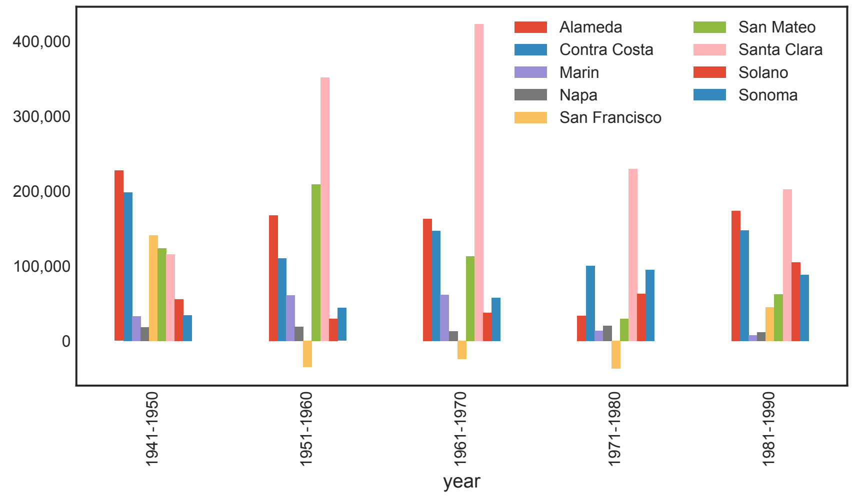

Figure 1.2: Bay Area counties population growth 1940-1980. Source: http://www.bayareacensus.ca.gov/

Highway Act of 1962 provided a devolutionary push of sorts, requiring, even empowering regions to have a say in how transportation monies should be spent. Per the Act, transportation planning should be "continuing, cooperative, and comprehensive" (the 3Cs) (Sciara, 2017), and the *Highway Act* required regional transportation plans *prior* to funding local projects (Innes & Gruber, 2001).

As a response, in 1963 the California legislature established a "Bay Area Transportation Study Commission" (BATSC) to prepare a regional transportation master plan, with a view to making the process more permanent. This move followed the establishment just a few years prior of the San Francisco Bay Area Rapid Transit District, charged with constructing the region's rapid transit system, underlining the budding regionalist thinking at least when it came to transportation planning.

We also noted in the background section that regional agencies were the natural entities to do regional planning work with increased federal devolution. Yet such agencies didn't necessarily exist, nor were they sufficiently equipped to take on the tasks required. The question was particularly relevant in the Bay Area where by 1960 there was no general purpose regional government agency. Who should do the long range planning and coordination of land use planning and infrastructure planning? The answer wasn't obvious, and depended on the balance of power between two factions: advocates for local control among local public officials on the one hand, and business interests and regionalists who saw common cause in better coordinated regional development (Dyble, 2008). In 1961, the Association of Bay Area Governments (ABAG) was established as a *voluntary* joint powers organization of local governments in an effort to preempt the the more business-aligned Bay

Area Council's aims to create a stronger, more formal regional government through the state legislature (the Golden Gate Authority) (Dyble, 2008).. This effort was seen by local governments as a direct assault on the home rule city officials thought sacrosanct (Tranter, 2001). In fact, the very birth of ABAG embodied an odd paradox: "Formed specifically to undermine regional planning, ABAG became the most viable organization to perform that function in the Bay Area" (Dyble, 2008). Yet, in spite of carrying the DNA of local control explicitly rejecting more regionalist temptations, the organization became the *de facto* forum for regional discussions on matters transcending individual jurisdictions. This organization notably came to being before the brewing federal push for councils of governments which saw many such councils emerge in other parts of the state (Chall, 1983).

By 1966, the US Congress passed the *Demonstration Cities and Metropolitan Development Act*, with promises of large sums of federal monies to be spent on highways and other infrastructure projects,[6] ("Demonstration Cities and Metropolitan Development Act. Public Law §89-754," 1966). Federal funding was contingent on review by a local council of governments (COG), and the California legislature recognized ABAG as such in 1966, while the federal Office of Management and Budget made ABAG the clearinghouse for federal grants to the area (Tranter, 2001). Yet, ABAG was by design a relatively weak (or "virtually powerless, per Dyble (2008)) organization with limited powers to get local transit agencies to resolve their differences over diverging funding priorities.

[6]The list of projects included hospitals, airports, libraries, water supply and distribution facilities, sewerage facilities and waste treatment works, highways, transportation facilities, and water development and land conservation projects.

This led the Federal Transit Administration, frustrated with what it saw as ABAG's weak political position in the Bay Area to withhold full certification to administer federal grants, jeopardizing considerable sums of money, including pending grants for the new BART system.[7]. Following a recommendation in the BATSC report, the California Legislature in 1970 created the Metropolitan Transportation Commission (MTC), and its first major work product would be to prepare a regional transportation plan (Innes & Gruber, 2001, pp.28-21).

[7]The loss of confidence was further cemented by an an assistant to the executive director systematically embezzling half a million dollars of pass-through federal funds (Tranter, 2001)

Regional agency governance

This set of perhaps historical accidents marked the beginning of a unique division of labor in the MPO / COG landscape in the Bay Area. In most regions of California, the council of governments (COG) and metropolitan planning organization (MPO) is housed within the same agency (Barbour & Teitz, 2006). Since 1970, as MTC was established as the region's MPO, the San Francisco Bay Area has been a peculiar exception, with the MPO and COG functions residing in separate agencies each with their own governance structure and accountability and oversight approach

(Barbour, 2002; Tranter, 2001). ABAG's governance structure is by design much more decentralized, giving disproportionate influence to small, but relatively numerous cities inherently representing a smaller part of the regional population, while MTC's commission is more heavily titled towards the bigger population centers: In this sense, ABAG is more like the senate, while MTC is more like the House of Representatives. This governance difference presents the two agencies with countless dilemmas about how to reconcile regional goals with local sensibilities; where to spend transportation dollars for what kind of land use. Sciara and Handy (2013) warn against the temptation to go for "geopolitical equity:" "Concentrating investment could mean advancing the economic future of one place over another, spurring growth in places where the transport system would support it but not in places where travel is largely automobile reliant." (p. 37)

The institutional split has has consequences in terms of the functional orientation the two agencies, with MTC having the transportation planning portfolio and associated federal transportation grant funds, while ABAG's responsibilities lay in the domain of land use and housing planning, first in administering housing grants and later as the implementing agency for the state's regional housing needs assessment (cf. P. G. Lewis, 2003). Additionally, ABAG functioned as a purchasing club providing economies of scale for its members through a natural gas and electricity purchasing pool (Tranter, 2001). This split was early recognized by not least the agencies themselves as a challenge to overcome to avoid obvious conflict in the two agencies' institutional orientations, work programs and priorities, here expressed starkly by one of ABAG's early executive directors, Revan Tranter:

> The institutional separation of these two extremely interdependent functions complicates the development of policies and plans which are coordinated and mutually supportive. Over the years a number of interagency committees involving ABAG, MTC and other agencies with related responsibilities have been created to foster this desired consistency. (Association of Bay Area Governments, 1975)
>
> I will admit that the temptation is constantly there to duck the key regional decisions. If it weren't, we wouldn't have several State-created agencies performing their roles and reminding us by their existence of local governments' failures. (Association of Bay Area Governments, 1977)

Those difficult decisions were highlighted by Jack Kent, a regionalist and ABAG general assembly delegate, noting the agency's poor footing to undertake something as ambitious as a regional plan precisely because of its lack of a governance structure to handle the political side of the work:

> [The] Association of Bay Area Governments decided to attempt the impossible. They proposed, and they now have succeeded in obtaining support for, an effort to prepare a regional plan without a government to finance the task on a permanent basis, and without a visible and politically responsible policy group to control the plan. Without such a policy group directly charged with the responsibility of making the difficult decisions that must be made, a useful regional plan cannot possibly be prepared. (Kent, 1963)

Still, in spite of this very split, the two agencies have nonetheless long collaborated on analytic services for the region, with an important work product since the late 1970s being biennial projections of employment, population, household and housing growth for nine California counties and their cities in the San Francisco Bay Area, with a two to three decade outlook. The projections have for decades been used in connection with the federally required Regional Transportation Plan (RTP), a financially significant document enumerating the spending of now hundreds of billions of local and federal dollars over the lifetime of the plan (Association of Bay Area Governments & Metropolitan Transportation Commission, 2017b, 2017a). Projections have also long been used by local jurisdictions in their analyses of proposed development project impacts, grant applications, and as context for general plan updates. In addition, nongovernmental organizations or business groups pay attention to projections from the perspective of what they imply for their particular topic of interest, from transportation, equity, public health, education, among others.

Regional agencies, particularly councils of governments are on paper relatively weak institutions with often contingent funding arrangements, underlining the need for procedural transparency and accountability to citizens, stakeholders and government officials with fiduciary responsibilities. Regional agencies must conduct their business in an open fashion, accountable to its citizens as well as to other government officials typically appointed to oversee them. Nonetheless, the scaffolding established by various federal laws passed during the 1960s requiring more local organization prior to being eligible for grant funding did afford some authority to regional agencies. First, in requiring plans, and second, as a coordinating clearinghouse for reviewing local infrastructure funding requests prior to submitting to the relevant federal agency.

The combination of a weak institution with review authority over at times strong local jurisdictions was one ripe with conflict either between jurisdiction and regional agency, or between jurisdictions. One approach of minimizing such potential conflict and appear to not play favorites when assessing the many local government grant applications from its member jurisdictions was to turn to “automated” scoring approaches with a strong quantitative bent, in order to avoid the appearance of playing favorites among its members. Echoes are found in more contemporary benefit-cost analyses in a range of planning subfields (e.g. Schofield, 2018). The notion that quantitative analysis is inherently more "rational" and devoid of undue policy considerations was evident in this 1970 quote from the 1970 regional plan, at the heyday of ABAG's regionalist ambitions:

> [T]he Association must develop a *quantitative rating system* so that proposed projects can be evaluated more *rationally*. (Association of Bay Area Governments, 1970, my emphasis)

Another foray into quantitative assessments, growth projections, as a structured fortune telling process took hold. To get local jurisdictions to make assumptions on the same basis, growth projections from someone else than the city's own local economic development department was recognized as having some utility. Growth projections have accordingly long been foundational to these agencies' planning work, serving as a reference point for conversations encompassing expectations for growth in cities and their surroundings: How will the region's economy change; which areas will see most growth, and of what type; and is sufficient infrastructure available to serve it. Apart from being examined with respect to transportation system performance in connection with Regional Transportation Plans, growth projections are increasingly seen through the prism of how they foster or hinder equity (Sanchez & Wolf, 2007).

The changing role and context of projections

During the past two decades, while land use management remains the exclusive province of local governments, the role of projections has changed, becoming more closely coupled with explicit land use policy goals. This represents a shift, albeit a technical one at first. Initially (ca. 1970-2002), projections were to a large extent a compendium of local jurisdiction's general plans,[8] but eventually, driven by a number of challenges of loosely coordinated growth, the approach was gradually changed to a more explicit assertion of land use policy goals relating housing and transportation growth.

The main impetus for the Bay Area was a growing realization on the part of planners that the status quo of more than a hundred jurisdictions each planning for jobs and housing growth as they saw fit as it were in separate silos, each with their own political and fiscal incentives, could not adequately address a number of widely recognized problems and endemic externalities. These included a familiar laundry list of lack of affordable housing, crowded roadways, lengthening commutes and worsening air quality, but also loss of farmland and open space to urban development. In contemporaneous surveys, residents indicated irritation with traffic woes

[8] This is technically speaking a broad generalization; even the early projections from the late 1970s made assumptions that local jurisdictions would eventually adjust local zoning to accommodate regional growth estimates. Accordingly, "[t]he projections are not a point-for-point reiteration of each jurisdiction's development policy. Rather, they constitute an assessment of the impact of those policies, taken together, on regionwide growth patterns. (Association of Bay Area Governments, 1980)

(Kurtzman, 1998), worried that traffic might hurt the economy (Feder, 1999), and expressed concern that a Bay Area housing "crisis" would make housing off limits to the middle class (Pascual, 1999; Beer, 1999). During each economic boom and bust cycle, it seems as though fodder were provided for a more regionalist thinking as challenges of housing and transportation became more obvious each time.

During the 1990s, support for regional governance to solve such varied land use related problems ticked up in the region among the public (Elder, 1991), and many policy makers with regionalist sensibilities had come to see these topically different challenges as connected, and connected through land use planning, echoing regionalist currents garnering national attention at the time (Rusk, 1993; Orfield, 1997).

Still, support for regionalism *in principle* didn't translate to support for action. A commission established to "[a]dopt a general vision for the Bay Area in the year 2020, and recommend specific actions necessary to make the vision a reality" (Innes et al., 1994, p.229) made headways in forging some consensus understanding of the challenges of managing growth. It was in finding consensus on merging the regional agencies that the effort failed not only at the hands of the state legislature where it mattered, but also notably and symbolically at ABAG's annual General Assembly of its membership jurisdictions. Local governments feared that home rule would be in jeopardy with a stronger regional agency (Innes et al., 1994, p.234).

Yet, while the time was not ripe for a serious reconsideration of the division of labor between local governments and regional special purpose agencies, the *discourse* and *framing* did begin to shift around the late 1990s towards a more comprehensive characterization of the challenges facing the region, and the need for addressing land use and transportation planning in a more systematic fashion at the regional level. The timing was perhaps no coincidence. The growth in the years leading to the turn of the millennium had been focused in more remote locations of the region, with attendant challenges of providing and financing the infrastructure, only to realize that twin problems of congestion and high housing prices remained. The means of addressing them would still lie further into the future.

Towards a Bay Area land use / transportation connection, with trepidation

From a transportation standpoint, MTC staffers had since at least the mid-1990s recognized that the success of discretionary transportation grant monies from ISTEA from an air quality and transit standpoint was to a large extent dependent on the land use the pattern in the vicinity of transportation investments, leading to a more formal agency process of thinking through the land use to transportation policy nexus more clearly. In 1996, an MTC task force recommended that future RTPs include a "[l]and use connection" (Innes & Gruber, 2001, p.98). Yet, using land use as a criteria for funding grant proposals still proved controversial (Innes & Gruber, 2001, pp.158-60), and MTC senior management was careful to not step too far into the land use planning arena, formally the province of the partner agency, ABAG.

> Deputy Director Hein, in a presentation to the Council about the transportation/land use nexus, made it clear that he saw significant limitations on MTC's ability to promote particular land use patterns. ... He argued that MTC needed to *respond* to the population projections, presumably rather than try to *alter* them through trying to influence land use (Innes & Gruber, 2001, pp.196-97, my emphasis).

While MTC staff had taken some modest steps at acknowledging the role of land use in the transportation planning process, the agency was careful to not be seen as usurping powers held by local jurisdictions, and secondarily ABAG. Ultimately, the slow pace frustrated the advocacy community, which had little patience for MTC's formal limitations in the realm of land use. They wanted to push the organization to use its considerable financial resources to incentivize what they saw as good policy. Members of MTC's Advisory Council, composed of various stakeholders to the transportation process, tried to push leadership to make the connection to land use much more explicit, in effect recognizing other sources of knowledge, such as that of the advocacy community, in crafting long term policy:

> One said privately that the Council was,
>
> > trying to prod them [MTC] on the land use issue, to make some noise. The point ... was to say: "look, everybody agrees that the housing/land use/transportation connection is real. Our transportation problems are housing problems. So what can MTC do about that? Why isn't MTC doing anything about that? I want to know right now." We want to force them [MTC] to think regionally, instead of just always log-rolling pork barrel.
>
> (Innes & Gruber, 2001, pp.197).

One example came from the director of the Greenbelt Alliance, a land use and open space advocacy group, noting the "most troubling ... fact [that] the Deputy Executive Director does not appear willing to consider land use and transportation from a regional perspective, even though the purview of the MTC is to develop regional transportation plans" (quoted in Innes & Gruber, 2001, p.198)

Downstairs, at the sister organization, ABAG–otherwise also careful not to encroach on local land use authority–nonetheless supported the effort of the regional agencies to work with the [advocacy umbrella group] Bay Area Alliance for Sustainable Development "to foster compact development in the Bay Area around transit centers and particularly in impoverished neighborhoods." (ABAG, 1998). The work was limited in scope to a focus on infill around transit stations, but it was still a significant and agenda-setting effort which would find echoes in the Priority Development Area program hatched a decade later. The agencies' joint work continued. In the beginning of the 2000's, the regional agencies held a series of regional visioning workshops. With these the regional agencies sought to re-frame important challenges as issues of a regional nature, requiring commensurate regional solutions.

These issues became sufficiently pronounced that decision makers were encouraged to try connecting the separate planning processes for transportation and land use, and a "blueprint" scenario planning effort took form in the years around the turn of the millennium (Barbour & Teitz, 2006). Regardless of reasoning, around this time, growth projections had become part and parcel of a more comprehensive dialogue about regional futures, adding a belated land use component to the long-standing transportation planning process. While ABAG issued its biennial and policy agnostic, business as usual projections in 2002 (Association of Bay Area Governments, 2001), already a year later, the follow-up policy-based and informed version saw the light of day (Association of Bay Area Governments, 2003a). The policy frame was one of more explicitly focusing on infill development while preserving regional open spaces.

This sort of thinking was formalized into state law with the passage in California of Senate Bill 375 (Steinberg, 2008). It prescribes the new statutory linkages between land use and transportation planning, and associated performance goals of using land use as a mechanism for reducing greenhouse gas emissions (GHG) (Barbour & Deakin, 2012). The Governor's Office explicitly noted the role of "better" land use planning, with "communities that rely less on automobiles and get Californians out of their cars for routine trips such as to work and the grocery store" (California Governor's Office, 2008). However, while the process sets regional goals, it didn't go as far as to change authority, while leaving much open to interpretation. This may be a practical necessity when dealing with the diversity of regions in the state, but it also kept the door open for knowledge and policy debates within individual regions, as was experienced in the San Francisco Bay Area: Though the state set the targets, regions had to define their own ways and means to get there, and with the stroke of a pen, regional analytics took on a much more visible and prominent role in the regional conversation about possible futures. In the following section, we will seek to understand the present better by an account of what went before; an overview of the process from the time when it was understood to be more strictly policy neutral in its focus, and more exclusively technical in its knowledge domains.

1.5 The Regional and Small Area Projection Process over Time

The regional projections process at ABAG has evolved over the past 40 years, but not entirely in the ways one might expect, given the technological advances in computing power during that time frame. The increasing complexity is not mainly technical but in the context in which projections have meaning, as a part of a wider planning practice, itself rendered more complex by larger data, more models, stronger state mandates, but with few changes in the overall political economy of local land use regulation. We divide the evolution of regional analysis and projections at ABAG into several stages, as shown in Table 2. The 1960s and 1970s ushered in early efforts to forecast the region's economy and population, reaching perhaps an apex of sophistication in the 1980s, when a set of state-of-the-art models were created in-house to project growth at the regional level and allocated down to the small area level. In the following two decades, the approach evolved through first a series of simplifications and revisions, and then from a technical process by advanced staff trained in regional science to, more recently, an approach overlaid with policy and political factors. Even as a technical exercise alone, forecasting was challenging because of both cyclical and secular changes to the economy, with inter-regional realignments and comparative advantages developing or declining over time. Those in turn have a bearing on future trajectories, the industries and occupations supported, and the wages they will pay, in turn affecting the demand and cost of housing, which in turn impacts migration levels. Accounting of future income distribution of a region is a technical exercise, but at the same time interpreted as a strong value statement on the part of the planners and modelers putting such a "scenario" forward, often inviting input by other "knowledges" eager to offer their own interpretations on the actual and should-be direction of the region. As other types of "knowledge" were added to the mix, the understanding of the future took on a different balance of expectations and aspirations.

Table 1.1: The main phases of 40 years of Bay Area growth projections

Period	Regional Projections	Small Area Projections	Outside Input
I: Early Regional Models (mid-1960s through 1970s)	Trend and single equation econometric projections	PLUM: Projective land use model	University of California research center
II: Business as Usual Projections (1980s and 1990s)	a) Regional Economic and Demographic System (REDS); followed in mid-1990s by b) Input-Output step-down approach	POLIS: Optimization location model; SAM: Small area allocation model based on historic and land availability	Local Policy Survey of zoning and general plan expectations or developable land.
III: 1st gen "Smart Growth" Policy Projections	Continuing Input-Output economic projections and county level demographic projections	Earlier location models modified to produce regional policy-driven distribution	Metropolitan Transportation Commission policy approach; FOCUS process for public input
IV (continued): SB 375 Sustainable Community Strategy (SCS) Projections (First SCS plan)	Consultant shift-share model capturing regional competitiveness	Heuristic rules-based approach with outcome asserted per policy vision. PDAs prominent.	Public workshops, regional planner and local planner review.
IV: 2013-present (Second SCS plan)	REMI based general equilibrium model for four subregions	UrbanSim econometric small area allocation, with explicit policies asserted for development capacity and costs of development, but not behavior	Technical advisory committees, public workshops; ABAG regional planner and local planner review; litigation and legal settlements

Phase I, 1960s: The impetus for models

As the postwar years came with both massive shifts in population, new industries and transportation infrastructure (Putman, 1974), there was much need for analysis. Faced with large urban regions with considerable growth pressures and lots of federal and local dollars hanging in the balance, a new way of knowing was needed. In this environment, computers, and with them bespoke models would emerge as a way of conducting large scale analysis. At the same time, computing resources became available for large organizations with big needs and pocket books. The reasoning for models was related to mainly the cost of transportation investments to federal tax payers, but, after a wave of national and state environmental review legislation had passed in the early 1970s, environmental impacts also entered the discourse, here from a US Department of Transportation sponsored report on the need for forecasting tools in the 1970s:

> The *complexity of planning* for urban transportation, and the *cost of major new investments* in highways and transit, make it imperative that accurate, *policy sensitive tools* be available to transportation planners and local decision-makers. Future travel demand, travel times, environmental and land use impacts and many more variables must be considered, not only to judge the costs and benefits of alternative investments, but also to allow all elements of the urban transportation system to function most efficiently. (Public Technology Inc & Urban Consortium for Technology Initiatives, 1978, my emphasis)

Elements of cost, policy considerations, and complexity highlights the view of cities and their transportation networks as complex systems to be analyzed and understood. While researchers from the regional sciences and geography since the late 1950s had been adapting the German location theories of Christaller and Loesch with their ideal-typical diagrams of how cities might be structured, it would take computers to allow for the possibility of a large scale testing of such ideas on real world data, and federal transportation dollars would frequently be a way to fund such early analyses intended for interstate highway impact studies (Berry, 1993).[9] A separate impetus but still under the transportation heading came in the form of a foundation grant. In 1960, the Ford Foundation funded the RAND Corporation for the purposes of an exploratory study of urban transportation, and RAND for its part wished to leverage its staff of both engineers and social scientists to conduct a full systems analysis of urban transportation (Kain, 1965), and the result was the Lowry gravity model, a seminal analyticly rich spatial interaction model with inspiration from physics encompassing the spatial distribution of both employment and population, along with interactions (Lowry, 1964).

[9] This attention to models would later be termed the quantitative revolution in geography (Barnes, 2001).

For the San Francisco Bay Area, the growth pressures were as acute as anywhere, but with the peculiarity of a bay sitting at the center of the region, with attendant land use and transportation challenges. The genealogy of land use models goes back to an effort at University of California, Berkeley where researchers at the Center for Real Estate and Urban Economics began work on a local implementation of a state of the art Lowry-type gravity model (Lowry, 1964; Gross, 1982) for the San Francisco Bay Area (Association of Bay Area Governments, 1980; Goldner, 1983). As part of the Bay Area Regional Travel Study Commission This effort found its culmination in the form of the *Projective Land Use Model* (PLUM) model (Goldner, 1968), working with the unit of analysis of zones, each with an accounting of jobs by sector, along with counts of households and population. Small geographic area modeling in the region was further developed during the 1970s, through a series of substantive studies of regional significance. A study of regional airports to identify priorities became the first real-life application, helping answer questions on locational impacts of having several airports in the region.

Phase II, 1970s-1990s: Business as usual models incorporating local knowledge

The second, and arguably more important major use case for the local area model would become established also during the 1970s, as zone-based transportation model simulations required detailed local accounting of future jobs and households, as trip generators and origins to aid in the study of future trip patterns (Goldner, 1983). Although knowledge of land use was here incidental to the transportation planning process, the biennial projections would soon gain significance in their own right as a major marker on the region's economic progress, with totals monitored by observers outside the region (Torriero, 1992) and sub-geographical distributions noted by locals.

A regional model represented a re-scaled epistemology of the region: allowing for connections across jurisdictions. But it also needed almost micro-level detail to be credible. While the level of detail of local land use policy information, chiefly land availability was modest at this time, the realization on the part of modelers–and the public through their elected officials–that such details had perhaps outsized influence on the modeled outcomes, and accordingly on associated transportation dollars, meant that the political was never far below the surface of the technical.

This observation translated into concern whether the initial data were correct; then that the assumptions regarding the projections were properly expressed; and finally, that the outputs corresponded with the policy expectations implicit in local zoning, density, and

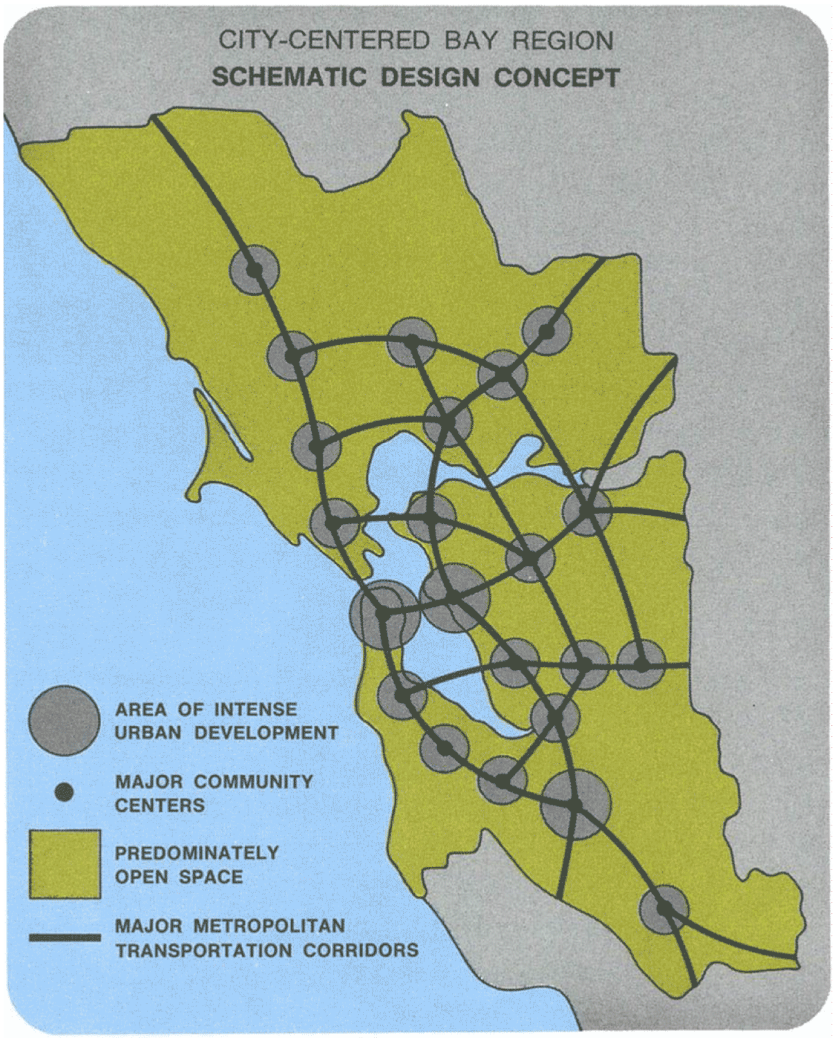

Figure 1.3: An early concept for a city-focused growth pattern. Source: Association of Bay Area Governments (1970).

land use instruments (Goldner, 1983, p. 279)

Accordingly, in 1976 ABAG began to systematically collect data from local governments in the region on availability of land, zoning and density expectations (Association of Bay Area Governments, 1976). The recognition that such input data were critical to the *acceptance* of the models meant two full years were expended on planning, designing, reviewing, and revising a comprehensive survey. An estimate of developable land was drawn from this local policy information and formed the basis for ABAG's first of a series of what would become biennial projections. ABAG referred to this Series 3 projection as the "first study of Bay Area's future population, housing and employment picture to use existing local development policies as a base" (Association of Bay Area Governments, 1986), distinguishing it from the earlier BATSC-driven PLUM projections with a less direct accounting of land capacity (Goldner, 1968, pp.62-65).

The projection was issued in early 1977 in draft form for comments, and in final form, late 1978 following 18 months of feedback and revisions. That such a considerable time frame was allowed for feedback may have helped the reception of these early projections. It is noteworthy from the quote above that the agency–or, at least its modelers–did not see ABAG's role as *setting* as much as *reflecting* local land use policy through the projections, but spent considerable time making sure the models were aligned with, and wouldn't greatly conflict with local expectations. The allocation model was, in effect, a very intricate accounting system built on top of local land capacity and future density assumptions. It could well be used for asking questions and identify transportation and housing mismatches and dilemmas, but advocacy for the agency as it related to its modeling work was focused on the *overall levels* of housing production more so than the *whereabouts* of it. Analysts also focused on the provision of affordable housing, and, importantly, more rental housing (Association of Bay Area Governments, 1979).

As ABAG took over the analysis of growth within the region from the academics who originally addressed the topic, ABAG's Information Analysis department faced the broader challenge of designing a set of models that were state-of-the-art at the time, generating projections in a systematic way consistent with regional science at the time for the region as a whole and across multiple geographic levels (Association of Bay Area Governments, 1993; Brady & Yang, 1983; Prastacos & Brady, 1985). Projections were created in several steps, moving from the most general regional level to the subregional and jurisdiction level, down to the more detailed analysis zones needed for transportation analysis. For regional projections, the analysis included econometric relationships to forecast economic factors from projected national trends with a cohort-survival component with migration determined by economic expectations. Growth was allocated to geographic areas throughout the region through a model built on a set of optimization equations and then to smaller units through a process based on existing land uses and available land. The analysis made use of the Local Policy Survey, the systematic local jurisdiction outreach and data collection effort begun in the late 1970s and updated approximately every two years. This embedded a certain level of local policy perspectives early in the development of the projections process. According to Goldner:

> The modeling mode shifted from projective to prescriptive as base year data, coefficients, and assumptions reflecting local policies were increasingly brought to bear upon the system.
>
> . . .
>
> The sequence of projections that constituted Series 3 Provisional, Revised, and Final, were not implemented in a policy vacuum, which goes a long way in explaining the careful attention paid to their modifications. The careful honing of policy instruments at several governmental levels was being carried on in parallel with the technical process of developing and reviewing the projections. (Goldner, 1983, p.285-86)

ABAG published its for the time last regional plan in 1980. A severe series of post-Prop 13 cutbacks ensued, while the agency backed away from strong regional policy goals, focusing instead on becoming "entrepreneurial" and providing services to its members. By 1992, ABAG's General Assembly adopted principles for growth management that were a prima facie rejection of any regionalist goals, reaffirming instead the body's solid commitment to local control. After declaring support for the planning principle that the "planning process in California should be broadly coordinated and integrated at the state, regional, subregional and local levels," the subsequent principles made clear that the regional idea was thoroughly dead:

> Governance is handled best at the closest level to the governed. Thus the planning process should be structured so that local issues are handled locally in General Plans, subregional issues are handled at a county or other subregional level and regional issues are handled collectively at the regional level. Moreover, greater efficiency and effectiveness in the planning process is desired; *not a new layer on top of existing agencies.* (Association of Bay Area Governments, 1998)

Local jurisdictions were to retain "full land use regulatory powers." Even when the Assembly affirmed its commitment to dealing with the existence of "transcendent" planning issue, the natural scale proposed to deal with spillover issues was the county.

> There are planning issues that transcend single cities and require coordinated subregional planning. Subregional planning bodies should be established following the desires of each subregion. Initially, the county level would be assumed to be the appropriate geographical area; however, nothing should preclude two or more counties from forming such a planning entity. (Association of Bay Area Governments, 1998)

A change in staff in the mid-1990s and a move to personal computers brought about some changes in the individual components of the modeling process and data collection efforts, but the forecast remained a largely technical exercise focused on getting the data and model relationships "right," and keeping planner's assumptions in the modest, and well in the background as the work of producing regional plans for the agency had come and largely gone already by the 1980s, during which decade the region's footprint grew considerably as more valleys in the East Bay were developed further from existing centers.

Phase III, Early 2000s: Towards "smart growth" policy-based projections

The basic contours of the local area projections continued until and including the release of Projections 2002, at which point the organization shifted gears and adopted a more explicit land use policy framework, under the influence of the wider smart growth currents permeating the planning discipline and discourse at the time (Daniels, 2001). The key impetus, as framed by the organization, was that business-as-usual projections, by their absence of any policy frame or mandate, failed to address issues of regional importance, such as adequate housing production (in size, price and location) commensurate with the region's strong engines of employment growth. Already in the Projections report issued in 1987, ABAG researchers noted:

> Inadequate housing production is the most persistent, serious obstacle to a healthy economy . . . [m]any communities are seeking job growth without commensurately encouraging increased housing production. (Association of Bay Area Governments, 1987)

In boldface, the report continued ominously:

> The public policy debate that this document will hopefully produce is not over whether growth is good or bad. Rather the debate should consider whether land use and other local policies that encourage job growth can be reconciled with the resulting need for housing production. (Association of Bay Area Governments, 1987)

While long term planners were fretting about housing and jobs imbalances, environmental groups for their part were concerned with the rapid expansion of the urban footprint, encroaching on open space. Transportation challenges in turn arose from an increasingly scattered development pattern. Those triple challenges existed in spite of the presence of regional agencies charged with addressing them, in part because the prevailing planning and modeling approach came up short relative to the scale of the challenge.

This distinctive new phase of the projections work thus happened in the early to mid 2000's and would be relatively short, before the next phase would begin with the more state-driven set of mandates pursuant to SB 375. While there are similarities in the orientation towards smart growth and from a modeling / technical standpoint assumptions about greenfield development and capacities for infill, we keep them separate primarily because the phases were driven by different *actors* (local environmental groups) and had a different *outcome* (that is, not a plan) than during Phase IV, described later. Phase III led to smart growth projections but without a planning mandate. Phase IV, culminated in a more fully fledged integrated land use and transportation planning process per newly enacted statutory authority with the proximate, but far from only, cause being transportation's role in greenhouse gas production (**California.OfficeoftheGovernor2008**; **CaliforniaGovernorsOffice2008**; California Governor's Office, 2008).

Phase III thus has the beginnings of a new modeling practice as far as assumptions go. In the late 1990s, a number of regional agencies with different missions spanning land use, transportation, water quality and supply, and the health of the San Francisco Bay[10]–began in earnest to discuss concepts of smart growth, how to "spread ideas" and "identify regulatory changes and incentives necessary to implement smart growth." The problem was framed around the business-as-usual planning, or lack of it, and growth projections reflecting this, suggesting growth of another million residents over a 20 year period, and wondering how to "maintain the region's beauty, natural resources, diversity and quality of life", along with how to tame "growing pains" such as "lack of affordable housing, crowded roadways and shrinking open space" if the "current growth pattern of spreading ever outward" were to continue (Regional Livability Footprint Project & ABAG, 2002, my emphasis). The regional agencies tapped into the emerging "smart growth" discourse, making some inroads into both graduate planning programs as well as, to some extent, the public imagination. They billed it as a pivotal means to attain sustainability, with little obvious cost: a prosperous economy, a quality environment and social equity. [11]

Addressing the economy side, "smart growth" would ensure more

[10] The agencies include ABAG, (land use), MTC (transportation), Bay Area Air Quality Management District (air quality), Bay Conservation and Development Commission (the health of the San Francisco Bay), Bay Area Alliance for Sustainable Development (umbrella advocacy organization) and Bay Regional Water Quality Control Board (water supply issues).

[11] While significant, the Footprint project is far from the first foray of joining land use and transportation planning in the region: The very first RTP from 1973 after MTC's creation in 1970, noted the desirability of "[i]ncentives and disincentives to curtail auto use, contain urban sprawl, promote transit development and concentrate population growth," per (Jones, Taggart, and Dorosin, 1974, as cited in Innes and Gruber, 2001).

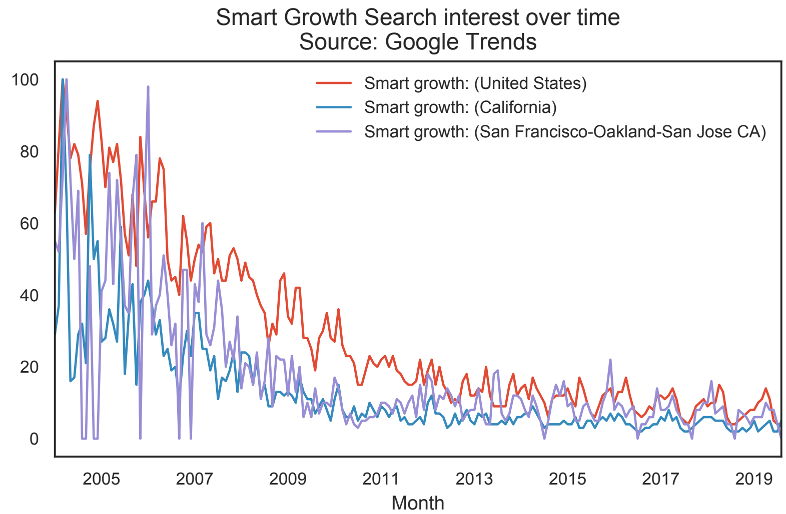

Figure 1.4: Google Trends reveals that smart growth as a search term in California peaked in 2004 (first year for which search trend data is available) and dropped since, with the interest being higher in the Bay Area than in Los Angeles, but lower than in Sacramento and San Diego from a search standpoint. Note that the levels are not directly comparable; each region is normalized to 100, suggesting a stronger tapering of interest for the US as a whole.

housing could be built at higher densities, addressing fears in economic circles that there wouldn't be adequate housing to house the region's workers, a concern that had been voiced in ABAG projections for some 20 years at the time (cf. Association of Bay Area Governments, 1980). The argument was that "the environment" would be sustained better by preserving farm land and open space, by focusing urbanization to a smaller footprint, and encouraging more mixed uses. Equity goals would be served by the production of more mixed income housing and investments in transit, grocery stores and child care. In short, growing smarter, to the agencies involved, was a way to address a series of interrelated problems, many of which fell outside the typical ambit of regional planning agencies.

The purpose of this sketch of events is not so much to evaluate these early forays into sustainability discourse and practice, but to note how this work would gradually become significant for the erstwhile technically-focused projections work. In terms of chronology, after the publication of a Projections 2002 series, the Livability Footprint report came out, and ABAG departed from the biennial projections schedule and unusually issued a Projections 2003 series, in which the earlier projection 2002 was described as a "base case" scenario, while the new series were designed to reflect the tenets of the smart growth vision. ABAG's research director, Paul Fassinger, noted that the Projections 2003 series did indeed represent a dramatic break, "reflect[ing] the Smart Growth Vision and land use policies, shifting development patterns from the expected trends towards a better jobs-housing balance, increased preservation of open space, and development of urban and transit-accessible areas" ("Projections 2003 Symposium: Smart Growth Policies Move Toward Shaping New Reality for the Bay Area," 2003). The staff lament from the mid-1980s about lackluster housing production relative to jobs was being addressed head-on in a more forward looking projections report.

The projections had thus switched from not taking explicit land use policy stances to a much more curated set of assumptions asserting how the region *should* grow, with the endorsement of ABAG's governing board (Association of Bay Area Governments, 2003b). Nonetheless, there was continuity with Phase I insofar as the agency through a survey had learned that 85 out of its 95 member cities had already adopted, or were considering adopting, some smart growth policies (Russell, 2004). It could be argued that the agency didn't as much set policy as merely encourage continuation of a direction already undertaken by a considerable number of its members.

Phase IV, 2008-present: Plan Bay Area–plan-based projections

The latest stage in projections came in the wake of changes in state law, notably the passage of Senate Bill 375 (Barbour & Deakin, 2012). This law enshrined in statute requirements for coordination of land use and transportation planning processes with specific greenhouse gas performance goals, had the side effect of subsuming the projections work into the wider regional planning work, ending its status as an "independent" activity conducted for its own sake. Henceforth, the regional forecast and local allocation would be part and parcel of a much more *prescriptive* exercise; a component of something resembling a regional plan as called for by the statute.

While SB 375 was a watershed moment in formalizing the requirements for coordinated regional land use and transportation planning, in some ways the transition had already happened across California's MPOs after years of experimenting with blueprint scenario-focused planning efforts (Barbour, 2015, p.84). Per Barbour (2015), there were four ways the four large MPOs began to change their RTP processes *before* SB 375: land use focused performance measures; enhanced stakeholder outreach; integrated transport-land use scenario evaluation; and lastly, integrated transport-land use implementation strategies. With the arrival of SB-375, it "did not radically alter existing processes, so much as it aimed to better coordinate and align them."

PDAs as a framework for both engagment and growth

While MTC and ABAG had coordinated and shared data in its preparation of the federally mandated regional transportation plans in years past, *Plan Bay Area*, as it would be called in the region, was now required by state law as a companion land use component to the regional transportation investment plan, somewhat elevating the role of ABAG. The first Plan Bay Area, subtitled "Jobs-housing connection strategy" adopted in 2013 after years of scenario development and visioning sessions, was thoroughly focused on smart growth principles of concentrating development near transit at higher densities and limiting greenfield development, showing a direct lineage from the early smart growth visioning document from ten years prior. Since then, a new regional policy tool had come into being which would prove critical to the plan framework and municipal engagement: Starting in 2007, Priority Development Areas (PDAs), or locally nominated transit-focused zones slated for growth would become eligible for regional financial incentives provided through transportation funds. These, along with Priority Conservation Areas, would form the conceptual scaffolding for the regional vision of future land use, where PDAs would encompass a lion's share of growth in housing, and to a lesser extent, employment, keeping pressures off the conservation areas. These serve as great examples of the planning approach taken for a regional agency with more soft than actual power : Set a conceptual frame and get local officials to participate, with planning grant funds available to set up the PDAs.

PDAs were arguably a meaningful policy for getting buy-in from local jurisdictions to accept more growth in strategic, transit friendly locations thus furthering both local and regional goals. Though, due to the decentralized nature of the nominating process, the resulting PDA map was extraordinarily varied, with PDAs in all shape and sizes put forward. Some PDAs encompassed large swaths of existing downtown districts (as in San Francisco), while others would be small areas near bus stops of moderate service frequency: The largest PDA, at more than 2,000 hectares, was more than 220 times larger than the smallest, at just nine. This variety was a "feature", not a "bug," and PDAs were classified into a number of distinctive place types, assumed to represent different development densities and transit service levels, helping to carry the message that growth was not uniform, but highly contextual, and substantially defined by local officials according to local principles.[12] While this helped in terms of sourcing local ideas and preferences for growth, and also in terms of further developing the local partnerships which would be needed if the plan's prescriptions were to become a reality, the variety in PDAs meant that the internal coherence of the *spatial* framing of the plan suffered somewhat as a consequence.

[12] The place types were Mixed-Use Corridor, Transit Town Center, Suburban Center, City Center, Employment Center, Transit Neighborhood, Urban Neighborhood and Regional Center.

Staffing new work

This period of emerging by historical standards "activist" planning at the regional scale coincided with further staff changes and reorganization within ABAG's planning and research group. As the external requirements increased and with it, political visibility and scrutiny, the research group transitioned to a more explicitly land use policy-focused set of skills, leaving behind some of its erstwhile technical expertise. As a result, the research group was left without the internal capacity to continue in-house preparation of parts of the forecast and projections.Instead, the biggest component of the forecast was an employment projection, and it was produced externally, based on shift-share analysis (Levy, 2012). Population was forecast based on labor force demand, with demographic characteristics drawn from state-level forecasts. Additional analysis on income distribution was provided by academic consultants (Chapple & Wegmann, 2012).

Having at this point departed from its typical model suite as developed in the decades prior, ABAG went for a more heuristic approach rather than the usual econometric one to translate the PDA concepts and a more compact vision into actual local ”projections” (Association of Bay Area Governments & Metropolitan Transportation Commission, 2013a). For the jurisdiction-level employment and household growth allocations, respectively, the agency identified a handful of ”growth distribution factors.” These included, for employment, separate algorithms for ”knowledge based jobs” assumed to increase agglomeration economies; population serving jobs assumed to follow the growth in households, and all other jobs, assumed to maintain the existing spatial distribution. For households, the growth factors included level of transit service; vehicle miles traveled, employment by 2040, low-wage workers incommuting from outside the Bay Area, and housing values. These growth factors were *asserted* to be drivers rather than “discovered” in an econometric sense, clearly signaling the transition towards a vision and scenario-based projection, with policy-relevant factors driving it. Ultimately, this was a notable shift: as it became accepted that land use policy would be an active component of the projections work, there were different approaches of defining, representing and capturing change, and what the role of technical analysis and visioning should be in the regional planning process.

Increased public visibility of projections

The planning cycle that ended in 2013 (Plan Bay Area 2013, Projections 2013) also saw a ramping up of the public role in the regional planning process and expanding dialogue on the numbers. During the spring of 2013, ABAG and MTC held public workshops and hearings, where members of the general public could speak with staff about details of the plan and could publicly state support or opposition in front of elected officials from the ABAG or MTC executive boards. The workshops and hearings came relatively late in the planning process, long after the forecast was completed, with participants having the perception that their concerns would be heard too late to be meaningfully incorporated in the plan. Some interest groups began to raise concerns over the legitimacy of the analysis underlying the planning process, and law suits over the plan led to settlements that dictated some portions of the analysis for the next planning round (2013 to 2017) (Bay Area Citizens v. Ass'n of Bay Area Gov'ts and Metro. Transp. Comm'n, 2014; Bldg. Indus. Ass'n Bay Area v. Ass'n of Bay Area Gov'ts and Metro. Transp. Comm'n, 2014).

The reception of the plan and associated projections was complicated by the rise of the Tea Party movement on the national stage. As a national anti-establishment movement arising on the heels of the Great Recession and in reaction to the election of Barack Obama (Boykoff & Laschever, 2011), its activist tactics of disruption were put to use in a very different context at the local level, finding the first regional land use plan to be a good testing ground for its newfound oppositional power.

At the local scale, its adherents called into question not only the very science of climate change and accordingly whether the main premise of SB 375's greenhouse gas reduction objectives was real, but the very legitimacy of regional planning, framed as an infringement on local control by bureaucrats eager to plaster over the region with "stack-and-pack" multifamily housing and mandates for transit use (Trapenberg Frick, 2013), echoing the debate at the state level in the wake of the passage of SB 375, where planning was seen as a way to dictate where people should live, taking away choice (cf. "Regional Planning Bill Advances," 2007).

The growth projection, now packaged in a scenario policy frame, was caught in this crossfire, even if the Tea Party demonstrably didn't represent the wider views of the region's population, expressing confidence in the notion of regional planning in a survey of residents conducted in 2012. Still, the public mandate for regional planning was limited: The majority opined that planning should be conducted by local jurisdictions (51%), while a smaller share of 44% said housing and commercial development should be guided by a regional plan: when framed as a choice between regional bureaucrats and local control, the latter reigned supreme (Corey Canapary & Galanis Research, 2012).

Another complication inadvertently came as the State of California's Department of Finance released their own projections showing substantially lower numbers for the Bay Area, while Plan Bay Area was being debated (Mitra, 2012). Ultimately, the more local projections were tied to the view that they reflected explicit policy assumptions, with little explanation of the technical side of the process, the easier it was to dismiss them by detractors, newly empowered by social media to make a bigger splash about local control: by being part of a policy frame, projections were removed from the technical domain and thrust squarely into the long standing divisions of land use politics surrounding the region's 101 cities across nine counties.

1.6 Key Themes in the Current Phase

Ends, means and lawsuits

The work on projections for the second Plan Bay Area began soon after the adoption of the first Plan Bay Area in 2013. At that time, ABAG had no in-house models for producing projections at the regional level, as explained earlier.[13] With his departure, ABAG had moved away from the more technical models used to distribute growth to subzones within the region, to simpler heuristic spreadsheet approaches based on proportions defined by on share of population growth or share of existing employment (Association of Bay Area Governments & Metropolitan Transportation Commission, 2013a). Efforts to replace the older technical models with newer, more state-of-the-art behaviorally and policy-explicit microsimulation tools (first PECAS and then UrbanSim) had not yet led to results, in part because agency leadership lacked confidence that a simulation model would prove tractable and suitable for the task of scenario and vision based local projections.[14]

[13] The previous Research Director had left the agency, along with his bespoke input-output models, after the research department was combined with the agency's planning department to form Planning and Research, under a single director.

[14] PECAS (HBA Specto Inc, 2016) and UrbanSim (UrbanSim.com, 2016) are both open source systems for distributing households and jobs within a region, but each required substantial technical skills and time commitments to reach a credible distribution of activity. Yet, the possibility of using microsimulations to mix empirical knowledge and "a priori"-reasoning has been recognized for some time in the urban economics literature, with Arnott (1995) observing that [s]imulation may offer a more promising approach to forecasting the effects of second-generation rent controls since it permits the integration of empirical knowledge and *a priori* reasoning.

During the production of the first Plan Bay Area from 2013, ABAG's partner agency, the Metropolitan Transportation Commission (MTC), had used ABAG's spreadsheet models, but had attempted to replicate these in UrbanSim for the environmental impact review (EIR) process required by California law for the plan. For the second Plan Bay Area, MTC, facing a long list of federal reporting requirements for its transport model system, strongly preferred to use a microsimulation model like UrbanSim at the front end instead as the basis for systematic transportation and performance analysis. During a joint MTC Planning/ABAG Administrative Committee hearing, MTC noted that the California Transportation Commission had called for the MPOs to "build formal microeconomic land use models, as soon as is practical, so that they can be used to analyze and evaluate the effects of growth scenarios on economic welfare" (Barna, 2007, as cited in Metropolitan Transportation Commission, 2012), aligning with the goals of SB 375. MTC staff had been attracted to the analytic opening made possible by integrating the microsimulation-based land use and transportation models, making possible the analysis of interactions over time of the two systems (Metropolitan Transportation Commission, 2012). In staff-level meetings MTC staff had expressed the benefits of and preference for giving primacy to a model-based accounting of the plan due to its explicit and transparent nature. ABAG staff agreed to use UrbanSim to inform the geographic distribution, but not necessarily to the point of using the model output as the final expression of the plan (implying a preference for allowing post-modeling adjustments).

Apart from this technical push towards increasingly complex models based on very detailed land use data for every parcel in the region, legal pressure came from outside the two agencies. Four different lawsuits had been brought against ABAG and MTC in their capacity as plan sponsors upon adoption in 2013. Although the lawsuits used the legal openings of the EIR process, they revolved around the decisions inherent in the forecasting and projections process, as well as the policies of the plan.

- The *Bay Area Building Industry Association* argued that, "[i]nstead of delivering a realistic and feasible plan, Respondents have prepared an SCS, called 'Plan Bay Area,' that fails to solve the Bay Area's bad habit of exporting its housing needs to outlying areas, condemning more of its workforce to lengthy commutes . . . " and therefore failed to "house all of the population" as required by the legislation (Bldg. Indus. Ass'n Bay Area v. Ass'n of Bay Area Gov'ts and Metro. Transp. Comm'n, 2013).
- *Bay Area Citizens* challenged the alternatives evaluated in the EIR as well as the failure of the EIR to take into account effects of state mandated mileage regulations on vehicle miles per gallon in the future (Bay Area Citizens v. Ass'n of Bay Area Gov'ts and Metro. Transp. Comm'n, 2014).
- *Communities for a Better Environment (CBE)*, the *Sierra Club*, and *Earth Justice* pointed to a number of inadequacies of the plan and the EIR, including the failure to include freight movement in the analysis (or the plan) and the inadequate analysis of and mitigation for displacement (Communities for a Better Environment and the Sierra Club v. Ass'n of Bay Area Gov'ts and Metro. Transp. Comm'n, 2013).
- The *Post Sustainability Institute (PSI)* argued that the plan enabled development in Priority Development Areas (PDAs) while making development more difficult in greenfield areas, thus treating landowners inequitably (The Post Sustainability Institute v. Ass'n of Bay Area Gov'ts and Metro. Transp. Comm'n, 2013).

Each of these legal challenges, while each working through the vehicle of the California Environmental Quality Act to address grievances, had distinctive knowledge bases and came from very different normative standpoints: the builders wanted to build, the Sierra Club, CBE and Earth Justice were focused on environmental shortcomings of the analysis as well as its mitigations, while PSI rejected the very edifice of a regional plan altogether.

The court combined the four lawsuits under one umbrella for review. The agencies reached settlement agreements with the BIA and CBE groups, while the remaining two lawsuits were ultimately dismissed by the court. The settlement agreement with the BIA required that the subsequent plan should "set forth a forecasted development pattern for the region that *includes* the Regional Housing Control Total, which shall have *no increase in in-commuters over the baseline year* for the SCS, and *shall not be* based on historical housing production" (Bldg. Indus. Ass'n Bay Area v. Ass'n of Bay Area Gov'ts and Metro. Transp. Comm'n, 2014, my emphasis). ABAG interpreted this requirement to mean that the plan include enough housing for the projected population and households as well as the amount that would be needed to house any projected increase in in-commuters (MTC Executive Director & ABAG Executive Director, 2015). Furthermore, during the preparation of the first plan, ABAG had lowered the employment projection to allow the region to build a smaller number of housing units, arguing that the larger number implied by the employment projections was not politically feasible. This reduction approach was also rejected by the language of the settlement. The CBE settlement included, in addition to numerous transportation related requirements, the need to provide ongoing housing performance data on the part of the agencies covering Priority Development Area performance, equity measures, and access to jobs and housing. Through the court room, the work of projecting the region had become far from a technical backroom exercise of coefficients, but one subject to scrutiny and challenges through the courts, where the conceptual reasoning more than the modeling prowess were subject to legal review. As an echo of Garrett and Wachs's (1996) account of courts interfacing with modeling design decisions in the face of (then) air quality requirements, projections were certainly sourced from the technical and political domains, and now also the legal one.

New Divisions of Labor

Two cooks in the kitchen

> We believe that MTC, like many other planning agencies, has not recognized sufficiently the importance of developing more collaborative approaches to addressing regional problems and that it needs to do so. (Innes & Gruber, 2005)

Methodologically, the current phase (2014 to the present) is marked by a return to land use modeling based on econometrics, using the UrbanSim open source model system as the main workhorse P. A. Waddell (2002), P. A. Waddell and Ulfarsson (2003). The Bay Area implementation of it–along with the database it is built on–has been painstakingly prepared by MTC staff over the course of several years, assembling and standardizing data for more than 2 million parcels from 109 separate jurisdictions, collecting data on building permits, zoning and development capacity, and estimating modeled relationships to locations for households, business

Mode of Production	External Environment Requirements	
	Outcome Agnostic	**Outcome Conscious**
Technical Focus	A: Classic disinterested, engineering-focused, parameter based modeling; fidelity to technical specifications, agnostic to outcome	B: Focused on strong technical model development, but with equal focus on outcome by way of explicit policy assumptions
Policy Focus	C: Policy idea driven work, yet agnostic to overall resulting land use patterns	D: Adherence to conceptual enumeration of policies, but with equal focus on overall outcomes

Table 1.2: A diagram of four analytical modes of projections development

establishments, and real estate markets based on a combination of multinomial logit models, hedonic regressions, and ROI-based real estate proforma models.

As a sign of changing times, the *regional* projections in Plan Bay Area 2040 had been unusually adopted by ABAG's board separate from the *local* allocation to jurisdictions: with past projections, they had been intrinsically linked as one product. This separation in part reflected institutional realities: the land use modeling function and principal modeler were formally transferred to MTC in 2013, to be part of a shared analytic team. Insofar as the agencies had largely agreed to use UrbanSim as a tool for the local allocation, it meant that the production process was somewhat less vertically integrated from regional to local projections, even if the technical aspects of the projections–land use and transportation–were consolidated in a larger, more internally coherent group under the auspices of MTC's analytic services division. On paper, the agency formally in charge of land use planning no longer had the in-house modeling capacity to carry out this work. This institutional separation complicated the process of making policy-based projections, though it required the development of deeper cross-agency ties at staff and management levels than had been the case in the past.

Once ABAG had formally transferred the modeling capability, the agency emphasized the importance of aspects it was thoroughly in control of: dialogue with cities, and the visioning process. ABAG–following in the footsteps of its earlier livability footprint work along with the non-econometric approach employed for the first Plan Bay Area projection described in 1.5, *Phase III,* *Early 2000s: Towards "smart growth" policy-based projections*–approached the allocation from an overall, more prescriptive/normative vision of how the region would fit together by 2040. MTC went the other way. Where ABAG focused on macro, MTC instead went micro, working on properly representing and encoding a set of smart growth zoning policies at the parcel level, and let the model in turn reveal what the spatial outcome would be *post hoc*: There was no strong *a priori* sense, or prejudging of, what the larger geographical patterns would be under this approach. Accordingly, in the work of translating the regional projections to the subgeographic allocations to be shared with local jurisdictions where policy decisions loom front and center, very different working styles among the working groups in the two agencies involved became apparent. These styles sometimes proved complementary and additive, at other times at odds with each other, as disagreements over ends, means, realism, tractability and schedule arose.

Such differences in approaching allocations were well exemplified over the course of the development of three distinctive land use scenarios by the two agencies. The two agencies organized scenarios around archetypical growth patterns (shown in Figure 1.5) related to urban form ideas percolating at least since the livability footprint effort–and went to work on back-filling and bundling each scenario with relevant policy strategies[15] and transportation investments and developing jurisdiction-level growth "targets" for the model. Where land use models are typically seen as simple (if technically complex) trend extrapolators conservatively interacting trends into the future (Wachs, 2001), the usage here was to adjust key policy inputs, using the model on an altered state of the policy landscape in which zoning is adjusted in future years in strategic areas, diminishing in a sense the distinction commonly used between "forecasting and envisioning," to use Wachs' terminology. The model in this sense was not just a trend based analysis, but substantially informed by key policy decisions about the region's land use future, from affordable housing to transportation and open space preservation.

[15] These included general policies such as which types of areas secondary units would be encouraged; where relaxations in zoning restrictions might happen, and at which level inclusionary housing would be recommended.

Cross-agency collaboration

ABAG and MTC, as joint authors of the Plan Bay Area work, were squarely on the same page at the conceptual level, having just received community feedback at that level of generality at a regional workshop on the overall scenario concepts (ABAG Executive Director & MTC Executive Director, 2015). There was even agreement that models would play a key role in pinning down the distribution of growth among the region's cities. In November of 2015, the two agencies released a memo noting that "MTC and ABAG staff will use modeling tools to assist in the development and analysis of sce-

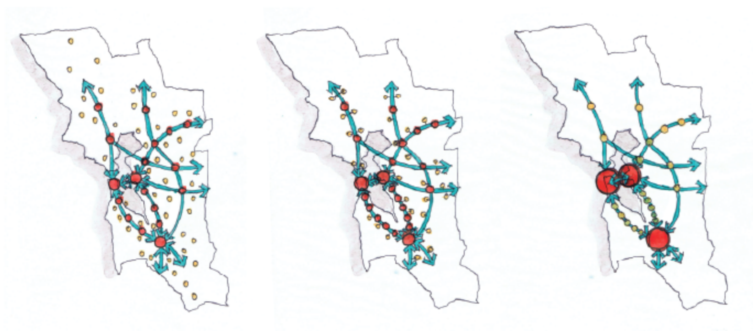

Figure 1.5: The three Plan Bay Area 2040 scenario concepts for different concentrations of growth (from left to right: “main street”; “connected neighborhoods”; “big cities” scenarios. Source: Scenario Sketches, from ABAG / MTC workshop material.

narios” and further, that using models would make it possible to evaluate the scenarios against a number of numerical performance targets including measures of transportation network quality, delays, but also money spent on housing and transportation (Chion, 2015). However, a debate quickly arose over *the role* of a model in quantifying scenarios. Should the model be the ”final” word, or should the regional planners exercise their judgment on the final results, adding a post-processing step to address issues where model results did not coincide with the vision? MTC staff, for a number of practical and philosophical reasons resisted going ”off-model” in a post-processing step, as it would complicate both running the travel model as well as calculating metrics for the comparative performance assessment of the scenarios that had been adopted as the formal ”benchmark” for assessing how the region was doing under each scenario. Second, any post-processing step would increase the burden of demonstrating that the environmental review per the stringent California Environmental Quality Act would be beyond reproach, a very real sensitivity after litigation followed the first Plan Bay Area from 2013.

During the first half of 2016 the model workflow between the two agencies consisted of a fairly extensive iterative process of tabulating model outputs for key variables such as jobs and households at the jurisdiction level, followed by a “truthing”-process of identifying any issues requiring addressing in the model output, and then refining UrbanSim parameters and assumptions accordingly. Revisions ranged from modest issues of vacancy rates needing adjustments in the base year data to more symbolically important ones, like preventing the model from closing down San Francisco general hospital, or turning City Hall into an office building, something the real estate model deemed desirable on a return-on-investment basis, neither of which would happen in the “real” world in which planning decisions are not strictly economic ones, but complex negotiations of needs and aspirations.

The explicit nature of the model, down to the parcel level, held the promise of potentially making its inner workings more transparent, which would be helpful from both a “debugging” as well as communications standpoint. The model could be trained to better understand such critical sites. A more transparent model would lose the much criticized “black box”-nature of earlier generations of models (cf. D. B. Lee, 1973). With the unit of analysis being households, jobs and buildings, complicated abstractions were not needed to explain the basic components of the model system (even if their specific workings remained difficult to explain). However, many issues are not as obvious up front and thus require considerable time to identify, always challenged by limits to available data. Nonetheless, the improvements in the model as it was ”seasoned,” run over a thousand times, were substantial, commensurate with the many components of the model that needed some sort of ”ground truthing:” A model with so many parcels over so many years will need technical expertise, but also substantial *local* familiarity since all zoning is locally designated, and local jurisdictions tend to view the zoning as an embodiment of local aspirations, and models offering a different take on what those zoning designations might mean would often be met with suspicion. Accordingly, a tension exists between technically produced but ”synthetic” growth over time in a location, and the local ”knowledge” (or judgment) that this specific ”synthetic” building would–or in some cases should–never be built. At the ground level, expectation of realism comes up against technical but stylized representation–or, insofar as the local judgment differs on normative grounds, the tension may be less technical than just political in nature.

Key dilemmas

> Overall, the growth allocation results of the UrbanSim model align fairly closely with these growth targets at a summary level as well as for most localities, though, there are substantial differences for some individual localities. The extent of the differences between local plans and the UrbanSim output is a discussion for the agencies, regional stakeholders, and individual jurisdictions. (MTC Executive Director & ABAG Executive Director, 2016)

> Last week, MTC decided to release the UrbanSim output as the three land use scenarios for Plan Bay Area 2040 without all the necessary adjustments to correspond to the original scenario narratives and local input. . . . Apparently, it was very

> difficult for UrbanSim to produce satisfactory results within the allotted time frame, and rather than further delay Plan Bay Area 2040, a decision was made to proceed with publishing the UrbanSim scenarios. (Association of Bay Area Governments, 2016)

> This allows the regional growth distribution to incorporate some of the local knowledge that regional-level modeling efforts might not capture. (Chion, 2016a)

> Instead, the collaboration with local governments enabled ABAG to develop a land use distribution that recognized the region's shared goals for a better quality of life in the future while remaining grounded in local realities. It also took into account the fact that land use changes only result from actions taken by local governments. (Chion, 2016a)

A recurring dilemma as reported in in committee memos was the relationship between *macro-concept* and *micro-representation*. While UrbanSim required a very detailed explicit accounting of policies at the parcel level in terms of zoning allowances, present and future, ABAG planners considered such level of detail informative though somewhat beside the point for a regional-level planning exercise. Further, while ABAG thought it reasonable to opine on which general types of areas should grow more, as per the practice per the first Plan Bay Area's factor-based Jobs Housing Connection, their planners were less comfortable pronouncing up-zoning decisions some 25 years in the future for specific groups of parcels throughout the region which was the level of resolution needed to simulate development.

The two agencies, in this sense, espoused different "scalar epistemologies," each being more comfortable at different levels of resolution, addressing the scenario work from different angles. Moreover, while ABAG preferred starting with the end goal in mind commensurate with the visioning approach, MTC preferred starting with the means in terms of policy, fitting a more utilitarian framework. All other things equal, MTC's approach tended to lead to slightly more scattered development, falling closer to trends, while ABAG's approach, being less bound by the *how to get there*-question, saw more growth concentrated in key transportation corridors and cities. However, MTC also toyed with end goals, adding additional areas of "concentration" to the Big Cities scenario and "equity" features to the dispersed scenario that led to a blurring of clarity between the three concepts.

Table 1.3 summarizes key differences in the two agencies' approach to scenario planning. It is important to note that these are both inserted into the frame of conducting policy-based projections. The differences are situated in a methodological, even epistemological layer instead.

Dimension	Econometric	Visioning
Overarching purpose	Identify economic relationships. Use to predict future state, assuming these relationships are constant (enough) over time.	Prompt a dialogue with stakeholders.
Operating principles	Micro to macro. Utility theory paradigm. Primacy of policy levers. Spatial form follows from policy.	Macro to micro. Less driven by theory but on relationship with local policy actors.
Standard of evaluation	- Model specifications	"Explanation test - does the scenario "make sense," intuitively speaking?
	- Formal tests of significance	No concept of significance or uncertainty
	- Model is deemed "true" if input assumptions, configurations are "true"	
	- Model uncertainty not explicitly quantified	
Relationship with policy	Explicitly input. Quality of output subject to model specification, architecture and existing data	Asserted rather than measured. Primacy of end goal; policies are identified once goals are set.

Table 1.3: A Tale of Two Agencies: Spanning methodological approaches to scenario planning.

By May of 2016, after the three scenarios had been fully developed in somewhat parallel processes by the two agencies, with ABAG having released its own Draft Scenarios to its members in December of 2015, the tension was palpable. In a memo to ABAG's Executive Board, the agency's planning director informed readers that ABAG had produced and distributed draft scenarios, obtained feedback and conveyed it to MTC staff for incorporation into UrbanSim, but that "[a]pparently, it was very difficult for UrbanSim to produce satisfactory results within the allotted time frame" (Chion, 2016b). The rub was whether UrbanSim's representation of the scenario concepts was ready for (political) prime time, and by which standard that would be judged. ABAG's standard was more focused on its expectations for policy based macro patterns should look like, and above all, conceptual, or narrative clarity. Per the memo, to ABAG management, if the suite of scenarios couldn't be explained to a council member in terms addressing that council member's "position" in the region, it was seen as the model's inability to match the concept, not a problem with the narrative built on top of the scenario descriptions in the first place. For example, Oakland, the third largest city in the region, the memo noted, could not meaningfully see *least* growth in the *big cities*-scenario relative to the other two scenarios. Oakland should see the most growth in the big city scenario, as it was conceptually focused on big cities. MTCs vantage point was not to place such a test on model *outcomes*: the numerical representation of the scenarios were meaningful insofar as the *input* assumptions and model specifications were meaningful. A technical reason Oakland saw relatively less growth in the big cities scenario had to do with considerable levels of growth that had been injected into the model manually in jurisdictions in the vicinity of San Jose. Given constant regional totals for the three scenarios, such additions effectively crowded out growth in other cities.

This highlights the role of assumptions in model outcomes (Wachs, 2001). The agencies, coming from different technical and professional traditions of planners and engineers, seemed to disagree on such details of outcome, although it was really a matter of different views on the relative weight placed on both process and methods as the scenario work proceeded during the spring of 2016.

The internal debate of means and ends quickly became public talking points as both board members of the regional agencies as well as members of the public and local officials opined on many a detail on the vision-based scenario, often critiquing the allocation either on faulty data grounds, or alternatively, as was more common for advocates, that the policies and strategies were too modest, lacked sufficient vision to achieve critical performance targets of affordability.

The variations in practice within and between the two planning teams indeed could be traced to the very origins and roots of the different teams: The MTC team with a transportation background focused on setting up the technical process, while being more outcome agnostic, while the ABAG team tended to employ the reverse orientation. At the risk of generalization, MTC staff cherished technical literacy in the worlds of models and coefficients, while ABAG staff often viewed such details as side points to the larger discussion of policy and goals, even if they were both working towards the same goals, though with differing epistemological approaches as to what they were and how to get there.

Econometric models, planning visions, and policy assumptions

Over the summer of 2016, a draft preferred scenario was crafted through a similar process, with ABAG providing a ”middle scenario,” modified from the earlier conceptual work but also building heavily on UrbanSim output, and MTC modifying the UrbanSim connected neighborhood scenario using levers within the model rather than off-model adjustments to make the changes. ABAG planners continued to speak on an ad-hoc basis with local government representatives to identify factors that would shape community futures. These conversations were at this point still mainly focused on managing numerical expectations relative to local general plans rather than setting new policy. Nevertheless, the UrbanSim draft preferred scenario had substantial differences compared to either the Plan Bay Area 2013 small area distribution or the "middle scenario." With the release of the draft preferred scenario local vetting became more intense, with planners and elected officials asking to review all inputs and the parcel level output. Meetings were held between MTC technical staff, ABAG planners, and local officials to discuss ways of moving the model output closer to the "vision," increasingly framed around PDAs, Big Cities, and "transportation corridor cities," along with "key nodes" which were by assumption *presumed* to accommodate the lion's share of growth in households and employment for the next 25 years.

The effort to merge vision with the technical modeling approach quickly ran into headwinds as the vision went beyond the domain of mundane technical black box assumptions. For any large scale modeling work, the assumptions, while technical, emerge as critical inputs where the choice is as much a matter of policy vision as "expert" judgment even if the boundary between the two is decidedly blurred.

An important reason is that even the most complex models can't encompass all social processes in the system it represents, leaving out key components to outside judgment. For example, a critical component of future visioning is *which* parts of the region should be available for development. Land capacity for development could / should arguably be endogenously represented in land use models but the technical requirements to do so are formidable, requiring detailed transactional data on zoning changes over a significant time period.[16] Cities may change zoning in response to market pressures, or conversely resist change even more so. A change in council members may change propensities in either direction. The point is that since this is not explicitly modeled, zoning assumptions for the future need to be made by analysts, carving out a substantial part of the modeling work from the technical to the normative / political arena. This is where business-as-usual projections, taking no or only modest positions on future zoning, gives way to the domain of "visioning".

It follows that a particularly dodgy issue pertains to which planning assumptions to encode. It is one thing representing current zoning and capacity assumptions which is largely uncontroversial. [17] A different matter entirely is what to assume for the region's cities looking towards the *next* 25 years–that is, where capacity is assumed to change, and by how much. In pre-SB 375 Califor-

[16] A few studies have treated zoning as endogenously determined for single city studies where good data is available over the long term, like Chicago (McMillen & McDonald, 1991; Pogodzinski & Sass, 1994).

[17] Practically it is a daunting effort to ensure both timely collection and a consistent representation of allowed uses for more than one hundred jurisdiction's zoning codes, each with typically dozens of districts and detailed regulations for each. San Francisco's planning code alone encompasses more than 850,000 words (San Francisco Planning Depart, 2018) in three volumes, equivalent in size, if not necessarily in quality, to Shakespeare's 43 works.

nia, local officials would provide their general plans and staff would encode them and make minimal adjustments for the future.

In post-SB 375 California, for the regional agencies, the policy directive handed down from the state represents a complicated balancing act. It is a given necessity that *some* departure from local plans is likely needed to reach statewide goals. First, a regional plan with stated regional and state objective arguably should add up to more than a "clearinghouse," or reporting, of local ordinances. After all, the state law was amended precisely because the localist approach came up short against regional or statewide goals. It is well known that local governments tend to prefer zoning for commercial uses rather than residential ones for fiscal reasons, with a side effect being that adding up all local general plans for housing means a squeeze in terms of reaching the projected regional housing demand.[18] Adding up commercially zoned areas, conversely, means there will be a glut of retail space competing for the same customers. A regional plan must necessarily make some assumptions about how to square this supply and demand imbalance.

[18] The State of California recognizes this dilemma, and requires regions to allocate regional housing demand to local jurisdictions on a rolling 8-year basis, per the Regional Housing Needs Allocation. The only requirement is to demonstrate adequate zoned capacity, not actual production, and consequences of non-compliance are negligible.

Regional planning as clearinghouse, regional planning as visionary

Moving beyond a projections and planning as a mere clearinghouse function has a number of implications: First, it entails some sort of regional framework for prioritizing some areas for housing, others for open space corridors, others for commercial areas, along with interdependencies, priorities and sequencing. Such frameworks are not supported by established institutional or governance structures, where land use decisions remain exclusively the domain of local officials. Such frameworks further challenge (and are construed as such) the localism that forms the institutional underpinnings of the region (cf. Briffault, 2000). Since local officials hold information on local zoning, past, present and near future, they are in significant ways involved in filling "deficits" in the expert knowledge and are to some degree active "co-producers" of knowledge ultimately used in the projections, to use Corburn's (2003) terms: Given the institutional privileging of the local scale, there can be no regional planning without strong collaboration, indeed knowledge co-production, between local and regional actors.[19]

[19] At a workshop on the draft plan, a participant shared the importance to her of child care, and how the child care map circumscribes work choices (you can't go to work at 8 if your child care provider doesn't open until 8:30), making it difficult to function as a parent around those parts. That broadens the jobs-housing nexus we have long been focused on, to *also* include *services*, requiring a wider conceptual frame and modeling capacity. This realization came not from reviewing coefficients but from learning of the lived experience and local knowledge.

Indeed, as the draft preferred scenario was released to the public in August of 2016, this very issue quickly became prominent. A recurring comment from jurisdictions to the "draft preferred" scenario was indeed how much should the regional agencies follow / depart from the general plans of its members? One city emphatically opposed the allocation of 4,200 housing units as consistent with a developer's proposal (and also technically with the city's own PDA application's upper bound), stating that it is "objectionable" for the draft preferred scenario to include this number which is inconsistent with its general plan (calling for up to 230 units), and that its inclusion amounts to either an "unjustified presumption" as to the outcome of the city's local planning process, or as an "unseemly attempt" to "pressure" and/or "intimidate" the city (City of Brisbane, 2016). Such sentiments were widespread in the comments received, highlighting a key dilemma in how much–or how little–license the regional agencies ultimately had in setting a general framework for the region's land uses insofar as it went beyond principle and became associated with specific growth counts.

Critiques on *performance outcomes* (rather than merely on input assumptions) were also forthcoming. When the performance targets for the Draft Plan were released and it became clear that the "preferred" scenario selected for environmental impact review fell short on a range of equity and housing cost measures, comments started coming in from not only the three biggest cities' mayors, but also from many advocacy organizations, that "[h]ousing and transportation costs for lower-income households would increase by at least 13 percent, resulting in 9 percent more low income families becoming at risk of displacement," before noting that "[t]his cannot be the "preferred" scenario for our region" (E. Lee, Schaff, & Liccardo, 2016). The implication was clear: the "vision" itself had failed to go far enough and was too tethered to existing planning practice. Ultimately, the regional agencies had to walk this fine line between "too visionary" and "too removed from local realities," and judging by formal comments submitted, they came short on both scores with different observers. It is premature to judge at this point how effective the Plan Bay Area process will be in actually achieving goals, as well as how widespread the support for more regionalist efforts will be in the coming decade.

1.7 Conclusion: The Bay Area Transition in Perspective

> The kind of planning that most resembles space travel is *transportation planning*, and it is significant that this was where computerized systems planning had its earliest and most successful applications. Elsewhere, it has proved harder. (Hall, 2002, my emphasis)

This study sought to place projections in a wider perspective of planning practice over a 40 year period. We asked how the projections changed from a relatively obscure technical exercise to a much more visible policy deliberation tool. We also explored the notion of growth projections as an open ended, non-deterministic knowledge generating process with many stakeholders and potential outcomes. While much of the shift was formalized with changes in state law requiring more coordination for regional planning, the shifts were underway well before. Regardless of whether state law was cause or consequence, the shift serves to illustrate how projections went from being a relatively disinterested technical exercise based on "technical-bureaucratic" knowledge (Innes and Gruber's (2005) term), with limited practical import to one with much political visibility during the current planning climate where projections and plan are now tightly coupled and part and parcel of the same knowledge generating and planning process.

The projections production process has changed substantially during the past 40 years, but in a perhaps surprising way: It is not so much that the projections and models that produce them got more *technically* complicated, but rather that they got more complicated with respect to the *policy domain* they purport to encapsulate: The policy domain which land use planning per California law was asynchronously both re-scaled to the regional level in terms of performance measures, yet with land use authority and incentives steadfastly remaining in place at the local level in the 100+ cities and towns in the San Francisco Bay Area. This plain sight contradiction, which was enshrined into law with SB 375 with the sentence "[n]othing in a sustainable communities strategy shall be interpreted as superseding the exercise of the land use authority of cities and counties within the region" (State of California, 2008), has been noted by several observers as limitations of the statute (Barbour, 2015; Sciara & Handy, 2013; Sciara, 2017). Notably, cities may choose to disregard regional plans and proceed with their own development program (Allred & Chakraborty, 2015).

This state of affairs of an uncoupled authority (local land use authority) with regional responsibility for a well performing land use and transportation system necessarily entails that both the planning process as well as the projections that accompany it must grapple with an added dimension of uncertainty on top of the standard uncertainty pertaining to guesses about the future: how strong *should* the assumptions of changed behavior be for the future in the scenario planning process? To what extent might local jurisdictions adjust land use policies? Will (future) residents adjust preferences for infill development at a hitherto unseen scale? Such questions are *handled* by modelers, mainly by assumption, but clearly involve much value judgment regarding changes in behavior at both the individual and community levels, and many reasonable guesses are possible. MTC's and ABAG's approach was to seek input through workshops on three distinct land use scenarios, each with a distinctive land use pattern, with varying degrees of infill vs urban limit line expansion on the fringes. A random sample telephone survey was also administered on key trade-offs between local and regional planning, although the questions were not specific to the scenarios developed for the plan (Corey Canapary & Galanis Research, 2016).

While the technical nature of the models remains indispensable to the integrity of the projection (and by extension planning) process, the ”softer” engagement side is critical not only on the grounds that localities need to ”buy in” to the spirit of the projections in order to make common planning goals achievable, and on occasion to introduce (or assert) dynamics to an otherwise static-coefficient modeling framework based on outside input, recognizing not all assumptions about modeling and planning are technical. The more this triangulation can be transparently conducted, we argue the more legitimacy will be retained by the modeling, and by extension, planning process overall.

The transition from business as usual projections to policy based projections opened the door for debating ”technical” knowledge, inserting explicit and normative assumptions about the how land use policies should change to solve larger regional goals. At the early stages, with the focus on the livability footprint smart growth dialogue, the agency still, to a significant extent, followed the lead of its members–smart growth was a regional priority, but a substantial majority of the agency’s members had made, or were planning to make changes to their zoning codes. As SB 375 became a reality in state law in 2008 growth projections would henceforth be formal planning statements as part of a larger scenario planning exercise where ABAG and MTC still channeled locally assumed plans, but where state-level interests in housing and transportation took a more prominent role. The State of California was in effect asking regions to push the needle, to preserve land, to reduce trips, to grow more compactly.

While projections got a new role as part of a planning process, the Bay Area case illustrated some of the challenges on methodological grounds of how to characterize scenarios, and whether it is a conceptual exercise or a numerical-technical one. The two Plan Bay Area’s so far released were produced by very different approaches: One more focused on visioning and heuristics; the other a fully-fledged land use model, each with benefits and drawbacks. Yet arguably the balance of the differences among the 100+ cities in the forecast was *not* mainly due to a change of policy from the first to the second round. Rather, the two versions, produced with four year between them, reflected the different methods of translating similar policy strategies into specific small-area numbers, a commonly recognized issue in the literature.

SB 375 offered a mandate to think strategically about the region and to inextricably reflect this thinking in the growth projections. The process of producing the vision proved tricky both in terms of crafting what it should be, why, the means of getting there, as well as providing a numerical representation of it. In California, this is further complicated by the environmental review process. UrbanSim is a stochastic model, where every run, even with the same structural equations and policy data, can produce a different outcome. This type of model lends itself to producing a range of possibilities, rather than a single set of numbers, with researchers having in recent years begun to quantify the inherent uncertainties in model systems commensurate with the complex realities they seek to describe (Sevcikova et al., 2007; Sevcikova et al., 2015). The regional forecasting approach, incorporating a REMI model, while producing deterministic, consistent projections from run to run given identical parameters, can still provide a range of possibilities, as many policy-uncertain assumptions are tested.

The projections process with state-of-the-art models in a public policy circumstances highlights the interaction of different sources of knowledge in analyzing future possibilities, including the strong roles played by assumptions as models are put to a wider scope of visioning uses than have typically been the case in the past. Technology allows the creation of increasingly sophisticated models that enable analysis of empirical data taking into account multiple factors. At the same time, the models are limited simulations, not replications of reality, and are only as good as their assumptions and their data. Weaknesses in both data and in estimated relationships require that other types of knowledge be applied to interpreting the model results, deciding how the model output will be used, and in adjusting the modeling process itself, ultimately, hopefully, both improving the process along with its wider legitimacy in a planning context.

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Essay 2
Does New Multifamily Housing Lead to Higher Nearby Prices? On the Localized Effects of Infill Development

2.1 Introduction

After nearly four decades' worth of "soft pushes"[1] from the State of California to nudge its cities towards delivering more of the new housing stock in the form of infill development near existing infrastructure, recently more housing has been heading to the state's major urban areas in the shape of multi-family development relative to earlier economic cycles. Already during the 1990s, before SB 375 formally pushed regions for more compact development, infill development already accounted for more than 40 percent of new housing units constructed across the state in major employment centers such as San Francisco, Los Angeles, Santa Clara, Merced, Orange, and San Mateo counties (J. D. Landis, Hood, Li, Rogers, & Warren, 2006).

[1]Since its 1978 Urban Strategy (Office of Planning and Research, 1978) pronounced urban sprawl as "wasteful"

As we look ahead, this trend should continue, with a key impetus arising during the Great Recession. In 2008, in a landmark bill shifting the land use power regime–however slightly–towards the state, the California Senate adopted Bill 375 (SB 375), a wide-ranging initiative to reduce greenhouse gas emissions from passenger vehicle use. Its main thrust was to require the State's 18 Metropolitan Planning Organizations (MPOs) to expand their established, four year cycle of regional transportation planning process to encompass a land use component as well. Though planners have long recognized the influence of land use patterns on travel demand (eg. Cervero & Kockelman, 1997; Cervero & Murakami, 2010; Boarnet & Crane, 2001), this was nonetheless a policy innovation, even if implementation powers were modest, as the sanctity of local authority over land use unchanged.

Infill is supported by policy makers both as a means of limiting greenfield development, but also as a way of managing transportation demand associated with sprawling urban regions, and boosting the state's inner cities. Planning policy had with a stroke made it to the state Capitol as the perfect storm of housing and transportation, core topics of city planners and important to resident's everyday lived experience. As infill is increasingly endorsed by policy makers at different levels of government, the need to understand what infill means at scale in our urban regions presents itself with some urgency.

Critics from mainly the activist community have suggested that focusing predominantly market rate housing in centrally located but often lower-income neighborhoods amount to state-sponsored gentrification. This would, they say, lower affordability levels while depriving the neighborhood of sites which could be developed as affordable housing. Supporters, conversely, say such housing is imperative as a way to both limit outward urban expansion, manage transportation impacts, and easing the rise in housing costs in the state's most costly urban areas.

The urban economics literature theoretically and empirically supports the argument that increased supply all other things equal leads to lower prices for a region in equilibrium (O'Sullivan, 2012). As a regional economy grows and adds employment, more workers will be needed, and they need a place to live somewhere in the region. With an inelastic housing supply, insufficient housing is added as the economy, income and population grows, and prices will increase (Capozza, Hendershott, & Mack, 2004; Winkler & Jud, 2002). At the regional level, prices are more volatile when supply is inelastic (Saks, 2008), and regulation is often understood to increase prices in regions with inelastic supply regimes (J. E. Gyourko & Molloy, 2015). The planning literature, in addition, has long documented deleterious price effects of growth controls constraining supply, something not uncommon in California (Levine, 1999; J. D. Landis, 2006; K. Jackson, 2018). There is little disagreement in general that constraining supply serves to decrease availability and thus increase the overall cost of housing in an area.

At the same time, there is less general certainty about price effects at the *neighborhood* scale of new development, in part because of the hard-to-track mobility decisions on the part of households in response to new development, as well as the difficulty of identifying appropriate counterfactual scenarios. A new development may be occupied by residents who might have lived next door in the absence of the new development, in which case that unit would be available to another household, potentially at lower cost. Or, it might be occupied by residents who moved from another district, perhaps outside the city.

From a *local* standpoint, in the latter case, the new development might help prices little. William Fulton, author of a best-selling planning textbook[2] for the past three decades, during the current upswing with its perennial discussions of displacement, asked a

[2] See Fulton and Paul Shigley (2018).

provocative question: does housing supply create its own demand, noting that at the local level "supply and demand get intertwined in peculiar ways." (Fulton, 2015) Those ways include what he calls ripple effects of housing built for the "uber-rich" (no pun intended) in turn attracting more uber-rich residents from out of town who can pay more than, and thus displace, everybody else.

While Fulton's reading may be an outlier–the supply of millionaires wanting to live in expensive condos is surely not infinite–his idea that at the local scale adding market rate housing will not necessarily lead to more affordable housing locally is more defensible (cf. Jacobus, 2016) and runs parallel to the transportation engineering and planning literature on induced demand, holding that adding vehicle miles is met proportionately with transportation demand, referred to as the "fundamental law of road congestion." (Duranton & Turner, 2011; Cervero, 2002b). The weakest-assumption version of this argument in terms of housing is that adding supply at the local scale may simply shift the demand curve from one neighborhood or jurisdiction to another, rather than adding to aggregate demand, a much stronger assumption.

That demand and submarkets cross boundaries is not controversial, but fundamental to the notion of spillovers tested in the growth control literature: adding constraints in one jurisdiction may lead to demand or price impacts in a neighboring one (Wachter & Cho, 1991). Housing substitution straddles city boundaries (Anthony, 2017). Some studies have shown how some cities of high renown such as Paris or London may be subject to out-of-town second-house buyers bidding up local markets (cf. Chinco & Mayer, 2016; Cvijanovic & Spaenjers, 2015). While there is as much as Vancouver initially courted Asian buyers contributing to local price spikes (**Ley2017**), leading to both British Columbia (and later Toronto) to impose a tax on foreign buyers of real property as a way to curb inflation (Kassam, 2017), effectively limiting price increases but without deterring new supply (Hu, 2018).

For present purposes, putting aside such complexities related what happens with the demand curve at the local scale, the point is that local scale effects of development are not clear in spite of close to general consensus on effects at the regional scale. Descriptive statistics on price trends for neighborhoods with much new development can be misleading insofar as new infill projects may be compositionally different from the existing stock in the neighborhood, implying a price increase effect when what is being measured is strictly speaking larger or newer units. Further, measuring prices locally certainly misses any supply effect that might appear in linked submarkets where favorable price changes effects might be observed.

One type of observable effect with grounding in the literature is spatial spillovers. Spillovers as a type of spatial externality are

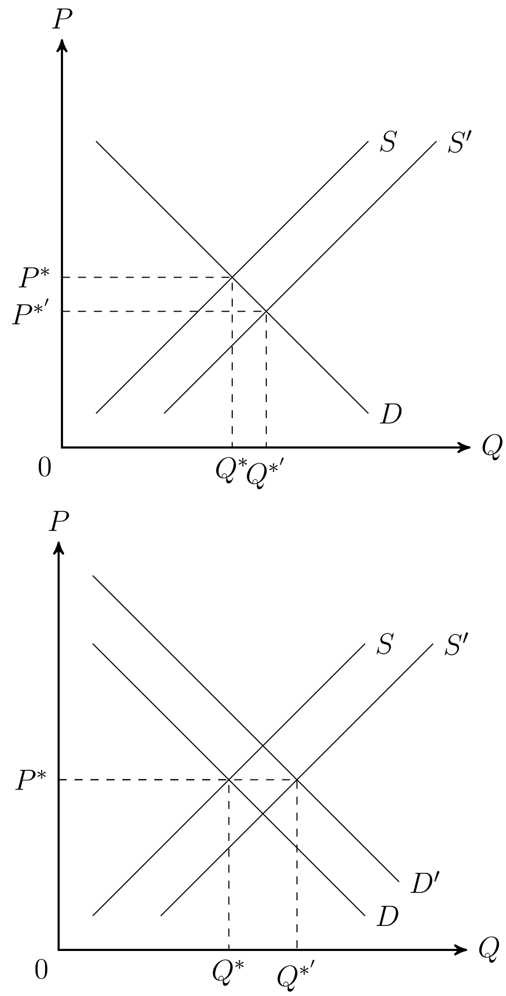


Figure 2.1: **Top**: Demand constant at local scale; only supply curve shifts ->Lower prices. **Bottom**: Demand shifts outwards, pulling residents from other districts ->Prices unchanged. (Supply effect exclusive of any spillovers.)

thought to be common occurrences in urban areas where actions by one market participant may impact neighbors. Such effects typically include congestion and crowding, noise, blocked access to sunlight, or service improvements. In effect, cities can be understood as an accessibility bundle offering opportunities or access to a larger number of activities, from employers to leisure and amenities such as open space. That access can be favorable or negative depending on the observer and the externality in question.

One approach that has been used with some success is the identification of spatial spillovers associated with development using hedonic models. Certainly, spillovers are a subset of the total effects of an "intervention," thought to take place in a relatively confined geographic vicinity, where the total effect includes a supply effect observable in linked submarkets. While there is little theoretical guidance for the spatial scope of such spillover effects, studies typically examine effect within a 2,000 foot radius. These studies do not capture equilibrium effects, but an all-other-things equal effect of being near development projects, seen as an intervention in an quasi-experimental framework. Early studies in this tradition were by Galster, Tatian, and Smith (1999), analyzing the effect of Section 8 housing on sales transaction prices of single family homes in Baltimore County. Follow-up studies focused on Denver in Santiago, Galster, and Tatian (2001), and in Galster, Tatian, and Pettit (2004). Ellen, Schill, Susin, and Schwartz (2001) and Schwartz et al. (2006) followed with studies of New York, adding controls for pre-existing, and unobserved differences which could influence price trends.

The core mechanisms for spillovers are thought to be manifold. A new development may remove a dilapidated site that is poorly maintained and of little use to a community. In some cases vacant sits can be nuisances subject to accumulation of garbage, or attract unwelcome activities such as crime. Notably, such effects have been found to vanish upon site cleanup (Kohlhase, 1991).

Conversely, a new development may be welcome on aesthetic or bundled amenity grounds; a nicely developed structure may add to a neighborhood, or alternatively carry market signals that the neighborhood is on an up-and-coming trajectory (though not necessarily *"caused"* by the development project), carrying a demonstration effect. Separately, new development could add more people to the neighborhood, which could patrol local stores. If the income structure of those moving in differs from the neighborhood average, a separate income effect could be present.

While much work has focused on single family homes and the effect on those, I instead focus on multifamily developments and effects on relatively more close substitutes, multifamily units and condominiums. Part of the motivation is the lack of consensus from this type of studies. While Ahvenniemi, Pennanen, Knuuti, Arvola, and Viitanen (2018) found no significant effects in Finland, Schwartz et al. (2006) found positive and significant of affordable units on existing properties, while findings from Ooi and Le's (2013) work on Singapore show positive price effects of market rate housing on neighbors.

In this paper, I examine a slice of this: the effects of new housing on housing prices at the very local scale, with an emphasis on urban, mixed use neighborhoods where infill typically happens. Most research on this to date has been focused on negative effects of environmental dis-amenities, or the negative impact of public housing on nearby properties. I examine whether the sorts of spillovers well recognized in the literature might exist with the opposite sign: That instead of leading to lower prices overall, an injection of new housing supply can generate positive price effects in a neighborhood and increase the risk of displacement at scale.

We analyze data for the San Francisco Bay Area to assess the extent of spillover effects for this market. I use 25 years of data and a substantial geographical scope to test for the presence of these effects for different price tiers of new development. While many studies focus on a relatively small number of sites, this artificially limits the measured effects. While estimating models for a handful of sites, the main contribution of this paper is the capturing of a larger number of development projects in their vicinities. The challenge in the specification is how to account for sales under the influence of potentially a large number of developments falling in the vicinity in the years leading up to the sale. I capture several measures and report the results.

We generally found spillover effects to be relatively modest and inconsistent depending on specification type and subset of the data, similar to what most other studies have found. I discuss reasons for this state of affairs and conclude that this may in part be due to the substantial heterogeneity of the Bay Area's housing markets, making it difficult to isolate effects in general. Still, care should be taken by local planners to mitigate disruption as large scale infill development is expected to continue in the years ahead.

The article is organized as follows: I begin with a background section, situating infill in the wider currents of the California planning context, focused on reducing VMT and greenhouse gas emissions through land use planning. I then discuss what makes housing a complex good before engaging with price shifts of the housing stock as a particular planning challenge. I then show stylized facts related to prices before discussing spillovers and the channels through which they could impact prices. A description of research strategy follows, along with identification plan and measurement challenges. I report on findings and discuss them in context, before concluding.

In the San Francisco Bay Area, plans were produced to lead more growth into more than 200 priority development areas, or PDAs. These were nominated by local jurisdictions as areas to focus development activities. PDAs vary in shape, size and existing development intensity, but in general are areas jurisdictions say could handle more growth and / or redevelopment at higher intensities.

2.2 Background

Major currents in the shifting regional economy

California is in the midst of a number of distinctive shifts, some related to changes in the economy, others to a reshuffling of skills and labor within and across regions. Those are background conditions for the realignment of the state's regional growth priorities, more focused on cities than in years past.

One shift is related to the longer term transition of the state's economy towards services, with substantial drops in manufacturing, and related shifts in the income distribution. This is part of a longer shift at the national level, related to globalization of supply chains, with local effects in part a function of how local communities were situated relative to those flows before and after China entered the WTO in 2000 (David H. Autor & Dorn, 2013; David H. Autor, Dorn, & Hanson, 2016).

This shift has a geographic component to it, related to the sorting of different skill levels into different parts of the United States, with high skilled individuals congregating in high productivity coastal trading regions, benefiting from substantial economies of agglomeration, in turn concentrating ideas, capital and career ladders there (Moretti, 2012; Cowen, 2013).

A related shift *within* metro areas relates to the sorting as high wage jobs are realigning closer to the centers as younger workers with technical skills favor locations near transit, leading to major tech employers to reconsider their real estate portfolio, with development offices moving *into*, instead of *out from*, the big cities (McNeill, 2016), even as San Francisco's economy is now being described as subordinate to that of Silicon Valley in the south (Walker & Schafran, 2015). As young college-educated workers have flocked to cities in general (Baum-Snow & Hartley, 2016) and to urban tech campuses in supply constrained cities in particular, it has helped fuel successive waves of record housing price appreciations (Quercia, Stegman, & Davis, 2002; Chapple, Thomas, Belzer, & Autler, 2004). These price swings are more pronounced in a restricted supply regime (Saks, 2008), and in spite of rent control may have contributed to concerns about displacement from the urban core.

On the land use side, during the past few decades, a reorientation of the planning profession and its discourse has emerged. The urban planning literature, perhaps not surprising given its origins and spatial focus, is focused on purposefully integrated land use / transportation strategies, with smart growth and new urbanism being the most prominent (G. Knaap & Talen, 2005; Bohl, 2000). Indeed, much of the thrust of California's planning practice during the past few decades has come in the shape of a renewed interest using the powers of the state to nudge cities towards addressing statewide goals of reducing greenhouse gas emissions from transport; limiting congestion, and increasing housing production. Perhaps nowhere are the three as closely coupled as in the urban planning policy portfolio.

A key tenet of the California Senate Bill 375 is to move towards more compact development patterns over time. The Governor's Office hailed the bill as "the nation's first law to combat greenhouse gas emissions by reducing sprawl," noting the strong land use-transportation nexus (Barbour & Deakin, 2012). This necessarily entails a larger share of future housing coming in the shape of *infill* developments. There is much room to grow here: Farris (2001) reported that for 22 cities reviewed, only five percent of permits were in infill locations, though J. D. Landis et al. (2006) found a much higher number in terms of the share of units for California. To move the needle, planners would face numerous challenges. Development sites may require clean up, infrastructure upgrades and the overcoming of neighborhood opposition (Altmaier et al., 2009), while site assembly could prove challenging (J. D. Landis et al., 2006).

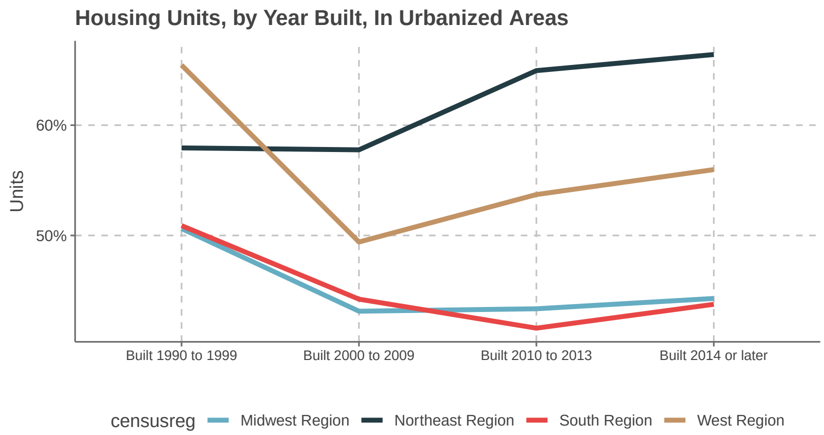


Figure 2.2: Infill development, as proxied by units developed in the national urbanized area (2000 vintage. Infill thus measured has increased in the northeast and west census regions, unlike the south and midwest regions. Source: US Census, ACS 2013-2017, B25034)

Accordingly, we have seen a revisionism against the more laissez-faire land use policies of the post-war years associated with increasingly low density housing development away from the core, something seen by many planners as well as economists as inefficient. As pressures to limit growth on the fringes have increased, an odd alignment of interests between those who have long advocated growth controls on the fringe and regional planners favoring infill development has taken place. While the geographic thrust is towards the center, production after the great recession has been sluggish, and many jurisdictions across the state have been under-permiting and developers under-producing housing overall and in particular in areas and densities accessible to where the job growth has been, compounding affordability challenges for many areas (Alamo & Uhler, 2015).

It is noteworthy that from a spatial perspective other state and federal policies are at cross-purposes. The State of California discontinued a key administrative pillar for infill development and affordable housing with the sunsetting of redevelopment agencies throughout the state (Swenson, 2015). At the same time cuts to local transit budgets make getting around more difficult, while California's Proposition 13 property tax measure may discourage multi-family infill development on fiscal grounds alone (Barbour &

Deakin, 2012).

However, SB 375 was just one of several reform bills, including Assembly Bill 32 (2006), setting greenhouse gas reduction targets, and Senate Bill 743 (2013), accommodating infill or transit oriented infill development through changed CEQA analysis requirements allowing for recognition of non-auto benefits. A key outcome of these planning efforts across the state remains the regional transportation plans (RTPs) but in addition to prescriptions about transportation investments, they are now explicitly paired with a land use planning process. The resulting document is referred to as the "Sustainable Communities Strategy," (SCS). The SCSs for each region contain a mix of land use, housing, and transportation strategies that, if implemented, would work towards meeting regional GHG emission reduction targets set by the California Air Resources Board (State of California, 2008).

Separately, Metropolitan Planning Organizations (MPOs) have been the sites of much experimentation with new modes of planning (Metropolitan Transportation Commission, 2005), devising funding strategies to support planning related to transit oriented development meeting performance goals (Association of Bay Area Governments & Metropolitan Transportation Commission, 2017a). While there is much benefit from a new round of investments in the already urbanized areas, questions surrounding neighborhood stability and prices of such a reorientation of regional housing markets are frequently raised by planners and activists alike. In addition, while local and regional planning efforts have been focusing on infill for several years since SB 375 was adopted, the pace may have been too slow. Several pieces of legislation have been proposed that would make it more difficult for recalcitrant cities to deny projects in transit rich areas meeting otherwise complying with local and state rules (Bliss, 2019). Ultimately, zoning remains a part of the local police power.

Regardless of these questions about effectiveness and how much *local* planning practice will change as a result, multi-family has in many parts of the state overtaken single-family development, and often in infill locations. This does represent a significant shift for planning in California, one raising questions on market effects in neighborhoods where significant amounts of infill housing is added; a question with added urgency as the state's major urban areas are seeing substantial challenges related to affordability and displacement (Zuk & Chapple, 2016; Zuk et al., 2018; Alamo & Uhler, 2015).

Housing as a complex product

On the heels of a renewed SB-375 driven focus on infill development at scale throughout California, I examine the effects of such a re-orientation of the state's housing markets at the neighborhood scale. To contextualize the discussion, I will briefly recap what makes housing an unusual product, yet critical to understand for planners.

In the standard textbook treatment, markets are conceptualized as efficient, decentralized institutions in which the desires and wishes of large numbers of price-taking buyers and sellers interact, where tastes and preferences of the former are responded to relatively quickly by the sellers (or producers), and where prices are determined by the consumer's marginal willingness to pay for, say, organic versus conventionally grown cucumbers. If consumers demand more organic produce, the story goes, producers will respond by offering more of this variety and less of the conventional kind, bringing prices down. This doesn't require a long term investment on the part of the consumer: If preferences change, the habit can be changed at the next shopping trip, and markets can adjust quickly and at relatively modest cost.

Housing markets, conversely, have long been understood to be rather different from the market for cucumbers. The urban economist Richard Arnott describes housing as a "singular and peculiar commodity" (Arnott, 1987). He goes on to enumerate ten ways in which housing as a commodity is peculiar, the most important of which being that housing is a necessity, highly durable, fixed in space, lumpy/indivisible, and very complex in terms of how features are bundled. As far as transactions go, costs are high, information on the part of consumers and producers is imperfect, and the ideal bundle of goods may not be available at any one point in time. Additionally, markets for any particular set of bundles are *thin*, which means market participants may have some ability to influence prices. To this, as Gibb (2009) observes, comes that housing is also an asset which may be purchased for reasons less related to its function as a consumption good and more tied to its role as part of a financial portfolio for either individuals or institutional investors. Since the Great Recession, for example, much demand for housing has come from institutional investors or companies holding portfolios as homes as rental properties (cf. Mills, Molloy, & Zarutskie, 2017). Foreign investment in real estate is currently at five percent of total real estate spending, down from 8 percent in 2018 (Yun & Cororaton, 2019), with some markets such as Palo Alto having brokers reporting 15 percent of sales going to Chinese investors (Blitzer, 2013), slightly higher than the 13 percent of San Francisco real estate searches originating abroad, according to data from Trulia (Karlinsky & Wang, 2014). In effect, housing, in addition to its tangible use value given its particular amenity bundles, is a parking lot for money. This in turn has a bearing on the overall evolution of housing prices and development of bubbles, where prices appreciate beyond what the fundamentals imply about overall economic conditions (Shiller, 2014).

While individuals make choices, housing markets are substantially structured in many ways by a range of public policies at various scales of government (e.g. Green & Malpezzi, 2003; Malpezzi, 1996), lending another less-than-visible hand.

- At the federal level, the mortgage interest deduction favors homeownership over renting as well as over-consumption of housing on the margins. (The median size of new housing units in 1973 was 1,500 square feet, while in 2014, this figure was 2,500, even as the average household size steadily declined for the same period (US Census Bureau, 2014, p.345).) Some economists have argued that such subsidies are spatially biased, pushing consumption towards the suburbs rather than central cities (Glaeser, 2010; Schill & Wachter, 1995). A more direct scaffolding has come in the guise of federal spending on highways. These outlays have been shown to also lead to further decentralization (Baum-Snow, 2007). The *Tax Cuts and Jobs Act of 2017*, passed in the 115th Congress, by capping the amount of state and local taxes that can be deducted against the federal tax due, will all other things equal make it more expensive to hold large loans, which could have differential effects on regional housing markets (Lin, 2019). More recently, federally designated opportunity zones offer tax incentives to private investors in exchange for development.
- At the state level, a number of policies influence local land markets. Property taxation policies like California's Proposition 13 limiting property-related levies, influence the supply, location and demand for housing (e.g. Ferreira, 2010). Statutes aimed at curbing greenhouse gas induced climate change such as Senate Bill 375 come with a push for more infill over greenfield development in the state's biggest regions (State of California, 2008).
- At the local level, cities and counties, acting through zoning and other policy instruments set the overall framework through which land markets operate, sometimes acting in accordance with market signals, and other times in contravention of them.

A key distinguishing feature of housing as a product is its spatial fixity. That housing cannot be moved brings a unique set of features to housing, pertaining to the array of externalities in cities more generally. Since the value of housing is often thought of (and modeled) as part neighborhood, part property characteristics proper, the "valuation" of the neighborhood has gathered much research attention. As O'Sullivan (2012) put it, "[n]eighborhoods differ in accessibility to jobs and social opportunities, local public goods and taxes, and environmental quality," and many of these external features can be capitalized into the value of a home. Values of homes have usually with hedonic models been shown to respond to neighborhood school quality (Downes & Zabel, 2002), socio-economic make-up (Foillain & Malpezzi, 1981; Guerrieri, Hartley, & Hurst, 2013), presence or absence of environmental contamination (Simons & Saginor, 2006), and accessibility, hereunder transit oriented development (Bowes & Ihlanfeldt, 2001). Housing prices respond to access to a variety of amenities and dis-amenities, as perceived by the marginal buyer. New infrastructure in the vicinity could positively or negatively affect area valuations.

The very fact that housing is fixed in space gives rise to urban planning as a sort of risk-aversion management discipline, as per the literature on the political economy of growth, with conflicting perspectives on the relative dominance of the impulse to grow (Molotch & Logan, 1987; Jonas & Wilson, 1999): Once a considerable investment has been made on the part of a homeowner, much is at stake to preserve the value of the investment (Fischel, 2000). Developers are often thought to be successful in forging through with upzoning plans, but the outcome is far from given, as coalitions for growth are much less organized (Schleicher, 2012). In California, however, neighborhood organizations thrive, and NIMBYism is prevalent when it comes to new development, which has a particular bearing on infill development.

While there are groups opposed to greenfield development, it is nonetheless with infill we see perhaps the most controversy as loss aversion registers with existing residents perceiving they have more to lose than to gain from added development in their midst, whether the opposition is based on aesthetics, expected effects on costs for public services, congestion, or demographics (Farris, 2001). Effects from new development–or spillovers–are *perceived* by the public, often in turn mobilizing to limit new development, through mechanisms such as legal challenges to environmental reviews (Hernandez, 2018), planning and zoning change advocacy, the ballot box, or working through the lengthy appeals process (Li, 2018). High housing costs and concerns over gentrification appear to drive much of the opposition to new development, with moratoria on development a relatively frequently proposed planning tool.

Development, filtering and submarkets

We know comparatively little about the geographic scope of housing search, and both data and modeling is relatively undeveloped (Monroe Sullivan & Shaw, 2011). Theory doesn't offer much guidance as to what specific decay function might be assumed to be at work, or which exact substitution patterns are operative when new housing is built, beyond matter-of-fact statements that households vacate one unit when moving into another one as per the filtering mechanism. As new units are built, which existing submarkets are affected (by not being selected). We lack good data sources for counterfactuals; move chains are mostly unobserved, and information on substitutions between unit types and housing submarkets is largely unavailable at sufficiently granular scale. To conceptualize and model substitutions requires both a competent model of submarkets–which properties are "comparable," from the perspective of not some unit of aggregation which happens to be available but from would-be occupants' perspective.

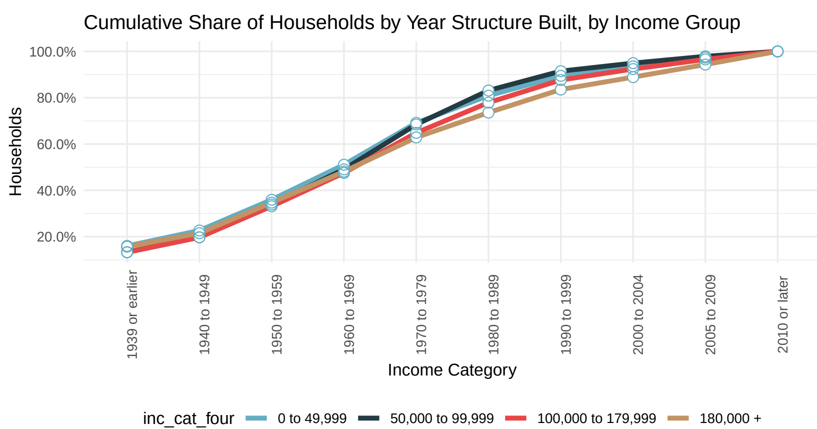
Big data harvested from searches on real estate sites hold some promise in offering a new source of behavioral data as it relates to housing search insofar as clicks by the same user on real estate listings indicate real indications of substitutions, but those datasets are proprietary and not easily available (but see Piazzesi, Schneider, and Stroebel (2015), on this question). Households may compare units within a large geographic territory meeting basic price and lifestyle requirements; the neighborhood may be an afterthought rather than a starting point to search, and this may all differ depending on the area (cf. Watkins, 2001).

Counterfactuals, in the absence of new development, are problematic too. Propensity score matching has been used to compare effects in neighborhoods seeing new development from those which don't–but questions of unobserved differences will continue to accompany such studies.

The reason the chain of events is complicated to settle at the local scale is related to a number of other housing concepts related to submarkets, chiefly **housing filtering** (Grigsby, 1963), market **spillovers** (Schwartz et al., 2006), and **housing composition**. How prices respond to new supply at the neighborhood scale depends on how these interact empirically, and more so at the local than the regional scale.

A core question is what the relation is between *local* development and *local* prices. The housing literature has long presumed, and sometimes directly engaged with, a stylized model of what happens when new housing is built. As a new unit is introduced, the household occupying it will likely vacate another unit, which in turn becomes available to another household still, setting off a sequence of moves, adding up to what housing researchers refer to as "vacancy chains" (Scholten & Hooimeijer, 1984). This filtering has, after the federal government got out of the business of building housing, come to be seen as a one of the main ways of providing housing for low income Americans, with some studies suggesting filtering is reasonably successful in that role, with the rental stock depreciating between 1.8 and 2.5 percent per year aged (Rosenthal, 2014). The predominant factor in the urban economics literature leading to filtering seems to be the age of the housing stock (Brueckner & Rosenthal, 2009), leading to heavily building-centric, as opposed to neighborhood-focused explanations of neighborhood change. Researchers leaning to more aggregate explanations of change find filtering either less convincing or useful from a policy standpoint, noting that whether a given unit filters up or down is not primarily determined by features such as building age, but rather at-large, area-related characteristics and trends (Somerville & Holmes, 2001). The same authors, however, later found that affordable housing units were much more likely to filter up than down in areas with little growth in housing supply (Somerville & Mayer, 2003). Skaburskis (2006) noted outright, based on Canadian data, that "[f]iltering is not helping lower-income households," and that there has been a "reversal in the direction of filtering in all Canadian metropolitan areas since 1981," with higher inflation in lower income units than higher income ones, as these tend to be located in gentrifying neighborhoods.

Some have argued that new housing serves as an inducement to gentrification; that units will pull in new wealthy residents who might perhaps not have arrived in the absence of those units (cf. Fulton, 2015). Though, using Bay Area data, high income households are as likely to locate in the existing, older stock than in new structures, suggesting (but without demonstrating it) that in the absence of new development, gentrification may be more accelerated than it would be with new units in some districts.



Source: U.S. Census Bureau, ACS PUMS 1 Year Data, Bay Area Counties

Figure 2.3: Do wealthier households live in newer units? Only marginally more so: They are much more prone to live in older units in the Bay Area, suggesting there is plenty of competition for high income household in the existing stock even without building new units.

Housing prices as a planning issue

While gentrification is heavily discussed in planning circles, housing prices are a key planning issue more generally. Housing prices are of great interest to planners and the public as they are fundamental to determining access to a local housing market for a range of household types. California general plans in their housing elements often contain language on the value of complete communities, in part because state law requires cities to demonstrate the capacity for meeting housing needs for different income groups as a condition for approval of the city's housing element. Accordingly, affordability and housing cost inflation and price stability is a key concern for local policy makers from the perspective of labor market access, fiscal health and community stability.

The U.S. Federal Reserve, recognizing the damages to the economy of high inflation and unstable prices, organizes its monetary policy around an inflation target at 2 percent (Federal Open Market Committee, 2017). This target is set equally across the nation, in spite of local differences in economic activity, where two percent might lead to either overheating, or conversely to too little economic activity. Studies have shown the different subregions in the United States to have different sensitivities in terms of personal income to changes in interest rates (Carlino & DeFina, 1999). In other words, some regional economies may run hotter than the national average given prevailing interest rates.

Such regional economic differences in income, as well as productivity, translate into higher housing costs as well (Glaeser, Gyourko, & Saks, 2005). Notwithstanding a 2 percent monetary inflation target, the costliest housing markets in the U.S. routinely witness inflation several times that amount for a particular product: housing (Figure 2.4). In coastal regions and beyond, planners are accordingly grappling with issues of housing affordability. In the San Francisco Bay Area, according to data from Case-Shiller, the most recent economic expansion saw annualized price increases of 8 percent for the high tier, 10 percent for the middle tier and some 17 percent for the low tier. Per FHFA data, California saw annualized increases of 5.5 percent, compared to an overall US recovery rate of 2.2 percent.

The increases in housing costs imply both private and public challenges. At the household level, dwelling costs are an important determinant of both spending and wealth accumulation, with a sizeable share of households being cost burdened, meaning they pay more than 30 percent of their income on shelter (J. Landis & Reina, 2019). Higher prices on the one homeowner side leads to homeowner equity which can boost the economy in the short term (Mian & Sufi, 2009, 2011). From the vantage point of the economy writ large, spending on housing crowds out other consumption to the tune of some $60 billion annually in California (Woetzel, Mischke, Peloquin, & Weisfield, 2016). It is accordingly no wonder that housing prices capture the imaginations of academics of different stripes, as well as of the public at large, as well as of policy makers. Local policy makers have a number of reasons to be concerned about inflation and housing costs for reasons not unlike those driving federal financial regulators to manage the interest rate as a means to seeing stable levels of inflation and managing expectations for prices. But local policy makers also have some uniquely urban reasons that are not present in the federal catalog of causes

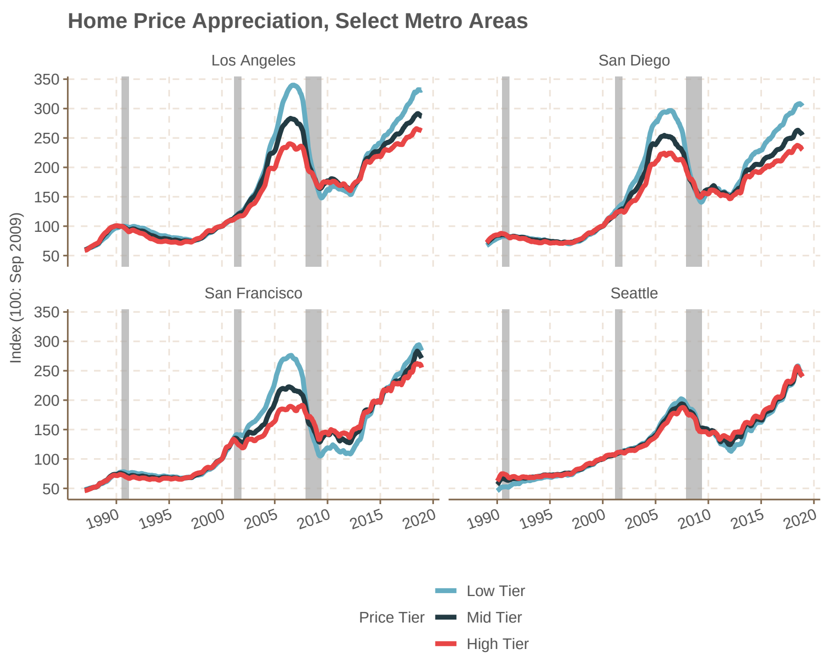


Figure 2.4: Repeat sales indices from Case Shiller; NBER Recessions (in grey). Source: Case-Shiller, NBER, via FRED, Federal Reserve Bank, St. Louis

for concern. High increases in housing costs could lead to an inability of the economy to grow as compensation packages for new hires would need to increase or no longer be competitive with those of other regions. Alternatively, employers may increase compensation packages which in turn also lowers their competitiveness relative to firms in other regions.

On top of such concerns related to the overall cost of housing and what it might do to families and the economy, an additional dimension is related to neighborhood change and displacement typically associated with the gentrification literature (Zuk et al., 2018). Some neighborhoods, per 2.4, appreciate more than average, and such differences can be attributable both to the traditional list of amenities and property characteristics, but also demand-side factors such as growth of highly paid tech workers in the commute shed of those particular neighborhoods (Chapple et al., 2004).

Planners are keen on understanding such changes prices in the wider context of neighborhood changes. Planners as *practitioners* are interested in housing prices as a reflection of the financial (and taxable) wealth of a local community, and prices further indicate who can afford to live there. Planners as *academics* study housing prices in the context of neighborhood change, at times in the context of transportation investments, recently believed to be intrinsically related to debates of neighborhood change, gentrification and displacement (Chapple & Loukaitou-Sideris, 2019; Zuk et al., 2018). Indeed, researchers have for decades sought to understand the core process of gentrification, its dimensions, spatiality, covariates, causes and effects, a research interest not made less relevant by the shift in the economomic geography of major coastal regions towards bifurcated tech and service economies (Moretti, 2012). Housing prices may reflect such wider economic changes. In the gentrification process, prices are both seen as cause and effect of a wider dynamic cycle of disinvestment and re-investment as public and private actors interact in and through the market (N. Smith, 1996). Such area-wide, more aggregate lenses are often contrasted with neo-classical micro-foundations found in much econometric work, such as hedonic models placing values on specific urban features, though in principle, such models can capture a wider array of features, taking into account neighborhood characteristics.

Demand-side explanations

Explanations for such increases include both supply-side and demand-side factors, with different emphases placed by different researchers. On the demand-side, as the economy has gradually transitioned from manufacturing to services, many middle class, middle wage jobs have vanished with low wage jobs replacing them, leading to an increasingly bi-modal income distribution in many regions (cf. David H. Autor & Dorn, 2013). At the same time, a new cadre of highly skilled, highly paid workers, with a new penchant for urban living, its amenities and transport options, has entered the labor force, and millennials at least for the time being remain in the major urban centers (Y. Lee, Lee, & Shubho, 2019). As incomes have risen, and housing is an income-elastic normal good, with relatively modest new supply in many coastal cities characterized by high levels of regulation and / or terrain, housing prices have increased considerably in many regions. Studies have documented, for example, how some cities of high renown may be subject to out-of-town second-house buyers bidding up local markets (cf. Chinco & Mayer, 2016; Cvijanovic & Spaenjers, 2015), and more generally the rise of "superstar" cities, where shifts in the share of high income households lead to crowding out of lower income households works to shift the overall housing market demand distribution (J. Gyourko, Mayer, & Sinai, 2013). This comes as the urban wage premium for non-college graduates has reportedly declined the past few decades to the point where such workers have little economic scope for a livelihood in the denser parts of our urban systems (David H Autor, 2019).

At the same time, as job sprawl has reportedly stalled (Kneebone, 2013), and tech employment centers are replacing erstwhile manufacturing strongholds (cf. Metropolitan Transportation Commission & Association of Bay Area Governments, 2019), new economy well paid tech workers find their ways into these urban centers

Katz and Wagner, 2014 with a disposition for not owning as many vehicles (Klein & Smart, 2017; McDonald, 2015), bidding up housing markets in the most transit accessible locations.

Apart from overall price levels, the difference in prices at the neighborhood scale have long intrigued researchers. Urban economists use prices to discern value in cities, and through value the overall structuring mechanisms of how activities are distributed within them. A core urban model of the second part of the 20th century, the monocentric city model, holds that residents trade off land with transportation cost, moving to the fringes to get more land where prices are lower (Muth, 1969). In that view, prices are a function of access to the city's core job nodes and amenities. More generally, urban economists explore which amenities are considered valuable in urban housing markets, how neighborhoods change, and the nature of the connection with urban labor markets and productivity. Per the canonical model, access determines prices, but housing supply looms large as well.

Supply-side explanations

On the supply side, per data from the Federal Reserve Bank of St Louis, construction relative to households is at its lowest level since the 1980s (Baron, Buchman, Kingsella, Pozdena, & Wilkerson, 2018), with housing starts not keeping pace with household formation (Figure 2.6), let alone job growth. Accordingly, these regions have seen a slide in affordability since 2000 (Myers & Park, 2019).

In much of the country, rising housing prices is usually met with increasing levels of construction, lowering prices all other things equal. In many parts of California, this relationship is quite inelastic. For the state as a whole, Baron et al. (2018) reported supply elasticity of .47, but already 20 years ago, Green, Malpezzi, and Mayo (2005) documented very low supply elasticities for a number of California cities (.14 for San Francisco; .33 for San Jose), suggesting basic economic mechanisms were relatively inactive in those areas: prices as a signal do little to spur construction in the most constrained areas (Quigley & Raphael, 2005), and insofar as they are areas of higher than average productivity, substantial deadweight losses are incurred to the overall economy through this channel alone(Hsieh & Moretti, 2015).

Indeed, the state's legislative analyst's office in 2015 declared a statewide annual under-production of housing by 100,000 units and attributed it in part to local opposition in the state's coastal communities (Alamo & Uhler, 2015). A year later, McKinsey Global Institute identified an acute shortage of 3.5 million units (Woetzel et al., 2016). Whatever the cause, the long term supply deficit it is widely recognized to be be a major contributor to affordability

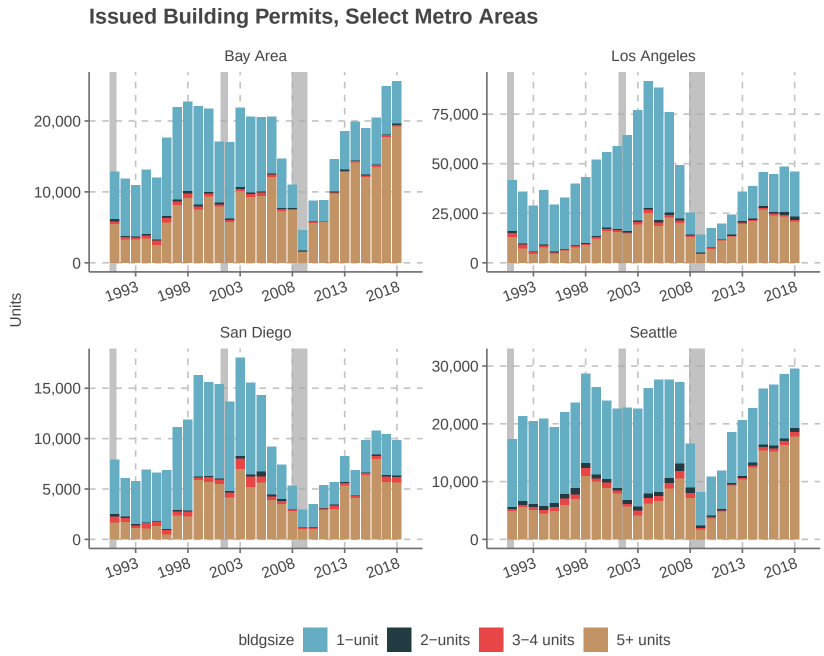


Figure 2.5: Building permits from Census BPS, quarterly releases

issues across the state, and in particular in its major urban areas.

This has led the past two presidential administrations to pay some attention to the issue. The Obama Administration's Council of Economic Advisors in the waning days of that administration issued a housing toolkit (Council of Economic Advisers, 2016). More recently, the Trump Administration issued an Executive Order establishing a cabinet-level council to study the elimination of regulatory barriers to affordable housing (Executive Office of the President, 2019). Given land use is fundamentally local, these are likely more symbolic than practical efforts, but state and regional levels of government are also paying attention to the issue, with a particular focus on underproduction of housing as a key proximate cause of housing affordability challenges.

California, long a hotbed for strong housing market regulations including locally enacted growth control procedures (J. D. Landis, 2006), provide a counterpoint to the earlier prevailing view in the political economy literature that cites were effectively governed as growth machines, responsive mainly to stakeholders with a stake in the city's future growth such as developers, utilities and newspaper publishers (Molotch & Logan, 1987). At the local scale, where land use decisions are ultimately made, complications quickly arise. While there may be relative agreement that more housing is needed from a regional standpoint, much of the practical challenge is that housing is caught up in debates about *where* and *how* to build it, and for whom, and what the role should be, if any, of public

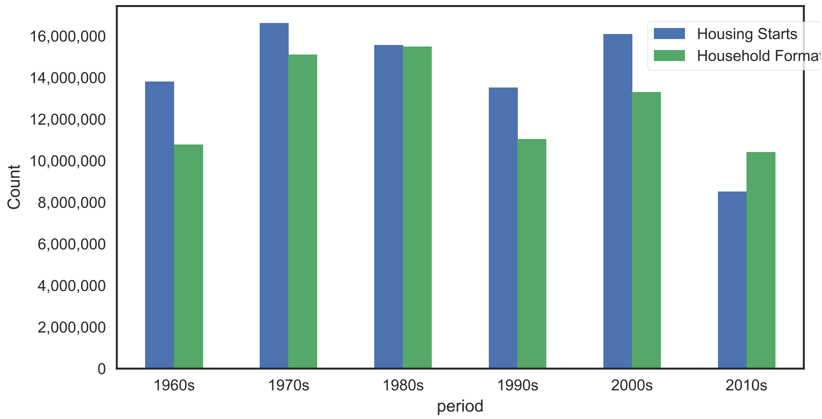


Figure 2.6: Housing Starts Vs. Household Formation. Data Source: U.S. Census Bureau, Total Households [TTLHH]; Housing Starts [HOUST], retrieved from FRED, Federal Reserve Bank of St. Louis, July 10, 2019.

subsidies.

In the San Francisco Bay Area, as the tech sector has come to define much of the growth since the great recession, with symbolic protests targeting the buses bringing tech workers to their place of work, housing affordability has become a defining political issue. Bay Area planners and policy makers at the local and regional levels have sought to address rising housing costs through a series of measures aimed at both boosting supply, stabilizing the housing stock, and protecting renters (CASA, 2019). While this is seen as a consensus proposal by many, the academic debate on the role of housing supply has perhaps surprisingly resurfaced as a policy and practical question to resolve.

Some academics are joining advocates in questioning the conventional wisdom of the mainstream economics. In a recent study taking on what they call the mainstream economics supply argument that high prices are predominantly driven by inelastic supply–whether due to regulations, NIMBY advocates or both–(Glaeser, Gyourko, & Saks, 2005), Rodríguez-Pose and Storper (2019) say there is more to the story:

> The affordability crisis within major urban areas is real, but it is due less to over- regulation of housing markets than to the underlying wage and income inequalities, and a sharp increase in the value of central locations within metro areas, as employment and amenities concentrate in these places.”(Rodríguez-Pose & Storper, 2019)

As economic geographers, they instead lean towards explanations related to realignment of labor markets and the re-sorting of jobs by skill and wages across different regions, building in part on book-length arguments of the forces shaping the city in Storper (2013b) and Storper, Kemeny, Makarem, and Osman (2015).

They note, though mostly without engaging with the housing literature specifically, that high cost cities in spite of regulations have nonetheless managed to grow their populations.[3] First, they say, larger cities are not necessarily stronger economic engines. Second, compositional factors help explain inter-regional price differences, not the extent to which supply is allowed to grow freely. Third, they say many cities with high shares of immigrants are in the very top of the list of supply constrained cities, while other cities with high housing growth have seen little immigration. While pointing out clear limitations in the assumptions of some economic models as far as unrealistic expectations if supply restrictions were removed, the authors seek to demonstrate their point using incongruous comparisons between job growth (a flow measure) and population size (a stock measure). It is true that housing affordability can scarcely be understood without reference to changes in the income structure characterizing the demand side, just asthe *geography* of jobs and wages, including stock and IPO income, matters to the functioning of housing markets, and the sorting of high skilled labor therefore looms large. Indeed, prominent economists make the very argument that while affordability and housing costs are related, the two are clearly distinct, and an affordability problem may not necessarily be a housing problem but an income problem (Glaeser & Gyourko, 2018; Albouy & Zabek, 2016). A larger housing stock would not in and of itself change that.

[3] This argument that was subsequently brought to bear by advocates in the debate over California's Senate Bill 50 (Wiener), a bill which would have made it more difficult for cities to say no to housing development proposals meeting applicable local requirements.

At the same time, as Manville, Lens, and Monkkonen (2019) noted, Rodríguez-Pose and Storper (2019) overlook much of the housing literature outright, including Uhler's (2016) findings using data from Zuk and Chapple (2016) that neighborhoods with *more* development have *less* displacement. Mast (2019), using a private dataset on household moves, estimates filtering effects associated with new luxury housing and mainly found lower price effects of new luxury housing, while Weicher, Eggers, and Moumen (2017), in an analysis of American Housing Survey data, noted both an increase in the affordable housing stock nationally and also a higher degree of filtering (units moving to a lower cost bracket) than gentrification (units moving to a higher cost bracket).

For our purposes, the point is to note the *presence* of the debate on the role of supply in addressing the build-up of housing prices. Been, Ellen, and O'Regan (2019) sums up the sentiment in a piece aptly titled "Supply Skepticism" and provides a useful overview, and mostly rebuttal of, the range of arguments questioning the efficacy of new supply being part of the solution in addressing housing costs, and does this engaging more directly with the housing literature studies related to housing prices.

2.3 Expected Effects of Adding Housing

New housing supply can conceivably have two effects on prices, and by the same token on gentrification and / or displacement of existing residents, depending on mediating regulations such as no-fault eviction rules. New supply, insofar as substitutions take place within the same neighborhood, means that new residents will move into new units, leaving vacant units in the same neighborhood for others to occupy. This supply effect would all other things equal lower prices. Separately, a spillover effect through a number of mechanisms could either lower or increase prices in a neighborhood depending on mechanism and magnitude. Depending on the relative size of these effects, the net effect on prices could be higher or lower. While the literature on submarkets frequently uses quantitative methods such as principal components to identify submarkets based on within-area similarity (e.g. Bourassa, Hamelink, Hoesli, & MacGregor, 1999), even if those are statistically similar doesn't necessarily mean an actual housing search process would follow those for substitution purposes. Based on recent big data reports (Rae & Sener, 2016; Piazzesi et al., 2015), there are indications that housing search may not necessarily be focused on contiguous areas, implying substitutions of a wider geographic reach.

In effect, the effects of added housing supply on prices can be appreciated at different geographical scales. At the scale of the region, the general-equilibrium approach (e.g. O'Sullivan, 2012) of adding housing units to the regional stock all other things equal lowering prices is fairly intuitive insofar as the region contains the full commute shed.

From an empirical standpoint, if follows that to fully trace price effects, one would need to unambiguously identify submarkets and track prices in such substitution-prone markets–looking at prices just locally will capture spillovers, but not the overall effect of added supply. This is important to keep in mind: supply price effects of *local* development may well be observed in entirely different jurisdictions. This is part of the rationale for more regionalist approaches to housing policies.

The implication for the local scale is that new development may have an effect on *neighborhood-scale* prices that is somewhat independent from the overall regional effect, and that this effect may ultimately be either lower or higher depending on what is produced and how move chains unfold and substitution actually takes place within a region. While prices will all other things be lower somewhere in the move chain, it may not happen at the local scale in part because development often means an upgrade of the stock relative to what was there before. New housing doesn't necessarily mean lower *local* prices, except where close substitutes exist in the neighborhood. Evidence is limited, but see Mast (2019), simulating the effect of luxury housing on prices.

Local spillovers

As the housing stock in central cities generally tend to be older than in the suburbs as a matter of how regions have typically grown from the core and out, it is a matter of historical record that the earliest layers tend to be in the center, with newer rings further afield. Accordingly central cities tend to be the repositories of the building stock most in need of upgrades or replacement (Rosenthal, 2008). This has led some to suspect that the preference for wealthy households to prefer suburbs may be an historical accident, due for course correction as the suburbs age and the building stock of cities is upgraded (Brueckner & Rosenthal, 2009). Regardless, it is clear that cities for a number of reasons will continue to be the sites of much infill development. The older building stock has at at least three implications: First, the buildings *themselves* may be subject to replacement from a structural standpoint. Second, and, from a land use perspective, their age may add to the risk that they may have a function which is less relevant than the time in which it was built, entering the calculus of the owner as to whether *other* uses of the property could be considered within the context of the prevailing zoning regulations. Third, given the historical geography of where older structure are in regions, economic theory would accordingly suggest those new developments, likely to be in areas with older building stock in core areas, would be sites of higher income households going forward.

As infill is at the same time encouraged by SB 375 and regional land use policies linking transportation funding to development near transit on the grounds of transportation, environmental and resource efficiencies (Cervero & Sullivan, 2011; Cervero, 1994; Younger, Morrow-Almeida, Vindigni, & Dannenberg, 2008), the question of impacts of such a transition arises, though the literature is relatively scarce on the topic. Still, there is a body of work on measuring effects of public facilities on prices, in part because sales data have long been collected as a matter of course, but also because there has been genuine interest in measuring effects of various environmental dis-amenities on properties nearby for more than half a century. In the case of infill, a term exciting to planners but less so to most other people (R. K. Lewis, 2001), there are policy reasons to investigate whether there are any effects at all, as it may be assumed that effects are negative.

It was early recognized that there could conceivably be substantial spillover benefits to neighborhoods where new public housing was put in, independently of the value of the project itself (Fisher, 1959). Nourse (1963) theorized that beyond the benefits to occupants of public housing, the neighborhood might be subject to positive externalities of a social sort, citing housing reformer's list of reduced crime, delinquency, lower police and fire costs, lower death rates as well as lower costs of medical care. His was one of the earliest studies of spillovers and in particular one focused on the social benefits.

Later, following the debacle of the poorly maintained Pruitt-Igoe, affordable housing has arguably carried a stigma, and delivering affordable housing has become increasingly complicated for fears of local negative effects on the neighborhood (Scally & Tighe, 2015). Wiley (2009) in a comprehensive study of data from suburban Maryland found mostly small, negative effects. While the directionality is arguably case-specific, it is widely recognized that external spillover effects could exist, though in later decades, the assumption has tended to be that the effect would be *negative* and measuring impacts of poverty rather than the new development in and of itself.

To wit, considerable resources are expended on analyzing environmental impacts of new projects in lengthy reports, per state and federal environmental regulations. The main purpose of these impact studies is to both identify impacts and propose mitigations for policy makers to consider prior to discretionary approval ("CEQA Guidelines § 15002. General Concepts," 2019). Impacts are in the context of environmental review analysis are predominantly presumed to be negative, such as, in the urban setting, traffic or crowding or loss of open space, though per economic theory there is no inherent reason development of sites in a neighborhood couldn't also bring benefits to an area. A poorly maintained vacant lot could be turned into something more useful for the area. A rooftop open space may be required as part of the the development, as could a child care center offering additional and tangible amenities. The environmental review process can be interpreted as a way to internalize external effects of developments by seeking to identify and mitigate impacts. An effect can thus be directly related to both what is built as well as what is removed.

While most research on spillovers have been concerned with the effects of public housing on single family homes, it may be helpful to think more generally about the types of effects that may be seen in a neighborhood with new housing construction. When a new housing unit is introduced, depending on the area context, it may be very similar to the existing stock (in which case its effect would be expected to be smaller), or it might be very different from the extant stock in terms of age, style, or quality (in which case the effect would expected to be larger. In an old neighborhood of less maintained properties, new construction may be perceived as more of an upgrade and thus provide a positive asset to the area, particularly if what it replaces was considered a nuisance by existing and would-be residents.

Notably, a study from Singapore, following an approach by Schwartz et al. (2006), found rising prices in a difference-in-differences framework in relation to new market rate development and found a "positive and persistent" contagion effect which was most marked on teardown sites Ooi and Le (2013). They controlled for supply effects and the difference-in-differences method in effect controlled for unobserved differences between neighborhoods with new supply and those without.

The Singapore finding is unusual. A Finnish team did a similar study of before-and-after pricing trends and, with insignificant coefficients, could not determine an effect in either a positive or negative direction (Ahvenniemi et al., 2018). The authors interpret this absence of an effect in terms of Finnish attitudes related to infill being less than favorable in general.

C.-M. Lee, Culhane, and Wachter (1999) used Philadelphia data from 1989 through 1991 and analyzed the effect of units rented with Section 8 certificates as well as federally assisted housing units on nearby property sales in small spatial bands. Controlling for local demographic, housing, and amenity variables, they showed these developments exert a modest, but negative impact on nearby property values. Conversely, they found that Federal Housing Administration–assisted units, public housing home-ownership program units, and Section 8 New Construction and Rehabilitation units to have small *positive* impacts. Also looking at Section 8 housing, Galster et al. (1999) found differential effects using Baltimore data. Small concentrations of new Section 8 housing in predominately White census tracts were associated with positive effects on prices. The effect was the reverse in tracts with generally declining values at distances up to 2,000 feet from the property transaction. Focus groups revealed that the negative effects were seen as connected to poor management of the properties. Similarly, Santiago et al. (2001) analyzing Denver data found differential effects for different area types, with positive effects in appreciating, White areas, but the opposite being the case in declining areas, areas with high shares of Black residents.

In the context of the debate over displacement related to new development, Pennington (2019), in a careful study of San Francisco, studied the effect new housing supply on the probability of evictions over a 20 year period. She obtained administrative data from the Planning Department for a nearly 20 year period, as well as address-level evictions data, and was able to model in detail the potential relationship between new housing development and evictions, but found no relationship. This echoes findings from San Francisco's Egan and Khan (2015), which took up the question in 2015 in connection with a proposed moratorium on market rate housing. That same report also examined the question of "indirect displacement," or what I refer to as spillovers. The report found more housing development lead to a reduction (5.9 percent) in nearby prices, varying the lag size from 1 to 3 years.

What would the specific channels of spillovers be? Ellen, Schwartz, Voicu, and Schill (2007) identify six separate channels through which new housing may affect the prices of existing properties. The *Removal Effect* may increase prices because a perhaps vacant or underutilized lot is developed. The *Physical Structure Effect* may impact the neighborhood if it is out of place or exceptionally well done. The *Market Effect* may induce other investors to introduce new projects. The *Population Growth Effect* captures induced effects from new population, providing additional local market potential for amenities. Lastly, there can be a price effect associated with whoever occupies the new structures, with the composition of the neighborhood being marginally different than what it was to begin with. This is what they Ellen call the *Population Mix Effect* (p. 264). In the following, I group the core mechanisms of spillovers.

Channel: Market effect

The existing housing stock may be affected in a number of ways. Developers may be involved in a signaling process when they pay millions to build a new development in an area where there is perhaps little history of that sort of building. A large developer placing their faith in a neighborhood may suggest to both existing land owners and residents that the outlook from a strictly financial perspective is favorable, leading to all other things equal higher prices for the existing stock. In a recent paper studying the Singapore housing market, Ooi and Le (2013) refers to a "signaling" effect the authors characterize as developers possibly having superior information and some ability to set the market, while Schwartz et al. (2006), writing about New York City, used the term "demonstration" effect. More specifically, in Ooi and Le's (2013) study of the Singapore market, they, following Schwartz et al. (2006), look at prices of nearby homes as new developments are delivered. Like Schwartz et al. (2006), they find a significant "contagion effect" on nearby houses as early as during the land acquisition stage. That is, controlling for general price increases, the existing nearby stock added 2.1 percent to their values. They interpret it as a "price discovery process" whereby the developer is thought to be a "price leader" with better information, which then subsequently serves as an anchor for individual sellers. New construction in a neighborhood may accordingly serve as a signifier of a more general state of reinvestment, with attendant changing expectations for the future of current residents and developers. In other words, rather than prices being set by agent-less processes, they are in effect in no small way being set by developers who are in turn able to marginally influence the market.

Channel: Removal effect

If new development falls on properties that detract from the neighborhood, such as vacant sites or poorly maintained properties, the models might pick up a positive signal from new development in part because of the discontinuation of the undesirable use. This would be separate from any effects of the new development in and of itself. We don't have a contemporaneous accounting of what new development replaces, so this effect is not modeled, but I acknowledge its existence here, as it as an omitted variable could serve to bias coefficients for new development upwards. Insofar as such uses are concentrated in particular neighborhoods, the effect would be caught, though imprecisely, in the neighborhood fixed effect. Schwartz et al. (2006) emphasized this channel in their finding of positive spillovers in the case of New York's housing program, as did Ooi and Le (2013), recovering a positive coefficient for building on "tear-down" sites. A related mechanism falls under the heading of removal effect, but acting via calls for services to local public works offices: McElroy and Opillard (2016) note that non-urgent public works service request calls to the 311 hotline focus on cleaning the streets and sidewalks and removal of graffiti, concentrated in gentrifying neighborhoods. Insofar as the city *responds* to these calls, this could be an unobserved amenity improvement or spillover effect from a hedonic perspective.

Channel: Physical structure effect

Some people may prefer a new building to older ones on visual or aesthetic grounds alone, particularly if it has unique or nice design features, or public usable spaces available to the neighborhood. Aesthetics more generally and views have been shown to have potential for affecting prices of an area (Bourassa, Hoesli, & Sun, 2005). The preference for design is subjective and not something I try to capture. A related effect might be related to well-publicized, branded projects where a project is notable enough to enter public discourse and shape the perception of an area. While there are likely few projects where that is possible, though the trend of developers branding their projects as a marketing tool is unmistakable. We don't measure this separately.

Channel: Population growth effect

Growth in population associated with new mostly larger scale development may bring side effects which could either be desirable or the opposite, depending on specific conditions. New residents could bring more foot traffic for local stores, more activity and live in the neighborhood. At the same time, this added traffic, on foot or otherwise, could be considered a negative by others, so the direction of the effect would not be inherently positive. I capture this insofar as I account for the number of units added, but that also measures the supply effect itself.

Channel: Population mix effect

Since housing services is a composite of the unit itself (structural features) as well as neighborhood features, the characteristics of the neighborhood feature heavily in the location choice process (Guo & Bhat, 2007; Myers, 2016). One of the most interesting effects from a planning perspective is is the mix effect, relating to how the neighborhood changes in tandem with development. This mix effect implies geographic substitution, and price changes in relation to changes in population. The study of urban location choice is about how households sort into urban space based on perceived or actual features of the homes there. On the margins, location choices change the demographics of a neighborhood, which in turn may change perceptions of new would-be residents. The sorting seems to be self-reinforcing, following the early theoretical work of Schelling (1971). More recently, Guerrieri et al. (2013) empirically showed that gentrifying neighborhoods are more likely than not found in the vicinity of wealthier neighborhoods, finding that residents tend to prefer neighborhoods with residents at least as wealthy as themselves.

In the context of new housing supply, we may observe higher prices not because of the composition of the housing stock itself but because of a compositional shift of buyers who may have higher incomes and /or willingness to pay for housing services in the area based on a different read of the stock and amenities offered, widely understood (cf. Bayer, Ferreira, & McMillan, 2007).

A further note on infill and neighborhood latency

In addition to specific spillover channels which could have a bearing on housing prices, a more overarching argument runs through this study: That the channels can be understood as parts of a wider process of re-mapping neighborhoods, changing perceptions of which areas to consider; which amenities they offer, and the different assessment of those amenities over time. As that happens, neighborhoods may come into, or fall out of, favor, and over time, such neighborhood are commonly subject to shifts in the hierarchy of neighborhoods. In the urban economics literature, such shifts are often interpreted in terms of age of *individual* units (Rosenthal & Ross, 2015; Brueckner & Rosenthal, 2009) more so than by neighborhood-level features. Exceptions include Somerville and

Holmes (2001), explaining changes in affordability instead with predominantly neighborhood-level characteristics. Neil Smith interpreted such changes through the prism of "rent gaps" and rounds of under-investment (N. Smith, 1996), while the neoclassical interpretation is that lower prices invite investors to take a second look (O'Sullivan, 2012). Regardless of interpretation, they are each referring to a type of latency which could be activated given some combination of public and private actions.

Building in existing neighborhoods may be a boon as the developer taps into latent capacity, transportation and amenities: Infill development is different because it by definition takes place not on a clean slate but in an already established urban fabric, where the value is a function of not only the features of the unit and building themselves following (Rosen, 1974) but also the bundled qualities such as relative access to amenities, recreation and jobs within the region (O'Sullivan, 2012). By the same token, access can be a negative amenity of sorts with the typical example being "access" to crime, or for residents near industrial neighborhoods (odors) or freeways (noise). More widely, it means that a large variety of externalities exist in the built environment: actions by one neighbor, or government or industry may affect a wide array of properties in any number of ways, some of which may be seen as desirable, others decidedly not (Sarte & Rossi-Hansberg, 2012; Malpezzi, 1996).

In an infill context, certain parcels may be "under-utilized," being land use imprints of an earlier economic structure in which warehouses were important armatures local production and distribution networks. As these economies have weakened, for example, warehouses in San Francisco and New York have long been converted, representing latent opportunities for re-activation of strategic sites in a larger urban reorientation around high capacity transit corridors. Whereas warehouses could scarcely make use of this transit access, those very sites obtain new meaning (and with it) value under a new economic geography focused in no small part on worker amenities (Gottlieb, 1995). The key point for our purposes is that high accessibility, substantially underutilized sites exist in relative abundance in central cities, whether in the form of parking lots or warehouses, and should they be developed, they would tap into existing transit and amenity capacities, offering a new housing bundle not as readily available before. Infill, by changing the dynamic of sites, may leverage latent capacities in the transportation network. It is no accident that city planners are often opportunistic when it comes to which areas to focus on for preparing specific plans: downtown areas with such latent capacity; places where infrastructure has been changed exogenously, such as the damaged central freeway terminus in San Francisco, leading planners to re-imagine the neighborhood as a more transit-focused, pedestrian friendly neighborhood (San Francisco Planning Department, 2007). To planners, such sites serve as the core canvas on which they operate.[4]

[4]This complicates studies of the effect of zoning on land markets insofar as areas selected for planning studies are not random, but areas with particular traits.

From a micro-economic standpoint, a would-be resident might prefer a neighborhood and housing bundle that doesn't readily exist. Suppose we think of the city as a large number of sites in a network providing different levels of access to different (dis-)amenities. To a newcomer, the bundle the access affords is fixed in the short term, but it will quickly change as infrastructure is improved and businesses and residents churn. Changes to the land use more generally changes the structure of accessibility for everyone in the network (Páez, Scott, & Morency, 2012): retailers can reach potential customers; employers can reach a larger labor force. Infrastructure changes the structure of this map; households and firms change its weights (per Equation 2.1). In this sense, the act of developing a site with housing changes the accessibility map for local retailers who can now access a larger group of potential customers (which in turn might induce more retailers to locate in the vicinity). Put simply, new housing leverages access to provide a new product.

There is a theoretical possibility that activating such latent sites could be seen as a form of "induced demand." Induced demand is a phenomenon well known in the transportation literature where new road capacity is quickly filled after introduction, seemingly out of nowhere; more than the pre-existing aggregate demand, hence the term induced (Duranton & Turner, 2011; Cervero, 2002b, 2002a; Goodwin, 1996).

Could latency be interpreted as induced demand? Could more housing supply, shift demand in a similar fashion? If a fundamentally new product is introduced–keeping in mind that the housing product is itself comprised both of the building itself as well as the neighborhood in which it is located–would-be home buyers might, even with unchanged preferences, decide to move there. The concept of downtown living, high-amenity housing flanked by cultural and transportation amenities has had a revival of sorts in recent decades (Birch, 2009; Y. Lee et al., 2019). Storper (2013a), without using the term latency, notes that older inner cities have become a draw in part because some of the features that made them glum compared with the gleam of the suburbs was that they turned their backs on waterfronts and had streetscapes focused on industry rather than workers. As industry left, cities got a makeover and newly imagined existence, leveraging their best qualities while being collections of the (mostly best) architecture that survived as the worst parts were removed: Cities are bundles of the best of the past, particularly as the negative externalities of industry has been removed. As sites are developed, they tap into this latency of what a city might offer, and it could entice new buyers who a generation ago would surely have been in the suburbs. In a planning sense, this is less bold than it may sound: in a region, and to a lesser extent between them, housing substitution straddles city boundaries (Anthony, 2017), and housing location choices are complex decisions made based on features of the house, neighborhood, availability of public services, personal networks, subject to capacity constraints (de Palma, Picard, & Waddell, 2007). This may not be induced in the *absolute* sense of increased aggregate demand for a region but induced in the more narrow sense that demand cuts across jurisdiction boundaries (Anthony, 2017) and could in effect shift the demand curve at the *local* scale if the right bundle of housing and amenities were forthcoming. This "re-mapping" (cf. "reimaging" in Hutton, 2009, p.990) of urban space is similar to what Steve Jobs did when he re-mapped the cellphone market by introducing the iPhone in 2008: it turned out to be a game-changer that shifted consumers to a new bundle. The urban equivalent may be the new-build, amenity rich, branded condo tower, re-imaginining and reimaging both the structure itself and urban living more generally, emphasizing lifestyle and urbanity, possibilities and prospects in an explicit rejection of the suburban lifestyle.[5]

[5] Marketing materials for a new luxury tower in San Francisco's indeed "reimagined" East Cut district, The Avery, places itself as the "center point of arrival for the confident tastemakers heralding San Francisco's next chapter. ... The Avery stands proudly in one of the world's most influential neighborhoods–home to global influencers like Salesforce, Amazon, Facebook, and Google." (The Avery, 2019)

Because of the joint nature of housing as a product, a housing unit may have five out of six desired attributes, but fail to garner much demand if the missing piece is critical to the marginal buyer. A developer may perceive a neighborhood to change and decide to seek permits for a new development that fits what she sees as a market niche–perhaps an amenity rich building, but in a location with improved transit service and thereby accessiblity to jobs. Many urban areas have had warehouse districts, and these have often been converted to new economy type jobs, shifting the nature of those neighborhoods from truck traffic to bikes next to parklets, and blue collar workers to their white collar counterparts.

While all this is theoretically possible, the analogy with the transportation literature only goes so far: Housing is much more sticky than travel demand: Transaction costs in connection with moving to a new luxury development are considerable and moving takes time. In addition, induced demand in the transportation realm may not be as surprising upon further examination: After all, most roads are free in monetary terms to users, leading to skewed estimates of the true demand. Housing, conversely, is hardly cost-free to new users.

The implication for this study is that it might be possible for a city with the right types of latency in a narrow sense to "produce" its own demand–to a point–by zoning for more housing of a particular quality and all the while observe price increases, insofar as demand for that housing type exists *in the region*, and substitution between submarkets is sufficiently fluid. At the same time, the increase would lower prices at linked submarkets, possibly including, though not necessarily limited to the same neighborhood.

2.4 Research Strategy

This study examines the relationship between new housing supply and the response in housing prices in the short to medium *time scale* at small to medium *geographic scales*. The research question, to recap, is *how* and *in which direction* new housing supply would affect prices at the local scale, with different parameterizations of the local scale. Economic theory largely suggests it should be negative due to the supply effect, but a number of studies from the planning and urban economics literature suggests reasons it might be positive. I use hedonic regressions to answer this question.

This research falls under the rubric of examining such locational externalities; the value attributable to the access that a particular address provides to a range of activities, events and communities. The effect of interest is the dynamics in neighborhoods where new housing supply, considered the "intervention" of interest, is introduced.

Hedonic models

The workhorse approach for sorting out such valuations in the literature is variations of hedonic regression models. The main purchase of hedonic models is the decomposition of sales prices into bundles of components, allowing the extraction of "shadow prices" for each: While the sales transaction of a property provides just one number, housing is characterized by a large bundle of attributes (Arnott, 1987). Hedonic models are a useful tool allowing us to disentangle these bundles of transacted components given sufficiently liquid markets and sales observations, according to hedonic theory from Rosen (1979), building on Lancaster's (1966) earlier consumer theory. From this approach, we learn that utility is derived not from a housing unit in and of itself, but rather because of the bundle of goods it provides. Assuming the researcher can observe some number of these attributes along with the sales price, she can infer the relative value a consumer attributes to each component, given a sufficient number of sales transactions. Hedonic models are accordingly a revealed preference approach to the problem of identifying values of components that are not *individually transacted* (and thus not individually observed), but bundled with the *overall* property transaction.

The hedonic approach dates back to Court's (1939) work on automobile markets, when product researchers were faced with the challenge of understanding (consumer response to) price changes over time for highly heterogeneous products such as cars. One issue was how to understand the marginal retail value of, say, additional horsepower. Another issue was how to even compare products over time when what is counted is so variable over time. A car from 1915 could hardly be compared with a 1935 model as the technology had changed dramatically during the intervening years.

Hedonic regressions would later usefully be applied to housing markets starting in the 1970s, with prominent papers including Rosen (1974) and Goodman (1978) describing housing as a complex, composite good comprised of both structural and neighborhood features. The structural features include, commonly, the size of a home, the number of bathrooms and bedrooms, the architectural style, quality of its fixtures, and any associated open space. In grouping variables affecting prices, Wilkinson (1973) made an early and meaningful distinction between "internal" and "external" amenities; chacateristics of the properties and, importantly, the location in which it sits. Palmquist (1992) showed that hedonic models are suitable for valuing localized externalities.

As important as these features are, a probably more critical part of the price of a home is its locational features, as per the old real estate adage, *location, location, location.* In this way, homes bay seem similar but for locational attributes. Location can account for much of the variation in prices within a metropolitan area, consistent with the classic trade-off between living space and access to jobs and amenities identified in the monocentric city models from the 1960s and 1970s (Muth, 1969). Yet, Cheshire and Sheppard (1998) suggests physical location is "a frequently neglected, but important, determinant of total structure price.“

Going a step further, location is *itself* a complex, composite good, masking non-market factors such as access to jobs, amenities like open space (Anderson & West, 2006), coffee stores or even wealthy neighbors (Guerrieri et al., 2013). The location effectively bundles a number of internal and external amenities (or dis-amenities, such as crime or environmental nuisances) with the purchase of property. Additionally, the location necessarily comes with some bundle of public goods, the quality and quantity of which is itself highly variable across space. School quality, for example, is typically capitalized into property values, due to either the sorting of residents according to income and / or "preferences" a la Tiebout 1956, with the effect of movers bidding up the home values in areas with better test scores (cf. Black, 1999). Conversely, what could be considered dis-amenities such as traffic noise (Nelson, 2008), hazardous waste sites (Farber, 1998) or crime (Troy & Grove, 2008) have been shown to adversely affect the value of real estate. Overall, it is well documented that housing markets are beset with a large number of externalities, yet prices tend to capitalize many of them, whether the direction is positive or negative, and the intervention a new park (Voicu & Been, 2008), a waste treatment plant, or a new housing development.

Conceptual and measurement issues

To confidently identify the effects of new housing supply on prices is not a trivial undertaking.[6] The burden of evidence goes beyond showing an association between the "intervention", new housing supply as infill development and the outcome measure, sales prices of vicinity properties. The association is a necessary condition, but not a sufficient one. Finding a positive relationship would be an interesting finding, but developers might have superior information about which areas to invest in, something not readily observable in a model. Or, it could be developers build in neighborhoods that are *already* appreciating considerably. We would observe a positive association and attribute it to the new housing supply "intervention," but what we would miss would merely be the developer's skill in picking neighborhoods and sites with strong underlying characteristics, and thus a basic selection bias of the object of study. This set of challenges has long been recognized in the planning literature (Galster et al., 1999; Ellen et al., 2001; Schwartz et al., 2006; Ooi & Le, 2013), along with ways of addressing the key identification issues.

[6] I am not focused on general equilibrium effects or the general supply / demand relationship; I am merely examining which types of effects are apparent at which geographical scales.

Studies recognizing this challenge include Galster et al. (1999) who, in a seminal study of the effect of section 8 housing on home prices utilized a careful identification strategy using both pre- and post-intervention variables. With them, they captured the underlying trajectory of the neighborhood in which the Section 8 housing was built. Ellen et al. (2001), Schwartz et al. (2006), Ooi and Le (2013), Voicu and Been (2008) each similarly relied on a difference-in-difference specification, in which price changes of the "intervention group" are compared to price changes of a control group deemed outside the intervention zone. A variant was provided by Ahvenniemi et al. (2018), who based on data from Finland estimated differnces between neighborhoods with new developments relative to controls of matched neighborhoods. By having prices before and after for the two groups, the difference-in-differences specification is in effect a quasi-experiment, provided adequate controls are present. While this is a quite strong identification strategy from an econometric perspective, practical measurement issues remain.

Most research examining the effects of new housing typically does so by creating buffers around the new housing sites and then evaluates prices within these buffers *relative to* prices outside them, but in the same general area. The recovered coefficient for a sale falling in the "intervention" area is then interpreted as the marginal effect of the intervention on the sales price. This approach is both computationally straightforward as well as conceptually compelling in that it clearly distinguishes the "intervention" or "treatment": given the buffer size, it is unambiguously determined which properties are (allowed to be) affected by the intervention project.

A number of limitations accompany this measurement approach. First, there are clearly boundary issues (cf. Griffith, 1983). The reliance of the model-control group identification strategy of the difference-in-differences approach leads to questions around which types of cut-offs to pick: what should the geographic scale at which a development is allowed to influence a sale be? There is theoretical guidance to to believe that the mechanisms through which spatial externalities operate (whether they be crime, noise, traffic or something else) would be operational on one side of a buffer (say, at a 499 meter distance) but not on the other side of it (say, at a 501 meter distance). Yet that is nonetheless the constraint of using such buffers.[7] Are all subgroups of properties impacted the same way?

[7] One practical way of easing this problem to some extent is to run multiple specifications, varying the size of the buffer, and seeing the distance at which the intervention has the strongest effect.

Second, further complications arise when the intervention to be captured comes in bulk with spatial clusters of projects appearing in close succession, and buffers accordingly overlap. This makes it less straightforward to capture unique effects of any one project. This raises the question of how to handles sales in the shadow of multiple developments whose effects on sales is hypothesized to be different from zero, leading to a sort of one-to-many problem going beyond a binary yes/no question. Here, the typical approach is a combination of flagging a sale if it is in the vicinity of "at least one subsidized housing unit," in Schwartz et al.'s (2006) usage, and some accounting of the magnitude of units in question.

Third, in addition to boundary effects, there is a *level effect* (though other variables could remedy this). This type of analysis does not distinguish between the effects of a project that has two units from one that has 200 and accordingly may be subject to specification bias depending on the size distribution of the intervention variable. Schwartz et al. (2006) allow for the recovery of heterogenous effects of developments by adding several ring variables, distinguished by whether a given project provides more or less than 100 units. While there may be some theoretical grounding to suggest distance decay effects per Tobler's first law of geography, there is little guidance in the literature to base such a decision on, and the empirical strategy must resolve which to choose. The analyst will need to decide on whether to keep just the nearest development or whether to sum all units developed in a given time span prior to the sale.

Fourth, this approach treats effects *within* buffer rings as essentially uniform–a property is *either* affected based on placement relative to the buffer–or it is not.

I address the first challenge on boundary effects by including a specification allowing effects to exhibit a distance decay, more consistent with the concept of accessibility commonly used in the transportation planning literature (Páez et al., 2012; Foti & Waddell, 2014; Handy & Niemeier, 1997). This approach captures in a continuous measure access to recently completed units from the vantage point of each sale.

The second challenge on level effects could be similarly handled by allowing continuous levels of the "intervention" variable. These adjustments would use more information than the binary case in which project size is not parameterized, only whether the sale exists in a certain vicinity as defined by the buffer radius. I expect each of these will improve precision of recovered coefficients.

Accounting for Spatio-Temporal Effects

Per the hedonic literature, residential property prices are heterogeneous bundles of features of the property itself, jurisdiction-level variables such as the provision of public services, as well as of more neighborhood-level attributes such as access to amenities (Silver, 2012; Blomquist, Berger, & Hoehn, 1988). However, in addition to providing information on the marginal value of an extra bedroom or floor, or whether the unit is at the top floor of a new building, sales transactions also hold information about two other important aspects relevant to this study–spatial and temporal trends–and with the proper models we can glean this information. In this section I briefly sketch the importance of capturing spatial and temporal heterogeneity, and then discuss how I approach it in my model.

Additional complications follow when using spatial data as well as time series data. First, all other things equal, prices tend to change over time and space in a non-stationary fashion (Dubin, 1998). Typically this registers as price inflation over time for real estate, and can be measured by constructing price indices for submarkets of interest. A simple approach for doing this is to include time dummies (year, or year and quarter) representing the time of the transaction (Triplett, 2006). With time series data, capturing the time trend is critical so as to not bias estimates by omission of this important trend. Coefficients can be interpreted as the time trend after controlling for building characteristics. Including time variables improves model fit, as well as provides more meaningful coefficients.

Second, prices are also thought to be spatially dependent; i.e. a part of the explanation for price levels are transactions of *nearby* property transactions. Prices tend to co-vary spatially, meaning prices may trend for reasons not related to right hand side variables as much as for reasons related to location. Not accounting for this spatially structured pattern of values and heterogeneity, or ignoring spatial auto-correlation (Getis, 2010), may lead to biased coefficient estimates the same way omitting time variables does (cf. Helbich, Brunauer, Vaz, & Nijkamp, 2014).

While both spatial and temporal trends complicate identification, the main (but far from exclusive) approach has been to include time dummies and / or lag terms to capture time effects, while spatial trends have been captured using spatial weights matrices, which may weigh closer observations more when estimating models (Getis, 2010). This approach, though, works well with smaller datasets, but as N gets larger, weights matrices become intractable as they grow $O(n^2)$. The critical piece is to ensure the model can capture and adequately control for not just the characteristics of the property itself but those of the location. Absent such controls, the residuals would not be independent and identically distributed, violating model assumptions.

Through a series of models, I employ in sequence two main ways of controlling for spatial auto-correlation and heterogeneity: First, for some of the models I rely on fixed boundaries to capture spatial heterogeneity, similar to the approach by Ellen et al. (2001) and Schwartz et al. (2006). For these, I use zip codes to capture neighborhood fixed effects. [8] I interact these with time variables to allow ZIP codes to have different price trends relative to all other areas, at different times. In a region where a number of districts areas are gentrifying, this is a reasonable assumption which does not constrain the coefficient to be fixed for the entire duration of the time series.

[8]ZIP codes are not without flaws for this purpose, given they represent points and not necessarily contiguous polygons. They are intended for routing efficiency rather than statistical area designation. Yet, while they are sometimes odd for non-residential buildings–a building may be one zip code–for residential purposes, they are more acceptable.

Another way that is typically used in the literature to capture spatial characteristics is to use distance variables to the CBD, particularly in markedly monocentric cities (Ooi & Le, 2013). This is a good approach in the conceptual world of the monocentric city model of Alonso-Muth-Mills where the CBD is thought to be the main driver of spatial variation in prices. Conversely, the approach is weaker if prices are thought to adjust jointly due to *other* spatial factors or amenity bundles, such as access to parks or cafes or schools, or where there are more than one center of interest. To the extent gentrification in San Francisco and beyond was not first and foremost most pronounced in areas immediately adjacent to downtown, other variables are clearly relevant. To get around the CBD issue, I calculate a number of general access variables to describe each small subarea, which is akin to characterizing each sales location with respect to the amenities it may offer. For tractability, calculations are done not at the level of each address, but at the level of each intersection, reducing the computational burden to one of characterizing 11,300 locations rather than uniquely describing each of the city's 200,000 addresses. More specifically, for the key right hand side variables, instead of denoting membership in a buffer around new housing developments, I calculated how many housing units fall within a given network distance relative to each of 226,000 intersections in the San Francisco Bay Area.[9] This way, we capture the effect not of being in in a treatment group but rather marginal effects of being near new developments, measured continually along the street network. With the intervention no

[9]To make accessibility computationally tractable, accessibility metrics are calculated relative to each street intersection instead of each parcel of which there are more than 2 million in the Bay Area.

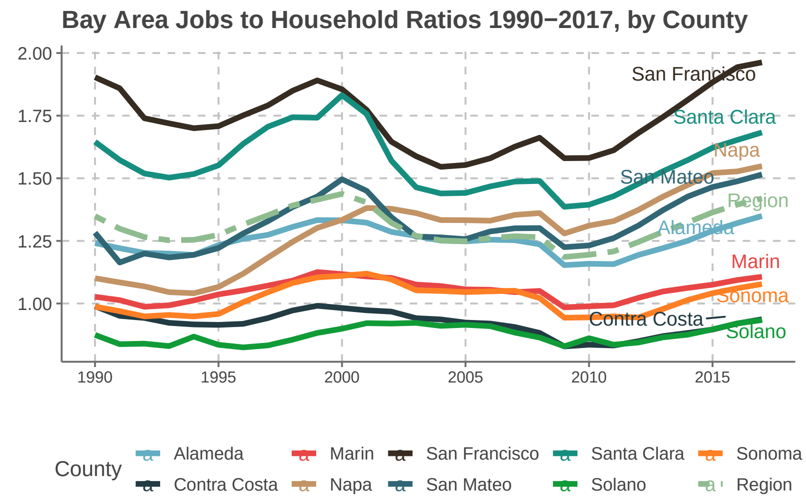
longer treated as binary, the effect of proximity to units is allowed much more flexibility; it can vary continuously. The parameterization will no longer measure not the marginal effect of being inside the 500 meter buffer, but rather the effect of access to an additional unit in the vicinity (a walkshed or driveshed measured along a network) on the sales price of a unit.

A complicating factor is describing neighborhoods consistently over a 25 year period at adequate spatial and temporal detail allowing for inclusion in a model. While census tracts offer insights going far enough back in time, the temporal resolution is limited to just a few observations for the period. The extent to which prices move *within* a decade, we cannot use once-a-decade observations to explain these changes. The wish to equally have spatially disaggregate data led me to use a business establishment dataset from the National Establishment Time Series, a provider who aggregates annual observations from the private provider Dun & Bradstreet. These data contain yearly observations on the location of a near-census of business establishments. I use these data as rough contemporaneous proxies for amenities: Access to retail jobs stand in for access to shopping opportunities. The same data conveniently also allow for the description of locations with respect to general job accessibility. While residents who move do not primarily select locations based on the work access it provides (Levinson, 1997), it remains a fundamental tenet of urban economics that locations with high accessibility tend to exhibit higher prices per the monocentric city model (see, e.g. Anas, Arnott, & Small, 1998), so I use this as the rationale for inclusion of access to jobs as Points-of-Interest on the right hand side, assuming it will have some bearing on transaction prices.

2.5 Shifts in the Bay Area Housing Market

Growing tech, growing pains?

In the spring of 2015, San Francisco set its all-time highs for both population and employment levels while earning the distinction of having the most expensive housing market in the United States. The city, while having been a major pacific center for financial services through the 1980s, had nonetheless seen its employment levels largely plateau since the mid 1980s as suburban locales offered lower cost real estate for more routinized back office business processes (Kroll, 1984). San Francisco further lost some of its corporate finance portfolio, raising questions as to the city's future role in a wider regional economic geography. As San Francisco was in some ways stagnant though still growing, San Jose, having by the turn of the millennium eclipsed San Francisco in population (though not in employment) added insult to injury by bumping the Bay Area namesake from its titular position in the Census Bureau's Combined Statistical Area designation for the region. Silicon Valley was on the rise, while San Francisco business and political leaders were searching for a new corporate identity for the new millennium.



Source: US Bureau of Labor Statistics, QCEW Files; CA Department of Finance, E-5 Reports

Figure 2.7: Ratios of Jobs to Households, Bay Area Counties.

They didn't have to search for long. While the Great Recession entered the national imagination in 2007, San Francisco registered only modest job losses, and only for a short time period, before embarking on a remarkable economic expansion as emerging industries would set their sights on the both city's more central business districts as well as the mid-market area, a centrally located district with only modest economic activity, high commercial vacancy rates, and pawn shops and payday loans characterizing the streetscape. A blow to the mid-market area came in 2011 when a ten-story furniture wholesale center closed down, adding 700,000 square feet of vacant space to the area. At the same time, city officials had gotten wind that Twitter, the social media company, were semi-seriously considering a move outside the city to avoid the effect of the city's 1.5 percent payroll tax should the company go public. The city relatively quickly produced a payroll tax exclusion zone in the mid-market region, allowing companies within the zone to be exempt from payroll tax payments through 2019 (San Francisco Board of Supervisors, 2011). Twitter took over the vacated Furniture Market. By 2014, three years in, two companies had proceeded with IPOs, and the city deemed the program a success, even with "modest" citywide effects but likely significant effects for the area (Office of the Controller, 2014). The irony, perhaps, was that Twitter would occupy the very furniture mart that went out of business in part due to the internet and changing consumer behaviors with respect to furniture shopping (Fornoff, 2008).

The emergence of the city as a center in the tech-focused social media industry meant a growth in relatively well paid technology workers and added much fuel to its longstanding problems with affordable housing provision (Association of Bay Area Governments, 2017). As local policy makers were torn over how to address the ongoing and seemingly perennial housing crisis, once again coupled with an economic expansion and transformation, the city was both the site and subject of a remarkable debate concerning fundamental questions about how actually existing housing markets work.

The stakes of this debate has profound bearings on the San Francisco Bay Area housing markets, and beyond. The question posed was whether, in the context of a housing "affordability crisis," the production of market rate housing was part of the solution, or if conversely, market rate housing, because it all other things equal tends to be more expensive than the existing housing stock, itself exacerbated problems of affordability.

As self-selection–between metro areas but particularly within them–of high and low income individuals into distinctive locales in what may be described as neo-segregation become increasingly common, how prices change over the course of an economic cycle will become critical.

The local politics reflected such concerns. David Campos, the county supervisor representing the traditionally Latino Mission District[10] had proposed to place a moratorium on market rate housing development (San Francisco Board of Supervisors, 2015b). His argument was that development of upscale housing would not only further *gentrify* the neighborhood, but remove scarce building sites, otherwise hoped to be turned into affordable housing units by non-profit developers (San Francisco Board of Supervisors, 2015a). The proposal was initially voted down by the Board of Supervisors, but was later submitted to the voters of San Francisco on the November 2015 ballot (San Francisco Department of Elections, 2015). Garnering support from 43 percent of the voters, the measure was handily defeated, but the debate remains active in policy circles and academia as to whether new housing *helps* or alternatively *hinders* the ongoing affordability crisis as noted earlier (Been et al., 2019).

[10] The Mission District has been long gentrifying, as a number of studies have documented Casique (2013), Mirabal (2009), Alejandrino (2000), Cespedes, Crispell, Blackston, Plowman, and Graves (2015)

To local planning directors and their policy teams, this proposal–and the ideas behind it–arguably represents a practical (let alone political) conundrum: While it largely remains the consensus view among economists and policy makers that housing prices are jointly determined by the relationship between supply and demand for housing units per basic economic theory for a housing market *as a whole* (cf. O'Sullivan, 2012), the *geographic scales* at which these interacting supply and demand effects register are less evident, and are typically settled *ex-post* empirically rather than *ex-ante* theoretically in the literature dealing with submarket delineation (e.g.

Grigsby, 1963; Bourassa et al., 1999; Coulton, Jennings, & Chan, 2013). The more recent thinking on submarkets, while far from uniform, is that submarkets contain some combination of structural and spatial dimensions, where neither takes precedence (Watkins, 2001; Piazzesi et al., 2015).

A practical complication relates to geographic scale. It may be market rate development in San Francisco's long gentrifying Mission District, an erstwhile Latino working class neighborhood, vacates *other* units in the near vicinity which then become available. To the extent substitution mostly happens *within* neighborhoods, new units will lead to more units available for local lower income workers even if filtering of the new units may take decades. If substitution happens *across* neighborhoods or even jurisdiction boundaries, new units may not necessarily lead to more availability - at the local scale, in the short term. An illustrative, though inconclusive finding using Bay Area data is that neighborhoods with much new development tend to see more churn in the *existing* housing stock, per Figure 2.8. While the evidence on filtering is mixed (compare Skaburskis (2006) and Weicher et al. (2017)), the lack of new housing development harms goals of affordability (Been et al., 2019), and cost burdens are on the rise across the country (J. Landis & Reina, 2019).

Each time ribbons are cut on new upscale housing developments, on the margins, the *composition* of the neighborhood housing stock likely changes; new retail establishment catering to higher income residents sign leases while old flagship stores may leave (Monroe Sullivan & Shaw, 2011; Meltzer, 2016), and perceptions may change of which areas are "hot" (and which are not). Lower prices in the existing stock may be seen as an effect elsewhere. This is, certainly, part and parcel of urban change (e.g. Zukin et al., 2009; Freeman, 2006) including the new-build gentrification variant (Davidson & Lees, 2010), but from the local perspective, even as added housing is indispensable from a *regional* housing supply standpoint, prices may not be all that much lower at the *local* scale as a result (Anenberg & Kung, 2018). Further, the same reasons developers pick a neighborhood may motivate higher income households to seek out the area as well, meaning these households would likely bid up the price of any pre-exisiting vacated units.

Because of such uncertainties and measurement issues, the debate on the role of housing supply lives on, with prominent geographers such as Rodríguez-Pose and Storper (2019) suggesting little benefit to affordability from statewide efforts to upzone near transit corridors, based on their more demand-side reading of the forces driving affordability. This study adds to the discussion by quantifying effects of new development on nearby for sale housing markets.

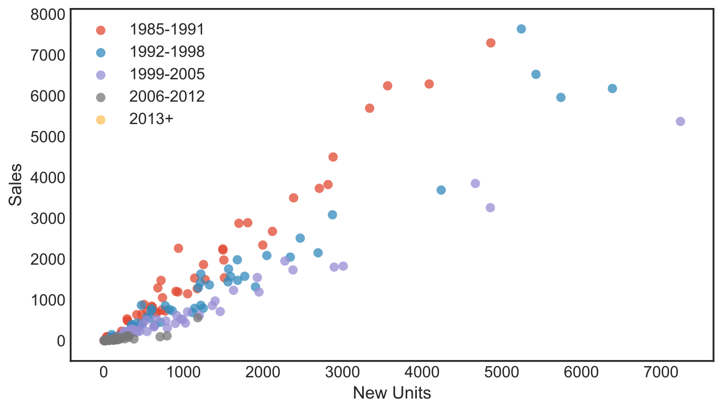


Figure 2.8: Is there more turnover in areas with more development? Sales, development data from DataQuick, summarized by PUMA geographies as proxy for submarkets.

2.6 Model Implementation and Data

Data sources

The main database I use for this research comes from DataQuick, now part of CoreLogic, a private reseller of sales transactions data from public assessor-recorder's offices across the country. The database has sales transactions starting in 1987, continuing through May, 2014. The data represents nearly all property sales recorded for the nine Bay Area counties, for a total of 2 million transactions. I remove records of non-arms-length, non-residential and time share sales as irrelevant relative to the research question. For the entire time period, for the counties of San Francisco, San Mateo, Santa Clara and Alameda, there are a total of about 1.4 million transactions.

The data is segmented into a sale transactions file and an inventory file. From the latter, I prepared a file of multifamily developments over the past few decades for the nine San Francisco Bay Area counties. The properties are geocoded and related to sales transactions using spatial queries.

Intervention sites

To examine whether I can observe an influence of new developments on sales prices of existing units in the vicinity I take two approaches to measuring any such price effects. One set of models utilizes a pseudo-experimental identification strategy, classifying observations as members of either a treatment or a control group, following the approach used by Ellen et al. (2001), Schwartz et al. (2006) and more recently Ooi and Le (2013) and Ahvenniemi et al. (2018). This approach consists of compiling a contemporaneous file on new multifamily development built during the past decades throughout the Bay Area, with variation in both *location* and *timing* of construction with respect to the business cycle. For each of these new developments, I have information on the completion year, the number of units along with a number of standard hedonic attributes, such as size, bedrooms, bathrooms, and more.

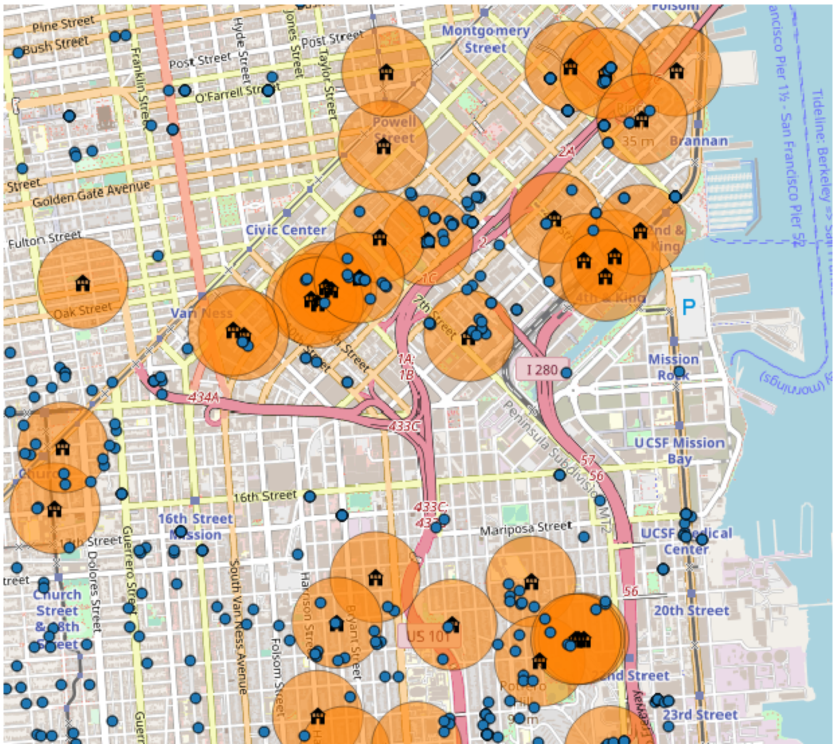


Figure 2.9: Partial view of development projects with 250 meter buffers, 2006, with Sales Shown, same year, Eastern San Francisco cutout. Data source: DataQuick

Table 2.1: Multi-family Development projects 1987-2013, by Price Tier, County.

launch_tier	A	B	C	unk
county				
Alameda	751	5,700	7,078	27,286
Contra Costa	1,216	1,621	4,565	25,342
San Francisco	1,329	11,216	5,197	15,447
San Mateo	109	1,481	2,179	4,694
Santa Clara	1,022	10,155	8,082	49,254

Note: Launch tiers places new development into price terciles. I collected new developments post-1987 from the assessor-recorder table, and then look to the transactions tables for sales with matching building IDs. I define launch tiers as units sold within the first three years of its existence. Those sales are then broken into three groups of high, middle and low. For units with no sales identified within the first three years following launch I classify as "unknown." Since these data come from assessor/recorder's data they include include buildings developed as rental units. A plausible interpretation for many of these unknowns is that they are rental properties.

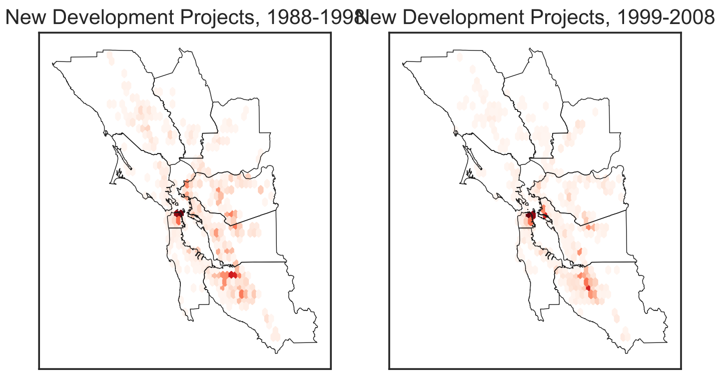


Figure 2.10: Development Projects, by Time Period. Overall, for the period 1988-1998, the dataset includes 102,500 units, and for the period 1999-2008, 88,200.

Classifying new developments into price tiers

As properties are heterogenous it stands to reason that they could exhibit different price effects on vicinity sales depending on which price tier they are in. To classify properties by price tier, I compiled a dataset consisting of new developments completed after 1987. I matched these developments with a dataset on sales transactions for individual units, linked them to the development projects, and calculated the z-score for the median price of units sold during the first two years relative to means for the containing city. I binned these into a low, middle and high tier. For units I could not tie to a specific building, as well as for buildings serving as rental properties, I assigned the value of unknown, for which a separate coefficient would be captured.[11] The value of this classification of developments into price tiers is that I can test for differential spillover effects for different parts of the price spectrum on nearby sales.

[11] The dataset unfortunately has no concept of a unique building id. Though it contains a property ID, it is legal property specific, not building specific; condominiums in the same structure have separate IDs. Instead, I assigned building IDs based on unique property address, which works reasonably well for many properties: In San Francisco, for example, most condos will have unit numbers, but the same street address. In some areas, though, condos may have a different address number for the same property whereby grouping by address would falsely see them as separate structures. However, the practical consequence will merely be that price medians for the first two years are made with reference to a much smaller subset of the building; the z-scoring will still be meaningful.

Relating developments to sales

For each of these developments, I draw a series of buffers (250, 350, 500 meter buffers), forming differently sized "intervention zones," within which any price effects of the new development might be observed. Since I am working with 20+ years of data I am interested in any supply effects irrespective of the year of sale. Sales transactions within the intervention zones are classified according to *when*, measured in years, they were sold *relative to construction* of the development project in whose vicinity a sale falls. For each sale record I standardize the ring variables into a series of time-agnostic dummies, capturing for each sale when it took place relative to the construction year. If a development project was completed in 2004 and a sales record from 2007 falls within its buffer, the transaction would receive a dummy equal to one for `construction_plus_3`, denoting the sale took place three years after a new multifamily development irrespective of the specific timing of construction and sale.

This year-agnostic set of dummies has the benefit of generalizing the effect across times and areas: a positive and significant coefficient would suggest a vicinity effect irrespective of when the sales transaction took place, and when the development was built, supporting the notion of spatial spillover effects, regardless of the mechanism at work. Conversely, if the spillover effect is of a more limited spatial and temporal nature, I would get non-significant coefficients on these dummies, with the interpretation that the sales price of a property is unrelated to whether it takes place near a new development project.

The canonical example of capturing environmental disamenities like garbage incinerators include one or a few sites of interest where there is a clear and finite count of effects to measure (Kiel & McClain, 1995). Increasing the number of sites of interest raises a number of methodological challenges. In practical terms, there are many more effects to keep track on in space and time. It is commonsensical that many factors may influence prices concurrently, but in econometric terms it is challenging to recover coefficients for any but a few intervention sites of interest, chiefly because they may overlap and contribute separate effects. In the case of housing development, for the most accessible sites, there may at any one time be a dozen projects in the vicinity, and, if pooling effects over a decade or more, there could be literally hundreds of developments whose effects I would need to account for and parameterize separately. While this is technically feasible as long as there are enough observations in the dataset, the difference-in-differences specification of the hedonic model implies that a sale in a buffer is identical to sales, but for membership in the intervention buffer's vicinity geography. If venturing immediately outside the buffer of interest entails falling in the shadow of another, similarly sized project, the control group design is at risk of losing its effect, though I still count the effect of being in the vicinity, though with less confidence that the effect is causal.

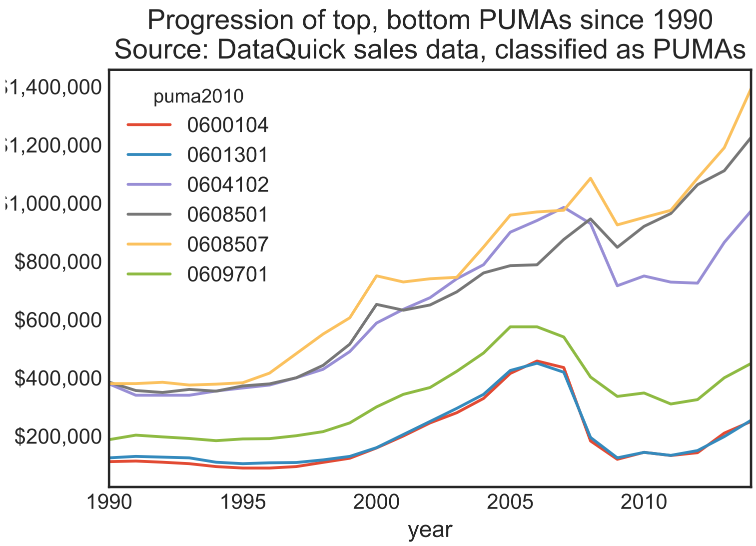
Practically speaking, for particularly the San Francisco portion of the sample, that city is compact and developments are indeed fairly concentrated into a few neighborhoods. With this clustering it is common for new developments to be near *other* new developments, and accordingly, for intervention zones of interest (the buffers around a new development) to overlap. To expand the example of the 2007 sale from above, such a transaction may not only be influenced by the 2004 sale, but find itself in the intervention zone of another development project slated for completion in 2008, a year after the sale. Since real estate development itself tends to cluster in space and time, models should be able to capture such compounding effects. In this case the vicinity sales record transacted in 2007 would, in addition getting the dummy `construction_plus_3=1`, also have information on sales taking place just prior to new project delivery, getting it the dummy `construction_minus_1=1`. In total I have time dummies (I do one for each of five years before and after, for a total of 10 time dummies). I also use variables that *sum* the units in the overlapping buffers encapsulating a sale so the full unit effect can be estimated.

An econometric challenge with this specification becomes particularly acute in the San Francisco case where clustering is tight, and developments are often close by, in part because they fall in community plan areas subject to upzoning, an activity which may induce developers to build, expecting good returns for doing so. If development is clustered in time and space with several projects completed in short order close together, it necessarily means that the approach of flagging sales with yearly dummies is econometrically challenged: If a sale is flagged with `construction_plus_3=1`, it might also tend to be flagged with `construction_plus_2=1` or `construction_plus_4=1`, leading to multicollinearity issues and associated high variance inflation factors, all other things equal making identification more difficult and coefficients less stable for the most critical variables (cf. Wooldridge, 2008, Ch.3). I checked variance inflation factors accordingly, and found high (10+) values for control variables such as spatial and yearly fixed effects but not for the key variables of interest.

2.7 Some Stylized Facts

New housing tends to be more expensive than the existing housing stock, so measuring housing costs by year constructed we would expect to see relatively higher costs for developments of a more recent vintage–all other things equal. This is strictly looking at year built, not by the location of where development happens. There is a considerable variation in sales prices by neighborhood, so if developers were building relatively affordable units but in pricier neighborhoods they would still look more expensive than the norm.

Splitting the data another way–instead of examining median sales prices by year built, I can assess it by location. Say I are interested in development *hotspots*: I define an accessibility-based measure of access those to be areas with a high cumulative number

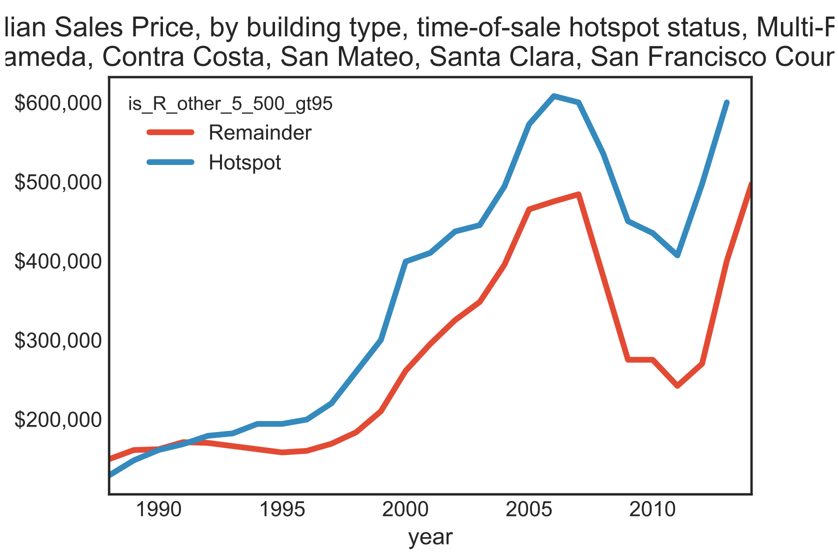


Source: Analysis of data from DataQuick

Figure 2.11: Median sales price trends for top and bottom Public Use Microdata Areas in 1990. The key observation here is not what happens to individual subareas, but that the gap between top and bottom subareas persists, even increases over time for the Bay Area.

of new units in the vicinity, where the unit of analysis is all intersections. Per Handy and Niemeier (1997) and Páez et al. (2012), accessibility A for residents p of zone i for the total number of opportunities k can be measured as:

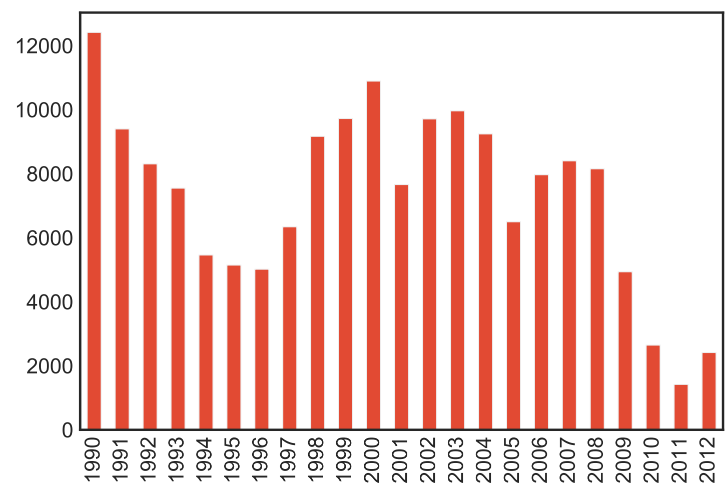
$$A_{ik}^{p} = \sum_{j} W_{jk} \times f\left(C_{ij}^{p}\right) \tag{2.1}$$



Source: DataQuick

Figure 2.12: Median sales price near development hotspots. For each street intersection, I sum the number of units developemed in the immediately preceding five year period within a 500 meter street network distance. Hotspots are then the top of this new-development accessibility distribution.

In our usage, I sum housing units constructed in the past five years, summed within a 500 meter street network distance using the pandana library (Foti, Waddell, & Luxen, 2012), yielding an intersection-level count of units in the vicinity of each intersection. I take the top of this distribution to identify the hotspots, setting the cutoff at the 75th percentile. Per Figure 2.12, the median sales price for units in multi-family buildings is roughly identical until the early 1990s, at which point the sales price near development hotspots diverges, staying consistently above the rest of the building stock. This could be explained simply by the units nearer hotspots being newer and / or better quality, as they tend to command a premium. Or, it could be explained by differences in unit size of the stock near hotspots. If units are larger, all other things equal, they would be more expensive. Unless such factors are controlled for in a multivariate framework, the fact that a good share of the value of a unit comes from the land it sits on, in turn determined by the level of access to the things that give land value such as amenities and work, as Henry George would have it, this tells us little, though calls for an accounting of the premium in sales price near hotspots in a multivariate framework, taking into account at minimum age and size of the units in question.



Source: DataQuick

Figure 2.13: Multifamily units, by year developed.

2.8 Model Specifications

To assume fixed parameters for the entire period and for the large geography under consideration for which I have data (20+ years) is arguably a strong assumption (cf. Triplett, 2006). It is also a large dataset for a regression, with 1.3 million sales transactions. To minimize this issue, I ran a large number of models on various subsets of the data, subsetting the data in terms of, in turn, different time spans and geographies, testing along the way how robust parameter estimates were to small changes in the time frame selected, say, 2002-2006 instead of 2003-2007, holding everything else constant.

Our initial baseline model is the following hedonic regression:

$$log(price)_{izdt} = \alpha_0 + \beta_i X_{it} + \delta_z W_z + \sigma NBH_{ct} + \rho A_{it} + \epsilon_{it} \quad (2.2)$$

where i indexes the property sold, t indexes time, j indexes development projects, and z indexes ZIP codes. X is a vector of property characteristics; W is a vector of ZIP code fixed effects, and NBH_ct is a vector of tract-level characteristics, including demographics, access to jobs. A refers to accessiblity per Equation 2.1, counting units built in the most recent five year window within a 500 meter street network distance. This is a direct estimate of the spillover effect on prices. I call this Series A to distinguish from models estimated with the difference-in-differences estimator. Following Schwartz et al. (2006) and later Ooi and Le (2013) approach with buffer or ring variables, I further estimate variants of the following hedonic regression:

$$log(price)_{izdt} = \alpha_0 + \beta_i X_{it} + \delta_z W_z + \sigma NBH_{ct} + \gamma RING_{itbs} + \theta RING_{itbs} DIST_{ij} + \eta RING_{itbs} QTRS_{ij} + \epsilon_{it} \quad (2.3)$$

where b indexes discrete buffer sizes (one of 150 m,250 m,350 m entered per regression), s indexes the size category of development project j (one of 20-100; 101-200; 200+ units entered per regression). I essentially replace the continuous accessiblity measure A_{it} to instead employ the difference-in-differences approach for a stronger identification. The additional variables include the ring variables, where I assign sales-specific membership in different buffers, varied by development project size and distance.

Alternate approach: Continuous accessibility to new units

To test whether supply effects might not be binary (either inside a project buffer, or not), I employ an alternative way of characterizing sales transactions with respect to their relationship to nearby construction: I use street network queries to describe in general terms if a property being sold is near many or few new housing developments. This set of variables is constructed using street network queries. Starting with 20 years of geocoded completed construction projects I describe each intersection in terms of how many units are within a 500 and 1,000 meter vicinity, with the result being a continuous variable that is high near development hotspots, and low elsewhere. These queries are done for each year beginning with 1987 through 2013. As with the buffer approach, I remove the specifics of the year in question, standardizing these such that a sale is ultimately described by how many units were within a given horizon distance built during the preceding 1, 2 and 5 years from the perspective of each sale. This alternative approach allows for finer resolution in the description of the sales transactions, moving beyond a binary characterization. This gets us around the boundary problem of census tracts (modifiable areal unit problem, MAUP per Openshaw (1984)) being somewhat arbitrary and instead allows a more consistent description of units using a constant network distance approach. This is an improvement over measuring new units at the level of census tracts, given their variable shapes and sizes. This access–to-new-units-variable is a straightforward test of the effect of being near hotspots (Figure 2.12), though without the benefit of the difference-in-difference approach to control for area self-selection. This comes at the cost of the loss the quasi-experimental nature of of the other approach. Figure 2.12 captured trends around these hotspots.

Right hand side variables

In addition to information on the property such as bedrooms, bathrooms and unit size, I include a year dummy, zip code spatial fixed effect, along with an amenity index capturing accessibility to coffee stores, groceries and parks. I also included a number of census-derived neighborhood characteristics (number of households in different income groups, size of labor force, seniors, racial characteristics). The census variables are pulled from the decennial censuses in 1990 and 2000, and from the American Community Survey five year sample from 2012 to represent the period around 2010. Given the coarse representation over time, Census 1990 is used to represent sales in the period 1888-1999; Census 2000 from 2000-2009, and ACS 2012 from 2010-2013. Lastly, I included job accessibility variables from a business establishment time series dataset, counting employees by place of work relative to each intersection, with sales inheriting the value for the nearest intersection. This indicates jobs by four groups in the vicinity of the sale.

Table 2.2: Key variable definitions

Variable	**Description**
dum5_c_time	Five before / and five after yearly dummies denoting where the transaction year is relative to buffer year. For example, if a sales record is in a buffer ring (geographic check) for a project built in 2004 and the sales transaction is in 2007, the t_plus_03 dummy gets a value of 1, everything else 0. Has a value of one regardless of how many intervention projects are in the vicinity of a sale.
general_dummies	simple dummy yes / no indicator denoting if sale falls in a certain area, without time consideration: a sale might be in an area where no "intervention" has been built yet; useful for capturing area trend distinct from area fixed effects.
interv_dum_postbuild	Equals 1 if sale in buffer of development project up and until five years after completion.
time_since_intervention	Quarters since *nearest* intervention completion.
nearest_intervention	Distance to nearest intervention, within a five year time span, within a given size group.
launch_tier_x_devsize.	Set to 1 if project falls within buffer. Development projects are segmented into three price tiers (A: high, B: medium, C: low) and three development project sizes: small (less than 100); medium (100-200) and large (200+).

Note: A key measurement challenge relates to sales where they are influenced / fall inside the buffers of several projects, sometimes completed the same year. This complicates the dummy approach as a means to uniquely distinguish projects in intervention areas from ones outside. Alternative variables were created to capture the amount of development to distinguish the level from just the inside / outside grouping: Some were prepared as summations of developments in the years before or after a sale in yearly increments (a variant of t_n was summing units rather than just capturing 0 / 1). Others were proper dummies, codes as one if at least one project was built in the vicinity in the relevant time period (general_dummies). Yet other variables focused on distance to the nearest development (nearest_intervention), or time lag since completion (time_since_intervention).

The basic descriptive statistics of the background variables and variables of interest are reported in Table 2.3.

Table 2.3: Basic Descriptives

	count	mean	median	max	min	std
SQFT	1,490,214	1,680.2	1,484.0	2,620,000.0	48.0	3,904.5
STORIES	1,490,205	1.3	1.0	225.0	0.0	0.8

Continued on next page

	count	mean	median	max	min	std
BLDG_AGE_SALE	1,450,576	33.4	30.0	173.0	0.0	25.0
BEDROOMS	1,490,214	3.0	3.0	975.0	0.0	1.7
BATHROOMS	1,490,214	2.1	2.0	250.0	0.0	1.0
Amenity Index	1,490,214	39.1	30.2	99.4	30.2	15.1
MFUNITS ($1Ms)	1,292,106	2,153.5	394.0	11,400.0	0.0	3,317.7
JOBSPROF (100s)	1,314,490	5.1	0.8	1,493.1	0.0	32.7
JOBSRETAIL (100s)	1,314,490	1.9	0.5	150.4	0.0	5.0
HHs Quartile 1 (100s)	1,373,048	4.8	2.1	190.4	0.0	8.2
HHs Quartile 4 (100s)	1,373,048	4.1	2.9	98.9	0.0	4.4
AG_65P (100s)	1,373,048	5.5	3.7	125.6	0.0	6.3
LABFORCE (100s)	1,373,048	34.6	27.8	467.0	0.0	34.4
OFFICE ($1Ms)	1,292,106	86.3	15.5	741.5	0.0	148.0
MULTIFAM_2YR_500M	1,475,316	0.0	0.0	10.7	0.0	0.2
MULTIFAM_5YR_500M	1,475,316	0.1	0.0	20.9	0.0	0.7
SINGLEFAM_5YR_1000M	1,475,316	0.3	0.0	16.6	0.0	0.9

In addition to numeric variables, spatial and temporal fixed effects are used.

2.9 Results

I present a number of different specifications. The simplest and most direct approach is one with basic unit characteristics such as size, bedrooms and age, with key neighborhood demographic characteristics, though also controlling for unobserved features with PUMA fixed effects, interacted with year to allow those to change over time. Census tracts are entered to capture time-invariant unobserved neighborhood features. These basic features are retained in all model series. I run two main variants of models to capture the effect of new development, all in a first-stage OLS framework.

Series A refers to regressions run in a non-experimental framework where in addition to the above mentioned control variables, the main variable of interest is units constructed nearby. I enter this into the model as a variable denoting multi-family development completed in the immediate five year period prior to the sale, captured within a 500 meter network distance from the location of the sale.

The Series B set of regressions rely on the GIS-based dummy approach, using buffers to capture the effect of being near a project relative to other projects in the same neighborhood (measured as PUMA fixed effects). I employ the difference-in-difference framework in which a sale is flagged if it falls in the vicinity of a project, and, separately, whether the sale takes place after the development of an intervention project. The difference-in-difference interpretation becomes less tenable where yearly pre/post-dummies are estimated, since there will be few observations that have the exact same sequence of dummies except for one. These specifications are nonetheless instructive insofar as they allow for the capturing of time effects relative to new development projects.

Series C regressions, like Series B, uses the buffer approach and is in principle also a difference-in-difference specification, though since a sale can be separately classified as being sold, say, three years before a price tier A project, two years after a price tier A project, three years after a price Tier B project, the clear distinction between treatment and control usually implied with the difference-in-differences estimator is less practical, even if theoretically still there: The control group would be projects that are identical with respect to all other variables but the one of interest, including the *other* time effect tier dummies. Certainly, this becomes a limiting condition with respect to sufficient data coverage, even when pooling 20 years over several counties. Nonetheless, I still present results from the tier analysis, though it should be seen as more tentative.[12]

[12] As noted, the data source has no concept of a building, so a heuristic matching approach based on addresses was employed, to classify developments based on the sales file, matching the development with transactions within the first three years following construction. However, many developments could not be successfully matched. I denote these as "unknown" price tier, though some of those are certainly rental properties.

Series A results

In Series A, the main variable interest measures from the vantage point of the unit sold, vicinity multi-family housing construction in the 5 years leading up to the sale within a 500 meter network distance. I tested two different "windows" of time for unit completion: one variable counted multifamily units constructed within a 500 meter network distance during the past five years; another reduced this to two years. To not force constant parameters for a 20+ year period, the models were estimated on different slices of the larger dataset, varying in turn the time frame and counties under consideration.

Starting with San Francisco, basic unit features such as bedrooms and square feet have expected signs and magnitudes: An additional 100 square feet increases the price in the 2-3 percent range, while an extra bathroom adds about 5 percent to the sales price.[13]

[13] The pooled regression in the rightmost column is an exception, with a much smaller SQFT coefficient.

Turning to the intervention variable of interest, `MULTIFAM_5YR_500M` and `MULTIFAM_2YR_500M`, I see different effects depending on the time horizon cutoff: Where I allow a shorter "memory" of development projects to influence sales prices over a longer two-year time period, we generally see negative effects of development on prices in the years that follow: in the pooled regression covering the longer time frame of sales from 1988-2013 (third column, Table 2.5, for each 100 additional units completed in the preceding two-year window within a 500 meter network distance, sales prices of existing units *declined* by 1.4 percent. The effect was stronger negative in San Francisco, at 5.5 percent for the full time period as a whole. However, allowing a longer time frame of influence, from two to five years, changes the pattern somewhat to positive, albeit with small absolute values. With the longer time frame, the effect of an additional 100 units within 500 meters is positive at .3 percent. Given these two slightly different measurements of access to housing development produced opposite signs for the same datasets it suggests the specific choice of measure is critical, though there is little theoretical reason to prefer one time frame over another. This is important to keep in mind when interpreting effects of continuous measures: Even those are subject to cut-off effects in time, and certainly in terms of the choice of network distance. Substantive explanations for the difference include that it could be the case that in the immediate years after new construction, people are more apprehensive about absorption and vacancy, with more competition for residents prior to full absorption. The longer time frame switching to a mostly positive sign could be interpreted as the development dust settling, and things normalizing, construction trucks leaving, units filling up and (perhaps) with second order effects of population change having a marginal effect as well.

The negative sign can be interpreted as support for the standard economic view that supply does lower prices on the margins, implying substitution takes place in the vicinity of the new development projects. Conversely, the positive sign of the larger time frame supports the opposite conclusion that spillovers matter. If taken at face value as represent a more long term effect than the momentary two-year window in which the effect was found to be negative, it is worth remembering that this doesn't conclusively establish the effect as causal; it could be that the effect is spurious and determined by the specific sites picked by developers which, to make sense of the negative signs, would imply them selecting relatively lower cost areas (though the effect was very small). Series B models address this with a different identification approach using differences in differences to distinguish sales in intervention zones from those outside them but still in the same neighborhood.

Table 2.5: Model results, Series A (continuous accessibility effects). San Francisco, Santa Clara, San Mateo, Alameda Counties

	geo_str	75		75,81,85,1	
	yr_str	1988_2013	2001_2013	1988_2013	2001_2013
	modspec	(Model, Series A)	(Model, Series A)	(Model, Series A)	(Model, Series A)
vargroup	variable				
A: Property	BATHROOMS	0.008	0.001	0.276***	0.109***
	BEDROOMS	0.020***	0.020***	0.002***	-0.000
	Building < 10 Years	0.125***	0.120***	0.119***	0.125***
	Building > 50 Years	0.147***	0.127***	0.256***	0.114***
	LOTSIZE (1,000 SF)	-0.000	-0.000*	-0.000***	-0.000***
	SQFT (100s)	0.051***	0.048***	0.006***	0.043***
	SQFT (100s) SQ	-0.000***	-0.000***	-0.000***	-0.000***
B: Accessibility	MULTIFAM_2YR_500M	-0.055***	-0.057***	-0.014***	-0.017**
	MULTIFAM_5YR_500M	-0.006*	0.014***	0.003***	0.006***
	SINGLEFAM_5YR_1000M	0.025	0.164**	0.018***	0.021***
C: Neighborhood	AG_65P (100s)	-0.002**	-0.004***	0.000	-0.001***
	Amenity Index	-0.006	-0.045**	0.019	0.023
	HHs Quartile 1 (100s)	0.002	0.002	0.000	0.000
	HHs Quartile 4 (100s)	-0.001	0.001	0.001***	0.001**
	JOBSPROF (100s)	0.001***	0.000***	0.001***	0.000***
	JOBSRETAIL (100s)	-0.004***	-0.003***	-0.005***	-0.003***
	WHITE_NH (100s)	-0.000	0.000	-0.000***	0.000
D: City	INDUSTRIAL ($1Ms)	0.000	-0.001***	0.000***	0.000***
	MFUNITS ($1Ms)	0.000***	0.000***	0.000	0.000**
	OFFICE ($1Ms)	-0.001***	-0.003***	0.000***	0.000***
	SFUNITS ($1Ms)	0.002***	0.003***	-0.000***	-0.000***
Model	Intercept	10.084***	8.921***	11.373***	11.934***
	N	19,448	10,726	135,185	89,841
	R^2	0.70	0.52	0.69	0.61

Note:

Dependent variable is log(price). Sales exclude units in buildings younger than 3 years. Interactive fixed effects `PUMA:year`, `Census Tract` not shown.

Geographic codes as follows: 75: San Francisco; 75,81,85,1: San Francisco, Santa Clara, San Mateo and Alameda Counties.

Table shows regression results for the basic model for San Francisco County and for San Francisco, Santa Clara, San Mateo and Alameda Counties for different time periods: 1988-2013 and 2001-2013, with control variables and the variable of interest being the accessibility-based `R_single_5_100` and `R_other_5_500`.

* $p < 0.1$,

** $p < 0.05$,

*** $p < 0.01$

Series B results

With Series B regressions, I examined sales prices in a difference-in-differences framework, where the treatment / control classifier was sale transaction membership in development or intervention project buffers relative to the sale, in both time and space. We are ultimately interested in whether we can identify a significant effect on sales prices from being near such locations with considerable new development preceding, or even *following* the sales transaction, consistent with the notion that expectations about the future can be material to the behavior of individuals and with them the wider housing market.

As for Series A, basic property variables have expected signs and mostly magnitudes. Model R^2's are between .48 and .61, depending on which geography and time period is modeled. Generally, the variables have expected signs: Square footage is positive, as is the amenity index, and the count of households in income quartile 4.

The `interv_dum` variables indicated if a sales was in a development project buffer before or after, with a cutoff period of five years. In the pooled regression, the effect of being in this general zone was 1.2 percent for the 20-99 unit projects, while for the middle project size of 100-199 projects, the effect was as much as 12 percent, suggesting a sales price premium in the neighborhoods where those projects are located. The largest development size category, above 200 units, conversely is associated with a slightly negative effect of -3.4 percent. It may be that developers of middle sized units pick relatively more established areas, where as developers of the largest projects can pick marginally more affordable areas, and in effect be part of the remapping of the neighborhood.[14]

[14]Ultimately, there are very few areas in the region where projects of that size are possible per zoning rules; this negative is driven by those areas.

The `postdummy` variables, in turn, indicate if a sale takes place in an area where a new development has been delivered in the five years prior. In the pooled regression, the effects are all negative, though small: a sale in an area where development is located had a small dampening effect on prices of existing multifamily property (-2 percent). For the largest size category, the effect was not statistically significant, perhaps owing to the fewer such developments in the sample. The negative signs generally conform to the standard view that more development all other things equal lowers prices, in this case at the neighborhood scale, though in the San Francisco subset, this is true only for the smaller project sizes (`postdummy_sz20_to_100_250` and `postdummy_sz100_to_199_250`); the greater than 200 unit categories see a 16 percent premium. This strong effect is only present in the pooled San Francisco regression and not in the later time period 2001-2013, making it more difficult to pronounce definite statements on effects.

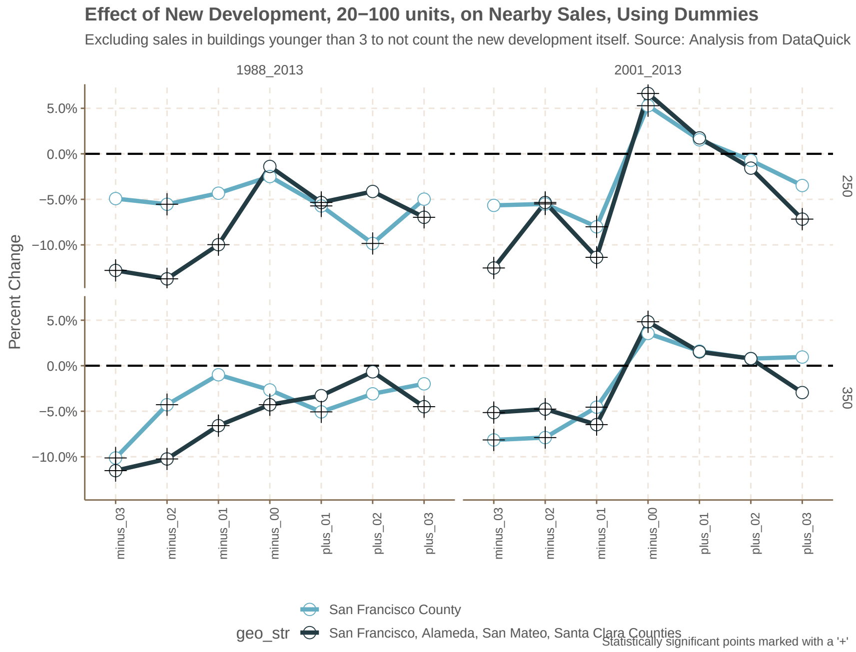


Figure 2.14: Each sale is flagged by whether any development took place in the nearby space-time matrix. Note not all points are statistically significant. Statistically significant points marked with a + glyph. The leftmost column shows the longer time frame of sales from 1988-2013; the other show smaller subsets.

Level and Timing Effects

Examining time effects, taken as a whole, there was considerable variation over time and space (Figure 2.14). Plotting coefficients for sale transaction year relative to construction year, the rough pattern is one where sales prices in the vicinity of new construction tend to start at below parity and then rise towards the construction year, and then with a post-build leveling off effect a few years later. The leftmost panels show the pooled regression longer time frame of sales from 1988-2013. San Francisco, in light blue, starts below parity, sees a slight uptick and then a tapering post-build. Several observations are not statistically significant, though the post-build *decline* is. The profile derived from the 350 meter buffer suggests a similar, but less spiky pattern, with a relatively clear up-trend over the course of the development cycle. The right panels show regressions for just the 2001-2013 period, with a more dramatic spiking of prices around the construction year. Immediately following the spike, prices level off, almost back to the starting point. It is possible the spike anomaly reflects a time period artifact related to the Great Recession as it was not present in the pooled regression.

Separate from the overall effect of proximity to new development, I captured gradients by interacting distance to the nearest development with different ring or buffer sizes. Coefficients were captured for different buffer distances around projects, allowing the plotting of a gradient from the effect taken in the 150 meter window through the 350 meter window.

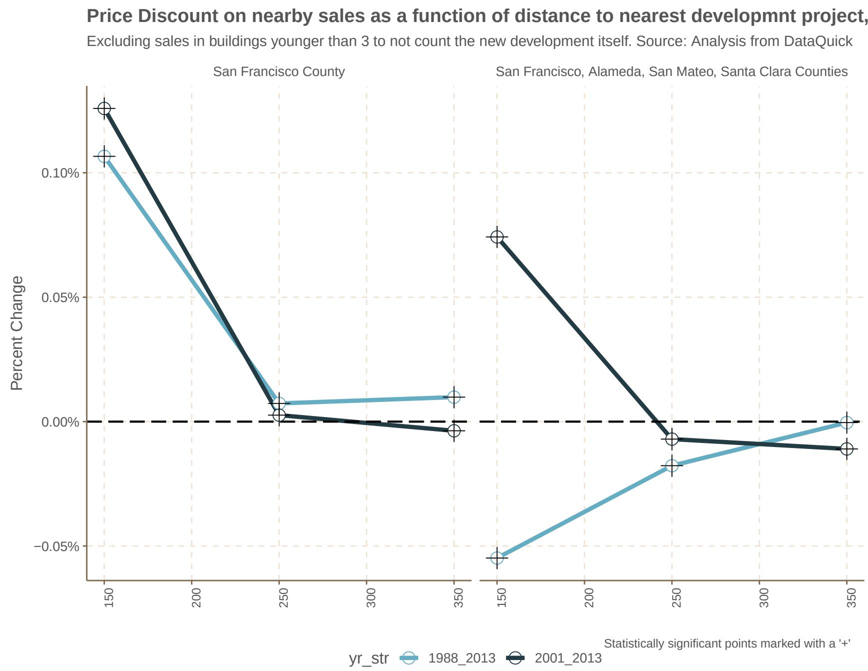


Figure 2.15: Price Discount on nearby sales as a function of distance to nearest development project, 20-100 units. Note not all points are statistically significant. Statistically significant points marked with a + glyph.

Development Size Effects

We entered variables for sales following within a five-year window od new development projects of different sizes to capture possible differences in effects from development intensity (Figure 2.16). The full time period 1988-2013 is included in the left panels. For San Francisco, in blue, with a 250 meter buffer (top panel), the smaller development projects have negative coefficients in the 3-5 percent range. Development projects larger than 200 units, though, came out with an effect of around 8 percent, suggesting considerable heterogeneity with respect to development size. However, this pattern was only present when pooling the years; the capturing coefficients from the period from 2001-2013 alone did *not* reveal this size premium; on the contrary, larger developments come with a relatively *lower* nearby price effect, though not statistically significant in this opposite direction. A plausible explanation could be that the fewer sales observations during the Great Recession made it more difficult to capture a signal in either direction, as both developments and sales became more scarce. Increasing the buffer size to 350 meters, the effect of size is most notable for the large project group in San Francisco, where the coefficient implies a more than 20 percent effect. As many of these coefficients lack significance, more research is needed to probe the differential effects of project size across space and time.

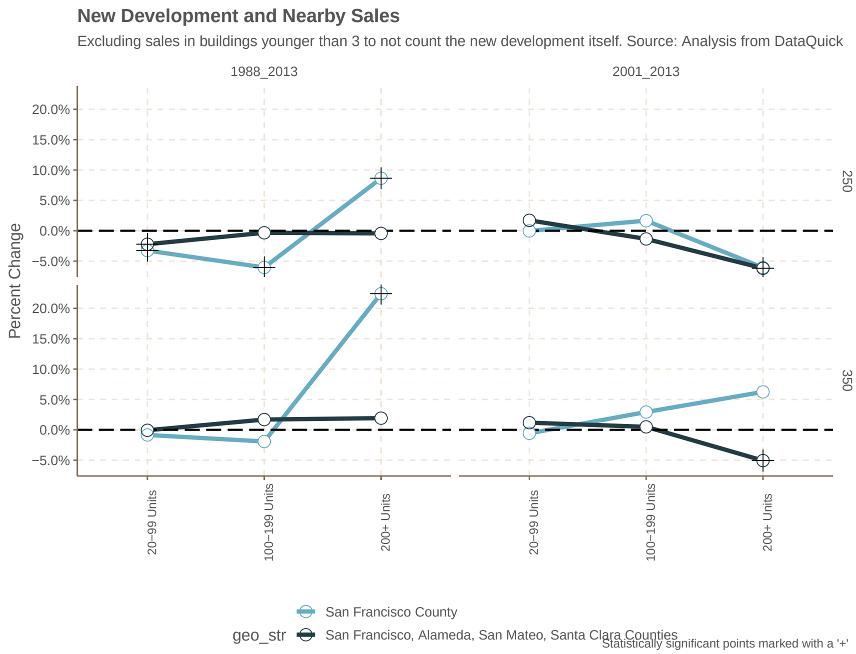


Figure 2.16: New Development and Nearby Sales, By Different Development Intervention Project Sizes. Note not all points are statistically significant. Statistically significant points marked with a + glyph.

Table 2.6: Model results, Series B. Housing prices vs interventions, using 250 meter intervention zones

vargroup	geo_str yr_str modspec variable	75 1988_2013 rhs_diffindiff_250	 2001_2013 rhs_diffindiff_250	75,81,85,1 1988_2013 rhs_diffindiff_250	 2001_2013 rhs_diffindiff_250
A: Property	BATHROOMS	0.002	0.009	0.235***	0.097***
	BEDROOMS	0.018***	0.019***	0.000	0.000
	Building < 10 Years	-0.006	0.021*	-0.120***	0.062***
	Building > 50 Years	-0.024**	0.013	0.113***	0.066***
	LOTSIZE (1,000 SF)	-0.000	0.000	-0.000	0.000
	SQFT (100s)	0.048***	0.044***	0.004***	0.036***
	SQFT (100s) SQ	-0.000***	-0.000***	-0.000***	-0.000***
B: Accessibility	MULTIFAM_5YR_500M	0.003	-0.013***	-0.012***	-0.005**
B: Intervention	interv_dum_sz100to199_250	0.098***	0.045***	0.121***	0.032***
	interv_dum_sz20to100_250	-0.021*	-0.024*	0.012*	-0.011*
	interv_dum_szGreaterthan200_250	-0.081***	0.067**	-0.034**	0.007
	postdummy_sz100to199_250	-0.060***	0.017	-0.000	-0.013
	postdummy_sz20to100_250	-0.033***	-0.000	-0.021***	0.017*
	postdummy_szGreaterthan200_250	0.086**	-0.061*	0.003	-0.062***
C: Neighborhood	Amenity Index	0.005***	0.006***	0.002***	0.001***
	HHs Quartile 4 (100s)	0.020***	0.002	0.028***	-0.001***
	JOBSPROF (100s)	0.000***	0.000	0.001***	0.000
	LABFORCE (100s)	-0.002***	-0.000	-0.002***	0.000
D: City	MFUNITS ($1Ms)	0.000***	0.000***	0.000***	0.000***
	OFFICE ($1Ms)	-0.000***	-0.001***	-0.000***	-0.001***
Model	Intercept	10.953***	11.764***	11.588***	11.963***
	N	19,448	10,726	135,083	89,841
	R^2	0.61	0.55	0.48	0.56

Note:

Dependent variable is log(price). Sales exclude units in buildings younger than 3 years. Interactive fixed effects `PUMA:year`, `Census Tract` not shown.

Geographic codes as follows: 75: San Francisco; 75,81,85,1: San Francisco, Santa Clara, San Mateo and Alameda Counties.

Results for different buffer sizes are reported in the appendix.

* $p < 0.1$,

** $p < 0.05$,

*** $p < 0.01$

Table 2.7: Model results, Series B. Time Effects. Housing prices vs interventions, using 250 meter intervention zones

vargroup	geo_str yr_str modspec variable	75 1988_2013 rhs_smdev_250	 2001_2013 rhs_smdev_250	75,81,85,1 1988_2013 rhs_smdev_250	 2001_2013 rhs_smdev_250
A: Property	BATHROOMS	0.013	0.019**	0.229***	0.097***
	BEDROOMS	0.018***	0.018***	0.001*	0.000
	Building < 10 Years	0.006	0.037***	-0.121***	0.060***
	Building > 50 Years	0.002	0.042***	0.138***	0.094***
	LOTSIZE (1,000 SF)	-0.000	0.000	-0.000	0.000
	SQFT (100s)	0.049***	0.046***	0.005***	0.037***
	SQFT (100s) SQ	-0.000***	-0.000***	-0.000***	-0.000***
B: Intervention	dist_to_intervention_sz20to100_250	0.007	0.003	-0.018**	-0.007
	dum5_c_minus_00_sz20to100_250	-0.025	0.053**	-0.028	0.066**
	dum5_c_minus_01_sz20to100_250	-0.043*	-0.080***	-0.099***	-0.114***
	dum5_c_minus_02_sz20to100_250	-0.055**	-0.055**	-0.110***	-0.053**
	dum5_c_minus_03_sz20to100_250	-0.049	-0.057*	-0.154***	-0.125***
	dum5_c_minus_04_sz20to100_250	-0.040	-0.100***	-0.099***	-0.079***
	dum5_c_minus_05_sz20to100_250	-0.205***	-0.135***	-0.312***	-0.100***
	dum5_c_plus_01_sz20to100_250	-0.057**	0.015	-0.045*	0.018
	dum5_c_plus_02_sz20to100_250	-0.098***	-0.007	-0.042*	-0.016
	dum5_c_plus_03_sz20to100_250	-0.050	-0.035	-0.039	-0.072***
	dum5_c_plus_04_sz20to100_250	-0.006	-0.042*	0.033	-0.096***
	dum5_c_plus_05_sz20to100_250	-0.004	-0.089***	-0.044	-0.089***
	interv_dum_sz20to100_250	0.007	-0.000	0.039***	-0.001
	qtrs_since_interv_sz20to100_250	-0.003*	0.000	0.002	0.007***
	sum5_construction_sz20to100_250	-0.001**	-0.001***	-0.001	-0.002**
	sum5_units_minus_01_sz20to100_250	-0.000	0.001***	-0.000	0.001
	sum5_units_minus_02_sz20to100_250	0.000	0.000	0.001	0.000
	sum5_units_minus_03_sz20to100_250	0.000	-0.000	0.001*	0.001
	sum5_units_minus_04_sz20to100_250	-0.000	0.001**	0.000	0.001**
	sum5_units_minus_05_sz20to100_250	0.002***	0.001**	0.003***	0.000
	sum5_units_plus_01_sz20to100_250	0.000	-0.000	-0.001	-0.000
	sum5_units_plus_02_sz20to100_250	0.002***	-0.000	0.000	0.000
	sum5_units_plus_03_sz20to100_250	0.001*	0.000	0.000	0.000
	sum5_units_plus_04_sz20to100_250	0.001***	0.001*	-0.000	0.000
	sum5_units_plus_05_sz20to100_250	0.000	0.002***	0.000	-0.000
C: Neighborhood	HHs Quartile 4 (100s)	0.020***	0.001	0.028***	-0.001***
	JOBSPROF (100s)	0.000***	0.000**	0.001***	0.000
	LABFORCE (100s)	-0.002***	-0.000	-0.002***	0.000
D: City	MFUNITS ($1Ms)	0.000***	0.000***	0.000***	0.000***
	OFFICE ($1Ms)	-0.000***	-0.001***	-0.000***	-0.001***
Model	Intercept	11.354***	12.201***	10.819***	11.583***
	N	19,448	10,726	135,037	89,841
	R^2	0.61	0.55	0.47	0.57

Note:
Dependent variable is log(price). Sales exclude units in buildings younger than 3 years. Interactive fixed effects `PUMA:year`, `Census Tract` not shown.
Geographic codes as follows: 75: San Francisco; 75,81,85,1: San Francisco, Santa Clara, San Mateo and Alameda Counties.
* $p < 0.1$,
** $p < 0.05$,
*** $p < 0.01$

Series C results

For the Series C results, I investigate heterogeneity in effects of developments on nearby sales by segmenting intervention projects into different price tiers: Do higher cost housing developments, relative to lower cost ones, differ in their effects such as it may be, on existing sales prices?

Apart from segmenting into price tiers, like in Series B, new developments were also binned into three size groups: 20-99; 100-199 and 200 and above. I mostly focus on the smaller size, mainly because there is much more data for this category. These results for data model reasons should be seen as more preliminary.

Unlike Series A which entered one continuous variable, I now examine the time trend three years before and after project delivery which is called `minus_00` on the charts (Figures 2.17, 2.18.) For San Francisco, the effect is relatively uneventful for tiers A and B, though for the relatively more affordable units, they appear to see a more negative price effect before project delivery, which largely recovers in the years to follow. Notably, though, the more pricey Tier A projects for most years trends *above* zero, though at a modest scale, in the half percentage point range.

Pooling the regression for the big urban counties (San Francisco, San Mateo, Alameda and Santa Clara), we similarly see Tier A having a stronger effect than the lower priced Tier C, with a notable leap in the last years of the period under study. This should not be seen as a recession effect whereby the lower tiers lost more in value (Cohen, Coughlin, Lopez, et al., 2012), as the scale is agnostic relative to chronological time, measures effects relative to the time of *sale*. From these models, the more dramatic departures from zero are in levels, with the relative change over time for each price segment quite modest. Tier C sees a little boosting effect relative to the starting point, but it is not sustained over time, and by year 3 following construction, it has all but vanished. The more apparently dramatic Tier A is ultimately less so as the early starting point lacks significance. Of these, it appears that the unknown price tier, which includes rental properties, leads to a small, but positive spillover effect on nearby properties, though the effect is difficult to interpret given the unknown nature of those developments.

Table 2.8: Model results, Series C (tier time effects). Housing prices vs interventions, using 250 meter intervention zones

	geo_str	75		75,81,85,1	
	yr_str	1988_2013	2001_2013	1988_2013	2001_2013
	modspec	tier_smdev_250	tier_smdev_250	tier_smdev_250	tier_smdev_250
vargroup	variable				
A: Property	BATHROOMS	0.010	0.016*	0.227***	0.096***
	BEDROOMS	0.018***	0.017***	0.001	0.000
	Building < 10 Years	-0.002	0.031***	-0.124***	0.062***
	Building > 50 Years	0.005	0.033***	0.128***	0.091***
	LOTSIZE (1,000 SF)	-0.000	0.000	-0.000	0.000
	SQFT (100s)	0.049***	0.046***	0.005***	0.037***
	SQFT (100s) SQ	-0.000***	-0.000***	-0.000***	-0.000***
B: Intervention	dist_to_intervention_sz20to100_150	-0.000	0.001***	-0.000***	0.001***
	interv_dum_sz20to100_150	-0.010	-0.030***	0.002	-0.032***
	launch_tier_minus_00A_sz20to100_250	0.285***	0.086	0.175*	0.146**
	launch_tier_minus_00B_sz20to100_250	0.042	0.021	0.089**	0.134***
	launch_tier_minus_00C_sz20to100_250	-0.164***	0.092	-0.081**	0.305***
	launch_tier_minus_00unk_sz20to100_250	0.019	-0.028	0.010	0.003
	launch_tier_minus_01A_sz20to100_250	0.220***	0.021	0.211***	-0.128
	launch_tier_minus_01B_sz20to100_250	-0.099***	-0.076***	-0.083*	-0.055
	launch_tier_minus_01C_sz20to100_250	-0.204***	0.100*	-0.132***	0.062
	launch_tier_minus_01unk_sz20to100_250	-0.085***	-0.059**	-0.066**	-0.055
	launch_tier_minus_02A_sz20to100_250	0.058	-0.101*	0.194***	-0.113**
	launch_tier_minus_02B_sz20to100_250	-0.012	-0.039	0.050	-0.052
	launch_tier_minus_02C_sz20to100_250	-0.201***	-0.034	-0.126***	0.025
	launch_tier_minus_02unk_sz20to100_250	-0.181***	-0.037	-0.033	0.012
	launch_tier_minus_03A_sz20to100_250	-0.266**	-0.150	-0.187	-0.158
	launch_tier_minus_03B_sz20to100_250	-0.003	0.024	-0.011	-0.061
	launch_tier_minus_03C_sz20to100_250	-0.164***	0.290	-0.165***	-0.016
	launch_tier_minus_03unk_sz20to100_250	-0.110***	-0.043	-0.068**	-0.123***
	launch_tier_minus_04A_sz20to100_250	-0.314***	-0.340***	-0.138*	-0.255***
	launch_tier_minus_04B_sz20to100_250	-0.026	-0.091**	0.060	-0.013
	launch_tier_minus_04C_sz20to100_250	-0.106***	0.022	-0.064***	-0.137***
	launch_tier_minus_04unk_sz20to100_250	-0.065	-0.158***	-0.037	-0.113***
	launch_tier_minus_05A_sz20to100_250	-0.530***	-0.438***	-0.173	-0.394***
	launch_tier_minus_05B_sz20to100_250	-0.210***	-0.224***	-0.153***	-0.174***
	launch_tier_minus_05C_sz20to100_250	-0.142**	-0.165	-0.203***	-0.266***
	launch_tier_minus_05unk_sz20to100_250	-0.154***	-0.125***	-0.197***	-0.115***
	launch_tier_plus_01A_sz20to100_250	0.142*	0.059	0.014	0.089*
	launch_tier_plus_01B_sz20to100_250	0.005	0.012	0.084***	0.045*
	launch_tier_plus_01C_sz20to100_250	-0.098***	-0.105*	-0.071**	0.080
	launch_tier_plus_01unk_sz20to100_250	-0.019	0.008	-0.013	0.005
	launch_tier_plus_02A_sz20to100_250	-0.332	-0.145	-0.230	-0.063
	launch_tier_plus_02B_sz20to100_250	0.101***	0.026	0.119***	-0.005
	launch_tier_plus_02C_sz20to100_250	-0.116***	0.078	-0.075***	-0.014

Continued on next page

vargroup	geo__str yr__str modspec variable	75 1988__2013 tier__smdev__250	 2001__2013 tier__smdev__250	75,81,85,1 1988__2013 tier__smdev__250	 2001__2013 tier__smdev__250
	launch__tier__plus__02unk__sz20to100__250	-0.021	-0.002	0.033	0.028
	launch__tier__plus__03A__sz20to100__250	0.005	0.086	0.157*	0.150**
	launch__tier__plus__03B__sz20to100__250	0.150***	-0.022	0.100***	-0.069***
	launch__tier__plus__03C__sz20to100__250	-0.282***	0.006	-0.042***	-0.168***
	launch__tier__plus__03unk__sz20to100__250	-0.033	-0.077*	0.029	-0.032
	launch__tier__plus__04A__sz20to100__250	0.191***	0.076	0.148**	0.028
	launch__tier__plus__04B__sz20to100__250	0.096***	-0.036	0.042**	-0.013
	launch__tier__plus__04C__sz20to100__250	-0.254***	-0.082**	-0.029**	-0.029**
	launch__tier__plus__04unk__sz20to100__250	0.013	-0.034	0.019	-0.000
	launch__tier__plus__05A__sz20to100__250	0.141**	0.021	0.162**	0.085
	launch__tier__plus__05B__sz20to100__250	0.110***	-0.024	0.007	0.039
	launch__tier__plus__05C__sz20to100__250	-0.251***	-0.179***	-0.049***	0.002
	launch__tier__plus__05unk__sz20to100__250	-0.100***	-0.085**	-0.069**	0.012
	qtrs__since__interv__sz20to100__150	-0.002	-0.003*	0.001	0.000
	sum5__construction__sz20to100__250	-0.001**	-0.001	-0.001*	-0.002**
	sum5__units__minus__01__sz20to100__250	0.001**	0.001**	0.000	0.001
	sum5__units__minus__02__sz20to100__250	0.002**	0.000	-0.000	-0.001
	sum5__units__minus__03__sz20to100__250	0.001	-0.001	0.000	0.001
	sum5__units__minus__04__sz20to100__250	0.000	0.002**	-0.001*	0.001**
	sum5__units__minus__05__sz20to100__250	0.003***	0.003**	0.002**	0.002***
	sum5__units__plus__01__sz20to100__250	0.000	-0.001	-0.001*	-0.001
	sum5__units__plus__02__sz20to100__250	-0.000	-0.001	-0.001*	-0.000
	sum5__units__plus__03__sz20to100__250	0.000	0.001	-0.000	0.001**
	sum5__units__plus__04__sz20to100__250	0.001*	0.001**	0.000	0.000
	sum5__units__plus__05__sz20to100__250	0.001	0.002***	0.001**	-0.000
C: Neighborhood	Amenity Index	0.004***	0.005***	0.001***	0.001**
	HHs Quartile 4 (100s)	0.019***	0.001	0.028***	-0.001***
	JOBSPROF (100s)	0.000***	0.000	0.001***	0.000
	LABFORCE (100s)	-0.002***	-0.000	-0.002***	0.000
D: City	MFUNITS ($1Ms)	0.000***	0.000***	0.000***	0.000***
	OFFICE ($1Ms)	-0.000***	-0.001***	-0.000***	-0.001***
Model	Intercept	11.042***	11.821***	10.567***	11.562***
	N	19,448	10,726	134,989	89,841
	R^2	0.62	0.55	0.48	0.57

Note:

Dependent variable is log(price). Sales exclude units in buildings younger than 3 years. Interactive fixed effects `PUMA:year`, `Census Tract` not shown.

Geographic codes as follows: 75: San Francisco; 75,81,85,1: San Francisco, Santa Clara, San Mateo and Alameda Counties.

Results for different buffer sizes are reported in the appendix.

* $p < 0.1$,

** $p < 0.05$,

*** $p < 0.01$

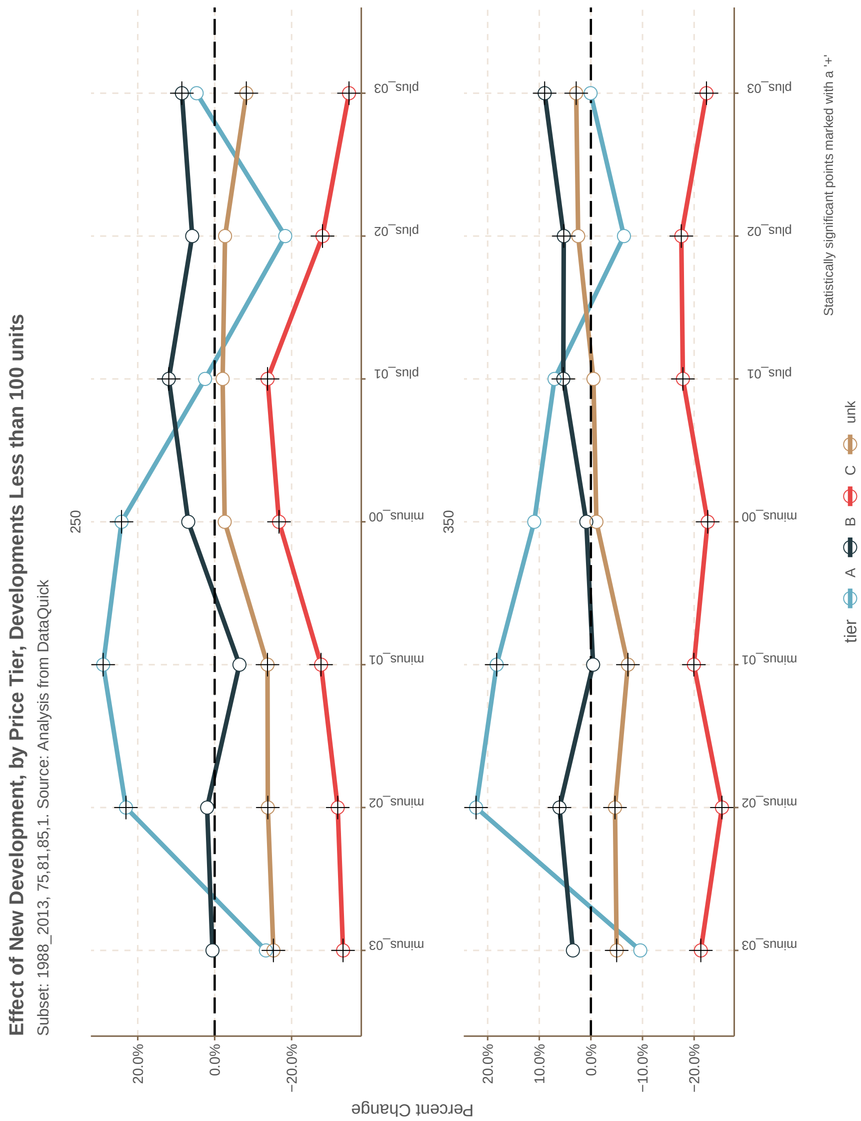


Figure 2.17: Price effect of different development tiers, San Francisco, San Mateo, Santa Clara, Alameda Counties 1988-2013 pooled transactions. Effect of different buffer distances from new development projects estimated separately (150m, 250m, 350m), shown in separate panels. Note not all points are statistically significant. Statistically significant points marked with a + glyph.

2.10 Discussion and Conclusion

This essay explored housing as a planning challenge and in particular some of the dilemmas related to housing growth: New development is indispensable for a growing region to act as a hedge against price spikes, though development is far from a sufficient condition to moderate inflation in the housing market. Over the course of the economic cycle, the region may experience considerable price increases if the demand side is sufficiently robust, including if there are changes in the economic structure changing parts of the wage and income distribution. There is in other words a strong demand

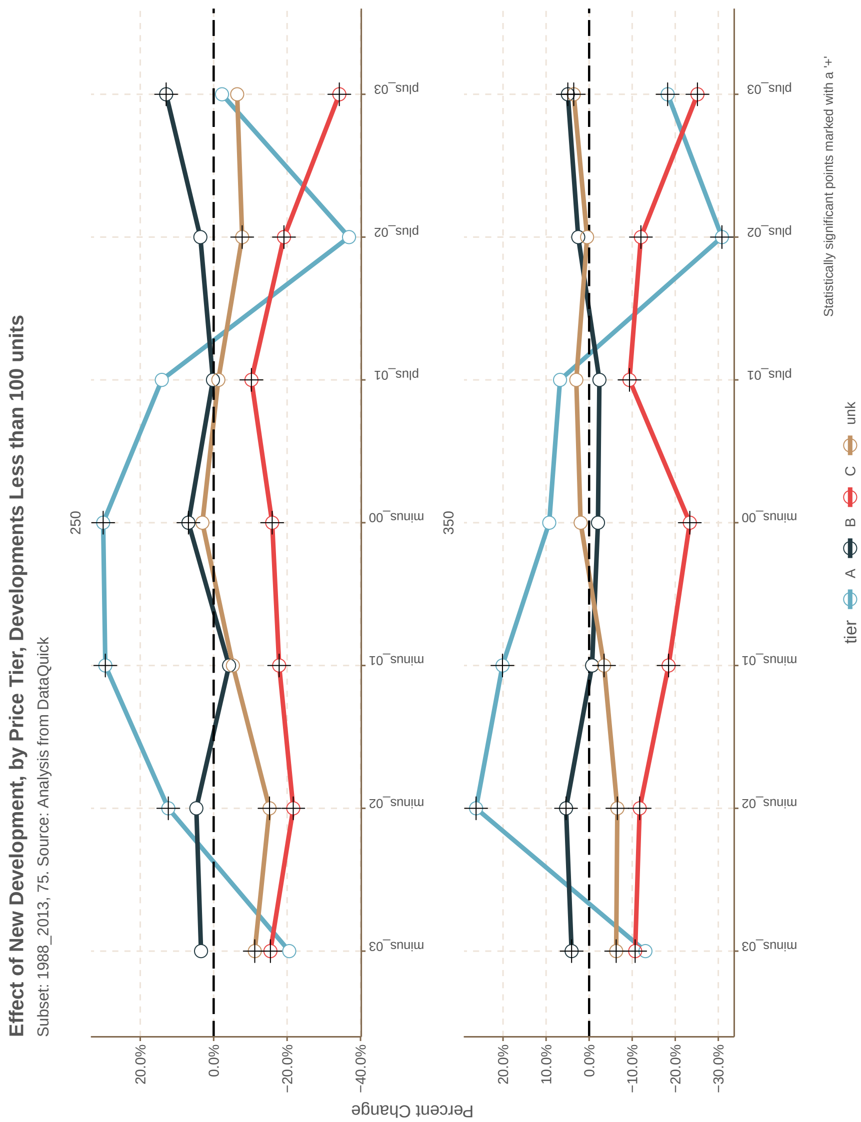


Figure 2.18: Price effect of different development tiers, San Francisco County 1990-2013 pooled transactions. Effect of different buffer distances from new development projects estimated separately (150m, 250m, 350m), shown in separate panels. Note not all points are statistically significant. Statistically significant points marked with a + glyph.

side to prices, though we also know that the more supply constrained the market is, the more elastic the price response will be.

Planners in large regions experience not the regional housing market but much more local ones, at the jurisdiction or even the neighborhood scale. At that level, the relation between what it is built and what the cost of housing is may seem much more tenuous, with readily observable higher costs due to composition and age shifts of the housing stock. This observation arguably leaves many to assume new supply is no part of the solution to high housing costs. Indeed, this seems to be the mantra for much advocacy work, noting, for example, that filtering is so slow as to be meaningless as a plank in a more general housing policy framework.

Planners and housing economists have for some time examined local spillover effects of new development on nearby prices. This study set out to investigate empirically whether spillover effects could be observed from market rate development on sales in existing neighborhoods. The question has gotten some urgency as California is in the midst of a stronger policy push towards sending more housing into existing neighborhoods in the form of infill as a way to better manage the growth of regions on the fringes as well as greenhouse gas emissions. While the U.S. literature has documented spillover effects from typically affordable housing development (Schwartz et al., 2006; Galster et al., 1999; Ellen et al., 2007), this study took a more general approach and looked at conventional market rate development. Using data for the major urban counties in the San Francisco Bay Area, I examine prices in relationship with new development hotspots. Since the composition of the new stock is newer than the existing stock, I exclude units younger than three years from consideration which as a side benefit ensures against us measuring the impact of a development on the sales of its own units.

A stylized finding was that development hotspots, characterized by a high degree of new development in the preceding five year period tended to see higher median sales prices than units in general. As this could be due to site self selection or compositional or quality differences, multivariate specifications were prepared to control for neighborhood and property specific factors.

In Series A I employed a continuous variable approach, relying on street network distance to new development, measured contemporaneously for the preceding five year period. This has the effect of smoothing boundary issues though it will be affected by prevailing development densities: Low density areas will all other things equal have fewer such hotspots than relatively higher density areas will. I regressed sales prices on a continuous measure of new development, measured as accessibility to new units built in the immediately preceding year window (2 or 5 entered). The shorter time frame tended to produce negative coefficients consistent with micro-economic theory, while the longer time frame of 5 years tended to produce positive, but small effects of new development on nearby sales prices a few years later. A plausible economic explanation for the difference could be that the shorter time frame is characterized by higher vacancies as units are absorbed, leading to more competition. A negative value could be attributable to such initial transitional effects, while the 5-year positive sign on the coefficient could be seen as the time frame in which the neighborhood is more stable; the cranes have left and new residents have settled into the neighborhood. Still, the difference in sign cautions that the choice of measurement is critical and strong interpretations ill-advised.

In Series B, I used a difference-in-differences specification relying on a GIS approach of drawing buffers around new developments, allowing us to classify a sales as either within or outside an "intervention zone" instead of the continuous network distance used in Series A. Whereas Series A captured a point-in-time effect, with Series B I sought to capture effects before and after developments, per the theory that expectations can build up beforehand, and (perhaps) dissipate after project delivery (Ooi & Le, 2013). I also sought to capture size heterogeneity, allowing parameters to vary with development size, as well as horizon distance.

We found mixed results for Series B, depending on data slice and measurement used. Looking at just whether a sale falls in the vicinity of any development project either before or after development (in a five year window) the pooled regression suggested an effect of 1.2 percent for the 20-99 unit project size group, while it was larger for the middle project size of 100-199 units at as much as 12 percent, suggesting a sales price premium in the neighborhoods where those projects are located, though this is a characterization of the neighborhood and not necessarily a consequence of a project insofar as the sale could be well before development. Conversely, looking strictly at post-build effects–where a sale takes place *after* development projects were delivered–the pooled regression revealed small *negative* effects: A sale in an area where development is located was associated with a small *dampening* effect on prices of units in existing multifamily properties (-2 percent).

Lastly, in Series C, in addition to project size, I also allowed parameters to vary with development *prices*, where I grouped new developments into contemporaneous tiers of low, middle and high terciles for developments for which initial sales prices could be determined. The difficulty of matching development projects with sales meant a considerable number had no information on which tier it was in. I classified those as `unknown`, and recovered separate parameters for that group to check for systematic variation. The `unknown` price tier development projects, which include rental units, seems to be associated with an uptick in prices, though by definition, it is difficult to interpret given the unknown nature of those properties and what the mechanisms might be.

Overall, the findings show many complexities when it comes to price effects, where issues of measurement, geographic scale, time frame of interest, have a considerable bearing on the magnitude, directionality and significance of the effect. I estimated the models on different slices of the data to explore parameter stability and included some of them here to make the point of considerable heterogeneity across geographies and time frames for the San Francisco Bay Area.

In preparing the data, a particular challenge was how to handle situations where development projects overlap. The desire to use the difference-in-difference quasi-experimental design leads to a search for simple binary zones, though in reality, such zones often constrain the data, or reality, as those zones are more multidimensional than the dummies allow. Series A took a different approach and measured accessibility to units instead of constraining the data to be in either / or terms. The study offers some support for the micro-economic view that more units can lower prices at the local level (Series A `MULTIFAM_5YR_500M`, and Series B `postdummy`) though a few coefficients for San Francisco implied a positive effect for larger developments, suggesting a variegated landscape with complicated geographic effects. Future research should look to different geographies, time scales and measurement to further probe this important question of how new supply interacts with existing neighborhoods as prices are discovered.

Policy planners need good answers on how to stabilize housing markets in regions with strong demand-side adjustments related to occupational shifts, operating much faster than the more slowly moving supply-side of urban infill housing markets. Absent such answers the complex politics of infill development will likely preclude new sufficient supply, leaving the region worse off. As supply is curbed, it will not be the well-paid software engineers paying the price. It will be residents at the opposite end of the income distribution with fewer options to afford either new housing or the ever appreciating existing stock.

2.11 Appendices

Table 2.9: Model results, Series B. Housing prices vs interventions, using 150 meter intervention zones

vargroup	geo_str yr_str modspec variable	75 1988_2013 rhs_diffindiff_150	2001_2013 rhs_diffindiff_150	75,81,85,1 1988_2013 rhs_diffindiff_150	2001_2013 rhs_diffindiff_150
A: Property	BATHROOMS	0.001	0.008	0.236***	0.097***
	BEDROOMS	0.018***	0.019***	0.000	0.000
	Building < 10 Years	-0.002	0.019*	-0.119***	0.063***
	Building > 50 Years	-0.025**	0.010	0.112***	0.066***
	LOTSIZE (1,000 SF)	-0.000	0.000	-0.000	0.000
	SQFT (100s)	0.048***	0.045***	0.004***	0.036***
	SQFT (100s) SQ	-0.000***	-0.000***	-0.000***	-0.000***
B: Accessibility	MULTIFAM_5YR_500M	0.005	-0.011***	-0.013***	-0.007***
B: Intervention	interv_dum_sz100to199_150	0.048***	-0.053***	0.112***	0.004
	interv_dum_sz20to100_150	-0.022**	-0.036***	-0.015**	-0.037***
	interv_dum_szGreaterthan200_150	-0.173***	-0.037	-0.032	0.054***
	postdummy_sz100to199_150	-0.087***	0.035	-0.021	-0.013
	postdummy_sz20to100_150	-0.030**	0.029**	-0.002	0.043***
	postdummy_szGreaterthan200_150	0.165***	-0.003	0.061*	-0.056*
C: Neighborhood	Amenity Index	0.005***	0.005***	0.002***	0.001***
	HHs Quartile 4 (100s)	0.020***	0.001	0.028***	-0.001***
	JOBSPROF (100s)	0.000***	0.000*	0.001***	0.000
	LABFORCE (100s)	-0.002***	-0.000	-0.002***	0.000
D: City	MFUNITS ($1Ms)	0.000***	0.000***	0.000***	0.000***
	OFFICE ($1Ms)	-0.000***	-0.001***	-0.000***	-0.001***
Model	Intercept	10.970***	11.802***	11.588***	11.962***
	N	19,448	10,726	135,083	89,841
	R^2	0.61	0.55	0.48	0.56

Note:
Dependent variable is log(price). Sales exclude units in buildings younger than 3 years. Interactive fixed effects PUMA:year, Census Tract not shown.
Geographic codes as follows: 75: San Francisco; 75,81,85,1: San Francisco, Santa Clara, San Mateo and Alameda Counties. PUMA:year, Census Tract not shown.
* $p < 0.1$,
** $p < 0.05$,
*** $p < 0.01$

Table 2.10: Model results, Series B. Housing prices vs interventions, using 350 meter intervention zones

vargroup	geo_str yr_str modspec variable	75 1988_2013 rhs_diffindiff_350	 2001_2013 rhs_diffindiff_350	75,81,85,1 1988_2013 rhs_diffindiff_350	 2001_2013 rhs_diffindiff_350
A: Property	BATHROOMS	0.003	0.009	0.236***	0.097***
	BEDROOMS	0.018***	0.019***	0.000	0.000
	Building < 10 Years	-0.000	0.024**	-0.118***	0.062***
	Building > 50 Years	-0.020*	0.012	0.110***	0.066***
	LOTSIZE (1,000 SF)	-0.000	0.000	-0.000	0.000
	SQFT (100s)	0.048***	0.044***	0.004***	0.036***
	SQFT (100s) SQ	-0.000***	-0.000***	-0.000***	-0.000***
B: Accessibility	MULTIFAM_5YR_500M	-0.004	-0.013***	-0.015***	-0.005**
B: Intervention	interv_dum_sz100to199_350	0.004	-0.016	0.042***	-0.003
	interv_dum_sz20to100_350	-0.053***	-0.039***	0.005	-0.003
	interv_dum_szGreaterthan200_350	-0.194***	-0.102***	0.007	0.013
	postdummy_sz100to199_350	-0.019	0.029*	0.011	0.005
	postdummy_sz20to100_350	-0.008	-0.006	-0.000	0.012
	postdummy_szGreaterthan200_350	0.224***	0.062*	0.027*	-0.051***
C: Neighborhood	Amenity Index	0.005***	0.005***	0.001***	0.001***
	HHs Quartile 4 (100s)	0.020***	0.002	0.028***	-0.001***
	JOBSPROF (100s)	0.000***	0.000	0.001***	0.000
	LABFORCE (100s)	-0.002***	-0.000	-0.002***	0.000
D: City	MFUNITS ($1Ms)	0.000***	0.000***	0.000***	0.000***
	OFFICE ($1Ms)	-0.000***	-0.001***	-0.000***	-0.001***
Model	Intercept	10.989***	11.802***	11.595***	11.964***
	N	19,448	10,726	135,083	89,841
	R^2	0.61	0.55	0.47	0.56

Note:

Dependent variable is log(price). Sales exclude units in buildings younger than 3 years. Interactive fixed effects `PUMA:year`, `Census Tract` not shown.

Geographic codes as follows: 75: San Francisco; 75,81,85,1: San Francisco, Santa Clara, San Mateo and Alameda Counties.

* $p < 0.1$,

** $p < 0.05$,

*** $p < 0.01$

Table 2.11: Model results, Series C (tier time effects). Housing prices vs interventions, using 150 meter intervention zones

	geo_str	75		75,81,85,1	
	yr_str	1988_2013	2001_2013	1988_2013	2001_2013
	modspec	tier_smdev_150	tier_smdev_150	tier_smdev_150	tier_smdev_150
vargroup	variable				
A: Property	BATHROOMS	0.008	0.014*	0.228***	0.097***
	BEDROOMS	0.018***	0.018***	0.001	0.000
	Building < 10 Years	0.003	0.027**	-0.125***	0.061***
	Building > 50 Years	-0.006	0.025**	0.123***	0.089***
	LOTSIZE (1,000 SF)	-0.000	0.000	-0.000	0.000
	SQFT (100s)	0.049***	0.046***	0.005***	0.037***
	SQFT (100s) SQ	-0.000***	-0.000***	-0.000***	-0.000***
B: Intervention	dist_to_intervention_sz20to100_150	-0.000*	0.000**	-0.001***	0.000*
	interv_dum_sz20to100_150	-0.002	-0.033***	0.013*	-0.029***
	launch_tier_minus_00A_sz20to100_150	0.218*	0.004	0.227*	-0.037
	launch_tier_minus_00B_sz20to100_150	0.000	-0.011	0.051	0.017
	launch_tier_minus_00C_sz20to100_150	-0.192***	-0.235***	-0.229***	0.092
	launch_tier_minus_00unk_sz20to100_150	-0.060	-0.042	-0.026	-0.093***
	launch_tier_minus_01A_sz20to100_150	0.019	-0.081	0.216*	-0.131
	launch_tier_minus_01B_sz20to100_150	-0.141***	-0.081**	-0.111*	-0.074
	launch_tier_minus_01C_sz20to100_150	-0.337***	0.053	-0.400***	0.056
	launch_tier_minus_01unk_sz20to100_150	-0.195***	-0.014	-0.122**	-0.095
	launch_tier_minus_02A_sz20to100_150	-0.001	-0.078	0.305***	-0.074
	launch_tier_minus_02B_sz20to100_150	-0.156***	-0.097*	-0.015	-0.081*
	launch_tier_minus_02C_sz20to100_150	-0.250***	-0.008	-0.303***	0.070
	launch_tier_minus_02unk_sz20to100_150	-0.254***	0.040	-0.054	0.006
	launch_tier_minus_03A_sz20to100_150	-0.330**	-0.066	-0.328*	-0.000
	launch_tier_minus_03B_sz20to100_150	-0.046	0.067	-0.122**	0.036
	launch_tier_minus_03C_sz20to100_150	-0.028	0.386***	-0.471***	0.035
	launch_tier_minus_03unk_sz20to100_150	-0.120*	-0.007	-0.129**	-0.055
	launch_tier_minus_04A_sz20to100_150	-0.202***	-0.059	-0.085	-0.034
	launch_tier_minus_04B_sz20to100_150	0.028	0.052	0.002	0.055
	launch_tier_minus_04C_sz20to100_150	-0.092	0.200	-0.375***	-0.087
	launch_tier_minus_04unk_sz20to100_150	0.042	-0.040	-0.132	-0.065
	launch_tier_minus_05A_sz20to100_150	-0.284***	-0.170*	0.108	0.010
	launch_tier_minus_05B_sz20to100_150	-0.221***	-0.227***	-0.169**	-0.079
	launch_tier_minus_05C_sz20to100_150	-0.175	-0.249**	-0.494***	-0.153**
	launch_tier_minus_05unk_sz20to100_150	-0.076	-0.064	-0.191***	-0.042
	launch_tier_plus_01A_sz20to100_150	0.097	0.117**	0.036	0.099*
	launch_tier_plus_01B_sz20to100_150	-0.017	0.027	0.041	0.009
	launch_tier_plus_01C_sz20to100_150	-0.158***	-0.230***	-0.212***	-0.009
	launch_tier_plus_01unk_sz20to100_150	-0.045	0.034	-0.008	-0.004
	launch_tier_plus_02A_sz20to100_150	-0.220***	0.015	-0.053	0.120*
	launch_tier_plus_02B_sz20to100_150	0.045	-0.051	0.079***	-0.074**
	launch_tier_plus_02C_sz20to100_150	-0.239***	0.023	-0.148***	-0.170**

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vargroup	geo_str / yr_str / modspec / variable	75 / 1988_2013 / tier_smdev_150	2001_2013 / tier_smdev_150	75,81,85,1 / 1988_2013 / tier_smdev_150	2001_2013 / tier_smdev_150
	launch_tier_plus_02unk_sz20to100_150	-0.081	-0.105	0.049	-0.026
	launch_tier_plus_03A_sz20to100_150	0.043	0.120	0.455***	0.236***
	launch_tier_plus_03B_sz20to100_150	0.052	-0.071**	0.142***	-0.108***
	launch_tier_plus_03C_sz20to100_150	-0.412***	-0.064	0.022	-0.202***
	launch_tier_plus_03unk_sz20to100_150	-0.005	-0.098	0.219***	-0.044
	launch_tier_plus_04A_sz20to100_150	0.245***	0.143**	0.342***	0.205***
	launch_tier_plus_04B_sz20to100_150	0.077**	-0.043	0.073***	-0.062***
	launch_tier_plus_04C_sz20to100_150	-0.261***	-0.136***	-0.040**	-0.044**
	launch_tier_plus_04unk_sz20to100_150	0.020	0.016	0.047	-0.036
	launch_tier_plus_05A_sz20to100_150	0.080	-0.048	0.156	0.134**
	launch_tier_plus_05B_sz20to100_150	0.061	-0.085***	-0.006	-0.027
	launch_tier_plus_05C_sz20to100_150	-0.341***	-0.282***	-0.058***	-0.036***
	launch_tier_plus_05unk_sz20to100_150	-0.158**	-0.203**	-0.016	-0.047
	qtrs_since_interv_sz20to100_150	-0.001	-0.001	-0.001	0.002
	sum5_construction_sz20to100_150	-0.000	0.001	0.000	0.002**
	sum5_units_minus_01_sz20to100_150	0.003***	0.001	0.001	0.000
	sum5_units_minus_02_sz20to100_150	0.003***	0.000	0.000	-0.001
	sum5_units_minus_03_sz20to100_150	0.001	-0.003*	0.002*	-0.002
	sum5_units_minus_04_sz20to100_150	-0.001	-0.002	0.000	-0.001
	sum5_units_minus_05_sz20to100_150	0.001	0.002	0.001	0.000
	sum5_units_plus_01_sz20to100_150	0.001	-0.001	0.000	-0.000
	sum5_units_plus_02_sz20to100_150	0.002**	0.002	0.001	0.002**
	sum5_units_plus_03_sz20to100_150	0.001	0.001	-0.002***	0.001
	sum5_units_plus_04_sz20to100_150	0.001*	0.000	0.001	0.000
	sum5_units_plus_05_sz20to100_150	0.002	0.003***	0.002***	0.001
C: Neighborhood	Amenity Index	0.005***	0.005***	0.001***	0.001***
	HHs Quartile 4 (100s)	0.019***	0.000	0.028***	-0.001***
	JOBSPROF (100s)	0.000***	0.000***	0.001***	0.000
	JOBSRETAIL (100s)	-0.003***	-0.002***	-0.002***	-0.001*
	LABFORCE (100s)	-0.002***	0.000	-0.002***	0.000
D: City	MFUNITS ($1Ms)	0.000***	0.000***	0.000***	0.000***
	OFFICE ($1Ms)	-0.000***	-0.001***	-0.000***	-0.001***
Model	Intercept	11.022***	11.830***	10.577***	11.560***
	N	19,448	10,726	134,989	89,841
	R^2	0.61	0.55	0.48	0.57

Note:

Dependent variable is log(price). Sales exclude units in buildings younger than 3 years. Interactive fixed effects `PUMA:year`, `Census Tract` not shown.

Geographic codes as follows: 75: San Francisco; 75,81,85,1: San Francisco, Santa Clara, San Mateo and Alameda Counties.

Intervention variables have the following naming convention: `[plus/minus]_[-5:5][tier A,B,C,unk]_[development size]_[buffer]`.

Intervention variables prefixed with `launch_tier` represent dummies; variables prefixed with `sum5` represent a sum of any intervention projects in whose buffer a sales transaction falls.

* $p < 0.1$,

** $p < 0.05$,

*** $p < 0.01$

Table 2.12: Model results, Series C (tier time effects). Housing prices vs interventions, using 350 meter intervention zones

vargroup	geo_str yr_str modspec variable	75 1988_2013 tier_smdev_350	 2001_2013 tier_smdev_350	75,81,85,1 1988_2013 tier_smdev_350	 2001_2013 tier_smdev_350
A: Property	BATHROOMS	0.014*	0.017**	0.227***	0.097***
	BEDROOMS	0.017***	0.017***	0.001	0.000
	Building < 10 Years	-0.008	0.039***	-0.122***	0.063***
	Building > 50 Years	0.010	0.037***	0.129***	0.090***
	LOTSIZE (1,000 SF)	-0.000	0.000	-0.000	0.000
	SQFT (100s)	0.049***	0.046***	0.005***	0.037***
	SQFT (100s) SQ	-0.000***	-0.000***	-0.000***	-0.000***
B: Intervention	dist_to_intervention_sz20to100_150	-0.000	0.001***	-0.001***	0.001***
	interv_dum_sz20to100_150	-0.010	-0.028***	-0.004	-0.034***
	launch_tier_minus_00A_sz20to100_350	0.090	-0.048	0.092	-0.057
	launch_tier_minus_00B_sz20to100_350	-0.035**	-0.009	0.015	0.022*
	launch_tier_minus_00C_sz20to100_350	-0.222***	-0.129***	-0.094***	0.086***
	launch_tier_minus_00unk_sz20to100_350	0.019	-0.013	-0.019*	-0.036**
	launch_tier_minus_01A_sz20to100_350	0.180***	-0.051	0.119**	-0.219***
	launch_tier_minus_01B_sz20to100_350	-0.026*	-0.040***	-0.031	-0.024**
	launch_tier_minus_01C_sz20to100_350	-0.180***	-0.061	-0.082***	0.025
	launch_tier_minus_01unk_sz20to100_350	-0.024	0.013	-0.056***	0.003
	launch_tier_minus_02A_sz20to100_350	0.214***	-0.098**	0.183***	-0.193***
	launch_tier_minus_02B_sz20to100_350	0.036**	-0.049***	0.035**	-0.062***
	launch_tier_minus_02C_sz20to100_350	-0.112***	0.020	-0.110***	-0.018
	launch_tier_minus_02unk_sz20to100_350	-0.055***	-0.045***	-0.039***	-0.003
	launch_tier_minus_03A_sz20to100_350	-0.158	-0.231**	-0.210**	-0.157*
	launch_tier_minus_03B_sz20to100_350	0.028	-0.027	0.006	-0.047***
	launch_tier_minus_03C_sz20to100_350	-0.123***	0.068	-0.076***	-0.027
	launch_tier_minus_03unk_sz20to100_350	-0.030*	-0.071***	-0.033**	-0.052**
	launch_tier_minus_04A_sz20to100_350	-0.291***	-0.286***	-0.222***	-0.290***
	launch_tier_minus_04B_sz20to100_350	-0.027*	-0.000	0.016	0.021
	launch_tier_minus_04C_sz20to100_350	-0.114***	0.026	-0.072***	-0.071*
	launch_tier_minus_04unk_sz20to100_350	-0.066***	-0.098***	-0.075***	-0.043**
	launch_tier_minus_05A_sz20to100_350	-0.334***	-0.355***	-0.159	-0.206***
	launch_tier_minus_05B_sz20to100_350	-0.089***	-0.113***	-0.043**	-0.099***
	launch_tier_minus_05C_sz20to100_350	0.102**	0.051	-0.064***	-0.156***
	launch_tier_minus_05unk_sz20to100_350	-0.108***	-0.054**	-0.064***	0.025
	launch_tier_plus_01A_sz20to100_350	0.078	-0.062	0.053	-0.072*
	launch_tier_plus_01B_sz20to100_350	-0.019	-0.003	0.051***	0.023*
	launch_tier_plus_01C_sz20to100_350	-0.099***	-0.106***	-0.059***	-0.031
	launch_tier_plus_01unk_sz20to100_350	0.027**	-0.016	-0.019*	-0.018
	launch_tier_plus_02A_sz20to100_350	-0.311***	-0.216	-0.201*	-0.061
	launch_tier_plus_02B_sz20to100_350	0.041**	-0.024	0.058***	-0.017
	launch_tier_plus_02C_sz20to100_350	-0.098***	-0.072*	-0.060***	-0.044*

Continued on next page

vargroup	geo_str yr_str modspec variable	75 1988_2013 tier_smdev_350	 2001_2013 tier_smdev_350	75,81,85,1 1988_2013 tier_smdev_350	 2001_2013 tier_smdev_350
	launch_tier_plus_02unk_sz20to100_350	0.004	-0.038**	0.023**	0.014
	launch_tier_plus_03A_sz20to100_350	-0.184***	0.024	-0.073	0.087*
	launch_tier_plus_03B_sz20to100_350	0.070***	-0.015	0.054***	-0.042***
	launch_tier_plus_03C_sz20to100_350	-0.234***	-0.045	-0.054***	-0.104***
	launch_tier_plus_03unk_sz20to100_350	0.025*	-0.030*	0.033***	-0.007
	launch_tier_plus_04A_sz20to100_350	-0.009	0.015	0.007	0.011
	launch_tier_plus_04B_sz20to100_350	0.066***	-0.005	0.045***	-0.018
	launch_tier_plus_04C_sz20to100_350	-0.197***	-0.093***	-0.036***	-0.036***
	launch_tier_plus_04unk_sz20to100_350	0.047***	-0.007	0.037***	0.000
	launch_tier_plus_05A_sz20to100_350	0.031	0.013	0.014	-0.006
	launch_tier_plus_05B_sz20to100_350	0.100***	0.024*	0.039***	0.007
	launch_tier_plus_05C_sz20to100_350	-0.227***	-0.120***	-0.029***	-0.002
	launch_tier_plus_05unk_sz20to100_350	-0.045***	-0.032	-0.016	-0.011
	qtrs_since_interv_sz20to100_150	-0.001	-0.002	0.002*	0.000
C: Neighborhood	Amenity Index	0.004***	0.005***	0.001***	0.001**
	HHs Quartile 4 (100s)	0.019***	0.001	0.028***	-0.001***
	JOBSPROF (100s)	0.000	0.000	0.001***	0.000
	LABFORCE (100s)	-0.002***	-0.000	-0.002***	0.000
D: City	MFUNITS ($1Ms)	0.000***	0.000***	0.000***	0.000***
	OFFICE ($1Ms)	-0.000***	-0.001***	-0.000***	-0.001***
Model	Intercept	11.023***	11.825***	10.560***	11.560***
	N	19,448	10,726	134,989	89,841
	R^2	0.62	0.56	0.48	0.57

Note:
Dependent variable is log(price). Sales exclude units in buildings younger than 3 years. Interactive fixed effects `PUMA:year`, `Census Tract` not shown.
Geographic codes as follows: 75: San Francisco; 75,81,85,1: San Francisco, Santa Clara, San Mateo and Alameda Counties.
* $p < 0.1$,
** $p < 0.05$,
*** $p < 0.01$

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Essay 3

Examining the Transition to HUD Small Area Fair Market Rents Using Craigslist Data

3.1 Introduction

In a report to Congress in 2017, the U.S. Department of Housing and Urban Development (HUD) quantified the scarcity of affordable rental housing, noting that, "[n]ationwide, only 66 affordable units exist for every 100 extremely low-income renters" (Watson, Steffen, Martin, & Vandenbroucke, 2017). The situation is not improving. Renters have faced a faster increase in rents relative to incomes, with 4 out of 10 renters paying rents that used to be within the bounds of what was within the top quartile in 2000, per Myers and Park's (2019) "constant quartile approach." If affordability was status quo, that number should be 2.5 of 10 renters instead of 4. In coastal markets, affordability challenges are even more pronounced, with affordability having deteriorated considerably since 2000 (Myers & Park, 2019).

While it is true that many markets could be substantially helped by an increase in the supply of affordable housing, how the *existing* stock is managed and available to different income groups, including through federal programs such as the HUD's Housing Choice Voucher (HCV) program, remains critical to low-income families throughout the country.

HUD has long provided a lifeline to millions of low-income renter households, subsidizing their housing each year. While the department has a range of programs supporting the poorest Americans, the largest by far in terms of outlays, is the HCV program (McClure, Schwartz, & Taghavi, 2014). The HCV program, administered by HUD, supports over 2.2 million households, or about 4.5 percent of all rental households, each receiving rental subsidies ensuring that their rent does not exceed 30 percent of their income. Forty percent of HCV holders are female-headed households with children (U.S. Department of Housing and Urban Development, 2019). The program has undergone changes in funding and scope since its inception in the Housing and Community Development Act of 1974, yet it remains a key pillar of today's tenant-focused (as opposed to project-focused) federal housing policy.

One of the determinants for access to users of the voucher program is a key regulatory feature of the program's implementation: the scales and geographies of Fair Market Rents (FMRs), which are the HUD-provided metropolitan-scale maps denoting what a unit would rent for in a fair market transaction in a given FMR area. By definition, FMRs are set at the 40th percentile of rents for units of different bedroom counts, meaning about 4 out of 10 units should be nominally available to voucher holders. Two challenges have long been associated with the program.

First, there is the issue of whether sufficient numbers of units are available to voucher holders in different markets. If a much smaller sliver than the 40th percentile would be available, it would create more competition and limit options for program participants (as well as to low-income households in general). Second, and relatedly, a limited stock typically translates to a limited geography, with households more prone to concentration in high-poverty, high-segregation neighborhoods.

Both factors—scarcity and concentration in high-poverty areas—have been demonstrated empirically over the years by HUD and others. As a way to address both, HUD recently transitioned a small number of areas to Small Area Fair Market Rents (SAFMRs), a much finer-grained estimate of rents. SAFMRs allow subsidies to be higher in more expensive areas, while conversely reducing them in more affordable ones. This could open access to new markets for many low-income Americans. The Final Rule on establishing SAFMRs was issued in the second half of 2016, requiring implementation for 24 HUD-defined metropolitan areas. HUD has issued interim and final reports on six pilot study areas, with early implementation of the shift from FMRs to SAFMRs. While interim and final evaluation reports suggest promising outcomes in terms of offering more units in higher opportunity neighborhoods, assessments including larger geographies have yet to be done.

This study relies on a recent national sample of rental data scraped from Craigslist, a listing website, to provide early insights into HUD's transition to SAFMRs. The rental listings are geocoded and can thus be classified by both the old "large area" FMRs as well as by the new SAFMRs, allowing us to identify transitions—listings that were too expensive in the old classification but fall below SAFMRs per the new schema. Although in many high-cost markets, the existing FMR system means many neighborhoods are de facto rental deserts, with few rental listings available below applicable FMRs, the situation is much improved with SAFMRs. I discuss limitations with the analysis as well as offer suggestions for the program.

We start the article with a review on the background of the FMR program, highlighting key challenges, from concentration to measurement issues. I motivate the study in the context of data limitations and the value in triangulating with an independent source. I then describe the data and report on findings for the United States as a whole and for the 24 mandatory areas under the SAFMR final rule ("Rule Areas"). I suggest other areas that could be added and then discuss the findings.

3.2 Background: HUD's Housing Choice Voucher Program in Brief

The HCV program, also known as the Section 8 program, helps households afford housing in the private market by topping off the rent they are able to pay (set at 30 percent of their income), up to the going market rate for a standard quality unit.

The program hinges on annually published FMRs for each of about 2,600 metropolitan and non-metropolitan areas nationwide, determining the typical cost of a non-luxury unit. Local public housing authorities (PHAs), in turn, use FMRs to set the payment standard for how much a unit should rent for and, accordingly, what the size of the subsidy should be for individual voucher holders at lease-up. The tenant pays 30 percent of their income, and the program pays the difference up to the lesser of the gross rent for the unit or the payment standard amount set by the PHA.

The voucher program is not an *entitlement* where every eligible family receives a voucher but a benefit subject to waiting lists for vouchers to become available. Implementation details of the program, such as how FMRs are determined, have a big bearing on how many households can be supported and where those households will end up living *within* regions. As an example, potential voucher tenants accessing the Berkeley Housing Authority's website during the spring of 2019 would find the waiting list closed; it was last open for 5 days during the summer of 2010 and some 37,000 people applied for a spot there (Berkeley Housing Authority, 2019). Nationally, an eligible family that has secured a spot on the waiting list will wait an average of 2.5 years for a voucher (Watson et al., 2017). Some markets see much longer waiting times; for example, in 2017, Santa Cruz reported a waiting period of 8 years (Panetta, 2017). An unfortunate lack of centralized data on waiting lists compiled from individual PHAs precludes systematic analysis of the predictors of waiting list length. For many, the program is all but off-limits and not a predictably reliable plank on which to build a family's housing career.

In addition to being consequential for individuals, implementation details matter to the overall fiscal health of the local PHAs managing the programs for HUD. If FMRs are set too low, underestimating the "true" cost of rentals, many households won't be able to secure a lease as they cannot compete with non-subsidized renters; that would negatively affect the program's "success rate," which hovers in the mid-30s in percentage terms in a large national assessment (Finkel & Buron, 2001). To the extent that the payment standard is set too low in some FMR areas with scarce affordable housing stock, those markets may, from the vantage point of low-income renters and voucher holders, effectively function as rental deserts. In rental deserts, expansive and expensive housing searches are conducted, with considerable difficulties securing leases, particularly in neighborhoods offering opportunities. This scarcity is exacerbated by low turnover, loss of landlords to the HCV program, as well as gentrification of typically amenity-rich, centrally located areas historically affordable to low-income individuals (Hwang & Lin, 2016; Somerville & Holmes, 2001).

Conversely, if rents are set too high with higher FMR levels, landlords may absorb the higher rents payable rather than provide more housing service, getting more money from the federal government in the process (Collinson & Ganong, 2018). This would deplete funds and could ultimately make fewer vouchers available for families in that area. Many local PHAs from high-cost areas watch, not surprisingly, with great interest as rents are published ahead of each fiscal year (FY), writing comment letters challenging local FMR determinations, using pointed language such as "unfathomable" to describe the published rents (Fredericks & Havlicek, 2017).

Well-Known Voucher Program Challenges

Metro-Level Rents Ignore Submarkets

High-cost areas with rapid rent increases, with all other things equal, have a harder time getting FMRs to catch up with local markets, but geography matters, too. The larger the region, the more internal variation of rental rates from one neighborhood to the next. This variation is attributable to a range of factors related to accessibility to jobs, open space, and other amenities, as has long been well documented by the hedonic housing price literature (Bayer, McMillan, Murphy, & Timmins, 2016; G.-J. Knaap, 1998; Rosen, 1974). FMR areas as regions in their own right, typically have a number of relatively distinct housing submarkets, each with their own characteristics and cost structures (Bourassa et al., 1999). While PHAs can set payment standards from 90 to 110 percent of FMRs, many FMR areas exhibit a much larger variation in rental costs between submarkets. Having uniform FMRs for such areas means that the voucher subsidy will be the same in the most expensive areas as in the most affordable parts of the FMR area. This effectively limits the geography of *where* the vouchers will likely be used, increasing the likelihood that lease-ups will be in the least desirable parts of the region. This is in contrast with program objectives of poverty deconcentration, while certainly flying in the face of the key premise of the program: that households be given a meaningful choice of housing options.

Deconcentration

Deconcentration has long been recognized as an important objective of the affordable housing programs,[1] due to poor outcomes on a range of development indicators from growing up in high-poverty, segregated neighborhoods. While there was little doubt that living in concentrated poverty was not beneficial, the record on dispersal programs had long been less than convincing (Goetz & Chapple, 2010). HUD's own Moving to Opportunity (MTO) for Fair Housing demonstration program has provided important experimental data underlying the policy importance of neighborhood quality, even if the mechanisms may not be fully understood. Leveraging these longitudinal data, Chetty and collaborators (2015), in a set of groundbreaking studies, have provided new insights from the MTO program data linked to administrative records. They convincingly demonstrated the long-term, positive effects of moving away from poverty-stricken neighborhoods before children reach adolescence, profoundly influencing individual life trajectories (Chetty et al., 2015). Whether the key policy implication of MTO is to address the root causes of poverty, fix the social fabric of existing neighborhoods, or encourage moving residents, concentration in high-poverty neighborhoods remains a reality for many voucher holders.

[1] "Fair Housing Act of 1968." 1968. 42 U.S.C. 3601.

More than 20 years ago, Newman and Schnare (1997) found that, by giving tenants choices not present with a policy based on place-bound, project-based assistance, the voucher programs appeared to do little to help improve neighborhood quality of residents, although the voucher program appeared to "reduce the probability that families will live in the most economically and socially distressed areas." Almost twenty years later, McClure and Johnson (2015) revisited Newman and Schnare's (1997) work, noting some success in terms of moving more households into low-poverty, less distressed areas—including suburbs—though still finding much room for improvement on racial integration and other factors.

A considerable amount of research, including research from HUD, has documented this very challenge of deconcentration of voucher holders away from the most impoverished neighborhoods. A number of studies have assessed particular markets with respect to the deconcentration goals motivating the program (Briggs, Comey, & Weismann, 2010, 2010; McClure, 2008; McClure et al., 2014; Varady, Wang, Wang, & Duhaney, 2010). Section 8 households are concentrated in relatively high-poverty neighborhoods (Wang & Varady, 2005). McClure and colleagues 2015 found that one in five voucher households situate in low-poverty neighborhoods, although voucher holders were a small share of the housing stock and are not particularly spatially concentrated. Pendall (2000)documented an association between high rates of poverty and the concentration of voucher holders in neighborhoods of distress. Higher vacancy rates, however, were found to increase the ability of households to move to areas of higher opportunity (Galvez, 2010), a finding consistent with the concerns raised by commenters on HUD's Proposed Rule on SAFMRs: That the program would be less successful at providing deconcentrating in markets with very low vacancy rates (U.S. Department of Housing and Urban Development, 2016a).

Why are Voucher Holders Persistently Concentrated?

Lack of deconcentration is thought to be due in no small part to the payment standard being too low for program design reasons. With the payment standard uniformly set for a metropolitan area, higher cost areas will automatically be off-limits. Recent supporting evidence comes from Wang's analysis of survey data from Florida, which show a marked difference between voucher holder stated preferences for safe and clean neighborhoods with good schools and the neighborhoods they could *actually* afford (Wang, 2018).

The assumption is that concentration has persisted for financial reasons, with payment standards set such that good neighborhoods were off-limits, although other plausible reasons have been identified.

Landlords may not actually lease to voucher holders, as was recently reported by both the *Los Angeles Times* and Pew Research (Khouri, 2019; Wiltz, 2018). In a landmark study of landlord behavior, particularly whether would-be voucher holders would be treated differently than other prospective tenants, researchers found the housing search process fraught with denials of voucher holders in more than 75 percent of cases in some markets (Cunningham et al., 2018). This is a longer standing challenge, having accompanied the program perhaps since its inception (Tighe, Hatch, & Mead, 2017). Building trust and long-term relationships with landlords is accordingly critical to overall program success (Varady, Jaroscak, & Kleinhans, 2016). Many landlords are leaving the program, however, representing an erosion of long-term relationships with PHAs.[2]

[2]Contra Costa County, for example, reported a drop of 631 landlords in recent years as they could lease to non-HCV renters (Villareal, 2016).

The program may fail to further deconcentration objectives for a number of reasons not necessarily directly related to the program itself, such as lack of social networks in higher opportunity neighborhoods or limited transportation options (McClure, 2008; Ruel, Oakley, Ward, Alston, & Reid, 2013).

Further, beyond payment standards, counseling appears to be an important factor for families to successfully secure housing in low-poverty neighborhoods (Turner & Briggs, 2008). Voucher holders generally have 60 days to search, select, and secure a lease after voucher assignment. Whether it is search difficulties, preferences, or discrimination, it follows that not all searches will be successfully turned into a lease, even if the listing price is technically within reach, or leases may not lead to the most promising neighborhoods given the typically higher cost they command (Shroder, 2002). In 2001, in a nationally comprehensive study, researchers found that the "success rate," or the rate of success of securing a lease for voucher families, was just 37 percent (Finkel & Buron, 2001).

A more structural reason for lack of deconcentration success is that demand-side programs such as vouchers are unable to address a key underlying reason for high housing costs in many areas, such as limited supply and low vacancies. In particular, as many high-cost markets are supply constrained, vouchers are of less use in those areas.

HUD, however, has long focused on addressing this programmatic challenge. Already in 2000, the agency issued an interim rule stipulating both that (1) some areas could base FMRs on 50th percentile levels, departing from the typical 40th percentile standard, and (2) that PHAs would have more flexibility in diverging from the areawide rent ceiling, allowing them to set the voucher "payment standard" to between 90 and 110 percent of the published FMR for each unit size (U.S. Department of Housing and Urban Development, 2000). This devolution of authority to the local level could mean PHAs could be much more responsive to local conditions and knowledge. Ultimately though, HUD assessed that the 50th percentile approach failed to sufficiently reduce the concentration of voucher holders in high-poverty areas.

Toward Small Area Fair Marke Rents

As the 50th percentile approach failed to sufficiently deconcentrate voucher holders, the most recent evolution involves adjustments to the geography of the FMRs. In tandem with yearly small-area data from the American Community Survey (ACS) that started to be available in 2011, HUD issued a notice that it would begin a pilot demonstration project for a small number of PHAs to use a new methodology of ZIP Code-based FMR areas, called SAFMRs (HUD, 2010).[3]

By shifting to ZIP Codes instead of metropolitan statistical areas (MSAs), rents would be able to track submarkets better, instead of treating housing markets as wholly uniform within an FMR area (U.S. Department of Housing and Urban Development, 2016a). The premise of geographically rescaling FMRs to the much smaller ZIP Code tabulation area geographies is to allow voucher payments

[3] The SAFMR demonstration consisted of five PHAs: The Housing Authority of the County of Cook (Illinois), the City of Long Beach (California) Housing Authority, the Chattanooga (Tennessee) Housing Authority, the Town of Mamaroneck (New York) Housing Authority, and the Housing Authority of Laredo (Texas). In addition, the evaluation of the demonstration study included two PHAs from the Dallas, Texas metropolitan area, the Housing Authority of the City of Dallas and the Housing Authority of Plano, which have both been using SAFMRs since 2011 as the result of a legal settlement.

to track actual rents much closer than the one-size-fits-all per the FMRs, meaning a much more variable payment standard within each FMR area. With the more nimble SAFMRs, households would therefore, in principle, be better able to locate in relatively higher opportunity areas, which typically are more expensive, than what they would have been able to with existing policy under prevailing FMRs. At the same time, the SAFMRs would also, "prevent[ing] undue subsidy in lower-rent areas (U.S. Department of Housing and Urban Development, 2010). Where the 2000 Interim Rule also increased the FMR ceiling for MSAs to the 50th percentile rent, the difference is the finer geographic scale. An areawide increase in allowable rents did little to combat the locating of voucher holders in areas of concentrated poverty and economic and racial segregation, while likely subsidizing landlords offering substandard units. In practical terms, whereas there are around 625 unique metropolitan area-based FMRs, the number of SAFMRs is almost 25,000, a forty-fold increase in geographic resolution, which is substantially better able to track real estate submarkets than the metro-wide delineations they may replace.

To test the effect of migrating to smaller-scale FMR areas as a way to better enable voucher holders to reside near jobs, transportation, and educational opportunities, five PHAs with different demographic and economic characteristics agreed to participate in the SAFMR demonstration in 2012 (Finkel et al., 2017). The demonstration project would test key outcomes for a handful of PHAs before rolling out the program as a replacement to the 50th percentile FMR areas.

Expectations and Early Assessments

By 2017, an Interim Report on the pilot areas was issued, demonstrating that this was indeed the case; that by re-carving metropolitan area geographies into ZIP Code-level specificity, the distribution of rental units tended to shift to relatively more expensive areas, often doubling as areas of higher opportunity (Finkel et al., 2017). The study also noted, however, an overall decline in units affordable to voucher holders in those areas.[4]

[4]The opportunity index constructed for this study includes percent non-poor, school proficiency, job proximity, and environmental quality.

Still, based on those findings, HUD issued a final rule that SAFMRs would become active in 24 named FMR Areas ("24 Rule Areas"), generally higher cost FMR areas, or areas with a high concentration of voucher holders in poverty (U.S. Department of Housing and Urban Development, 2016a). After pushback from stakeholders and some PHAs, HUD announced a delay in the implementation of SAFMRs for the 24 Rule Areas to FY 2020, citing the desire to complete the full pilot study and more fully analyze potential downsides of the transition (U.S. Department of Housing and Urban Development, 2017). A legal challenge was filed by two voucher holders and a nonprofit organization devoted to providing housing opportunities for low-income people in Connecticut, with the District of Columbia Circuit Court enjoining HUD to continue with the SAFMR as HUD had not made the proper procedural findings necessary for a delay.[5] As SAFMRs were officially rolled out in 2018, an early assessment came from the New York University (NYU) Furman Center. They expanded HUD's Interim Report analysis of the pilot SAFMRs demonstration to the 24 FMR areas mandated to use SAFMRs under the 2016 SAFMR Final Rule (NYU Furman Center, 2018). They analyzed the introduction of SAFMRs in these 24 Rule Areas, using ACS data tabulated for HUD on rental units and their rent distribution at the Zip Code Tabulation Area (ZCTA) level, and found that switching to SAFMRs *furthered* housing options in higher-rent ZIP Codes while *reducing* them in lower-rent ZIP Codes, which was consistent with program purposes. Somewhat in contrast with the pilot, their analysis also found that, in total, the number of units affordable to voucher tenants would increase with the use of SAFMRs when looking at the 24 Rule Areas as a whole (NYU Furman Center, 2018).

[5] *Open Communities Alliance Et Al v. Carson Et Al, Civil Action No. 17-2192 (BAH).* 2017. Washington, D.C.

Palm (2018), in an assessment of the program using non-census rental data from Rent Jungle, a web listing aggregator, analyzed rents from two time periods in five FMR areas and similarly found that the switch to SAFMRs would positively influence availability of units in higher opportunity neighborhoods; that finding stresses the importance of the geographic scale of the program. He further found different trajectories in different areas. Sacramento, for example, would benefit from inclusion in the SAFMR program as the switch would mean a substantial increase in listings affordable in low-poverty neighborhoods, without an offsetting "cataclysmic loss" of listings in higher poverty areas. Overall, the assessments of the switch so far are encouraging, though issues of measurement will remain a challenge.

Key Measurement Challenges and Motivation

A difficulty in assessing FMRs comes from the data used to calculate FMRs in the first place; ACS data. While nationally comprehensive, the data are collected by an ongoing survey throughout the year with 1-year data released for larger geographies (areas representing more than 63,000 persons). For all its wonders as a timely, repeated, and comprehensive data resource for researchers, a sample-based survey such as ACS presents unique analytical and programmatic challenges when using it for program development and, in particular driving regulatory geographies of FMRs. HUD, in 2018, indeed noted that "[i]n general, it is difficult to measure the accuracy of FMRs for the simple reason that no single, widely accepted measure of gross rents exists to use as a benchmark to compare with the FMRs" (U.S. Department of Housing and Urban Development, 2018). While it is instructive to assess unit availability below FMRs using the special tabulations of the inventory of rental units by rent at the level of ZCTAs provided by HUD, by definition, availability largely follows FMRs quite closely as program and evaluation is defined using the same source. Many PHAs, in their comments on annual releases of FMRs, indeed note the challenges related to using ACS data, the lags it necessarily entails, and the challenge of tracking fast-moving markets with higher than average increases in prices not captured by the current usage of national trend factors.

> "In 2013 and 2015 the eight PHAs in the [Oakland-Hayward-Berkeley, CA] Metro Division paid for and conducted a statistically valid rental survey in order to refute proposed FMRs that either were drastically low given our rental market or reduced from the previous year. In both 2013 and 2015, the FMRs were significantly increased as a result of the study data (approximately 16 percent in 2013 and approximately 34 percent in 2015), thus demonstrating the inadequacy of HUD's FMR methodology" (Villareal, 2016).

While SAFMRs represent a clear conceptual and policy-wise great leap forward recognizing the significant intra-regional housing market heterogeneity, questions of measurement will nonetheless continue to be an issue. The core challenge, only made more acute when going to the smaller ZCTA level, is intrinsically related to capturing at relatively fine spatiotemporal detail the behavior of the rental housing market with a survey with a *locally* modest sample size, coupled with the requirement for both spatially and temporally detailed data on rents for different unit sizes. The need for timely data requires further subsetting to recent movers to capture recent inflation, further limiting the sample. HUD's guidelines are such that estimates with a margin of error ratio larger than 50 percent are not to be used for calculating base rents and recent move factors. This means a wide band around a point estimate would be acceptable, and necessary (U.S. Department of Housing and Urban Development, 2015). HUD caps possible year-over-year decreases to 10 percent, effectively smoothing the effect of such measurement volatility (U.S. Department of Housing and Urban Development, 2015).

Apart from sampling error, there is the challenge of using a survey that is not ideally suited as a housing survey. Some commenters on annual FMR notices in the Federal Register have noted, in connection with the requirement that HUD exclude subsidized households from the ACS rental data, the difficulty of properly identifying and discarding them; however, HUD handles that by truncating the bottom of the rental distribution using administrative data on assisted housing rents before calculating the 40th percentile. Similarly, some major cities, typically in expensive coastal markets, have rent control, which could serve to downward bias FMRs in exactly the costliest markets. In sum, inasmuch as these factors affect FMR levels, having external data to compare against FMR levels is critical, highlighting the value of separating training and validation data for FMRs.

Such assessments with ACS-independent data are rare, however, mainly because few nationally comprehensive datasets exist on rental markets. While there is a strong data infrastructure associated with home sales in the form of recorded transactions, rents leave far fewer traces to track them effectively and across geographies. It is typical for vendors to exist in particular markets. While the localized nature of rental information makes generalized, consistently measured assessments difficult, it by the same token makes it hard to do larger scale accounting of the housing program. Assessments have accordingly typically focused on individual areas due to data limitations. Holding some promise, but nonetheless representing the problem of aggregation, as well as of fair use, the increase in the number of web platforms has given rise to big data collection efforts; that potentially offers insights into a range of domains, including rental markets, if the data are available to harvest and prove to be reliable.

A few researchers have relied on such big datasets to answer questions related to housing markets and FMRs, offering a triangulation independent of ACS data. Boeing and Waddell (2017) used Craigslist to assess FMRs nationally in a demonstration project of using big data to address substantive social science research questions, while at the same time comparing the rental data to federal sources. While they found 37 percent of listings to be below FMR levels, close to the 40th percentile defining the program, they found many variations between metropolitan areas, with costlier FMR areas falling in the single digits. More recently, Palm (2018) provided preliminary evidence that suggested the transition to SAFMRs would overall lead to more units in higher opportunity areas. While Boeing and Waddell analyzed listings relative to FMRs, this study extends the work by reporting on the transition from FMRs to SAFMRs. This article expands the conversation and provides more detail on the potential for the program to move households into higher opportunity neighborhoods with the transition to a more fine-grained regulatory geography.

3.3 The Current Study

What will Small Area Fair Market Rents mean for would-be voucher holders across the 24 Rule Areas? This study explores differences in rental listing availability using a national dataset following the introduction of SAFMRs in the 24 Rule Areas. While there are only 24 areas that were mandated to use SAFMRs under the final rule, I expand the comparative analysis to include all areas for which SAFMRs are published, to cast a wider net on the effect of this type of geographical-regulatory reclassification, including to assess which non-rule areas would be well suited for using SAFMRs.

To gauge the availability of units at the relevant price point, this study relies on data scraped from Craigslist, a rental listings site, to characterize the voucher program. Using alternate sources of data to illuminate large scale urban phenomena is part of a wider emergence of "urban analytics" (Goodspeed, 2017). These alternatives rely on an array—often implied to be "bigger" and more "real time"—of sources of data and are often of a volunteered nature from "citizen sensors," with questions as to both motivation and accuracy (Goodchild, 2007). In the case of data from Craigslist, listings are provided for business reasons by owners of units or companies managing units on an owner's behalf.

Description of Dataset

The national sample[6] covers the first 6.5 months of the federal FY 2019, beginning October 1, 2018. I note that using data covering the first half of the fiscal year should all other things equal, means a better match with the FMRs as it will cover the period least affected by inflation over the course of the year.[7]

While there are issues of accuracy and duplication, perhaps the most salient issue is that of coverage, since not all listings end up on Craigslist. As a non-research volunteered geographic information dataset, there is no standard for inclusion, no published benchmarks of market saturation and share, and coverage will vary over time and region, with usefulness needing to be determined on a case-by-case basis. Using data from a non-scientific sample, or in our case a form of "volunteered geographic information" (VGI) data, raises additional challenges, as the extensive quality control measures associated with the federal statistical infrastructure are entirely absent; the data generating process is not a neatly curated, purpose-driven sample, but rather one from data "in the wild." The data are an artifact from the rental listing process; digital ephemera not meant to leave a footprint; and are in many ways the equivalent of looking at historical yellow page listings. To clean these, I went through a process similar to that described in Boeing and Waddell (2017), dropping formal duplicates (landlords reposting the same listing days later to generate more views). I similarly limited records to ones with valid geocoding. I filtered outliers using percentiles as well, but instead of defining outliers relative to the national distribution, I calculated outliers separately for each

[6] The listing data is scraped from Craigslist by UC Berkeley researchers using the Python-based Scrapy library. See Boeing and Waddell (2017) for details.

[7] The listing data have not been adjusted for inflation or seasonality, nor would it be appropriate to do so: the rents such as they are, over the course of a year, will be what is compared with the payment standard over the course of the year.

county to more closely reflect the norm for local markets.

To assess the dataset, I compared listings in the sample with the latest 1-year ACS release for 2017 at the core-based statistical area (CBSA) level for two pieces of information:

- Do the data roughly correspond to counts of recent mover households?
- Do the listing rents approximate those reported by ACS?

Listings and moves are distinctive conceptual worlds: Some people move more than once per year, but this is not captured by the ACS survey, asking "Where did this person live 1 year ago?" By the same token, the same unit may be listed more than once and appear more than once in the sample legitimately without being a duplicate. We would accordingly expect a larger number of listings than movers *if* the rental data represented the entire universe of listings, which of course they do not. Another difference is that listings may be akin to asking prices, and a lease may ultimately be signed with a rent below or even above the advertised price, depending on the conditions of local markets.

In the aggregate, I found sufficient alignment in the two datasets to suggest reasonable accuracy. I found, first, a strong correlation (R^2: 0.84) between Craigslist listings and recent movers per ACS, and second, a strong correlation (R^2: 0.86) between median rents, both measured at the CBSA level. While these correlations were both strong, there were outliers particularly in the relationship between listings and moves. I mark a number of those on Figure 3.1 and note that New York falls substantially below the regression line, having far fewer listings than the norm. New York's rental market is heavily dominated by brokers, with accordingly a lower utilization of services such as Craigslist (Boeing & Waddell, 2017). On the other hand, the Los Angeles area has more listings than expected, as do MSAs around Seattle; Washington, DC; Denver; San Francisco; and Portland, to name the larger ones. Those housing markets could either see above average relocation activity, or those areas could be more prone to duplicates not caught by the heuristic approach sketched.

Geographical duplication was widespread in the dataset. The scraped data comes with the listing ID assigned internally for tracking purposes by Craigslist. This ID will appear repeatedly if users resubmit the same listing days or weeks later to appear as a more current listing. These formal duplicates are removed. A more subtle class of duplicates involve new listings beyond resubmitting an earlier listing. In this case, in substance, the same unit is offered through several listings each with different IDs making them appear distinct. Depending on the market, this may take place over the course of several months as landlords may wait for a tenant to take the offered price, even on occasion lowering the rent to entice. I filter these by assuming that units on the same location (lati-

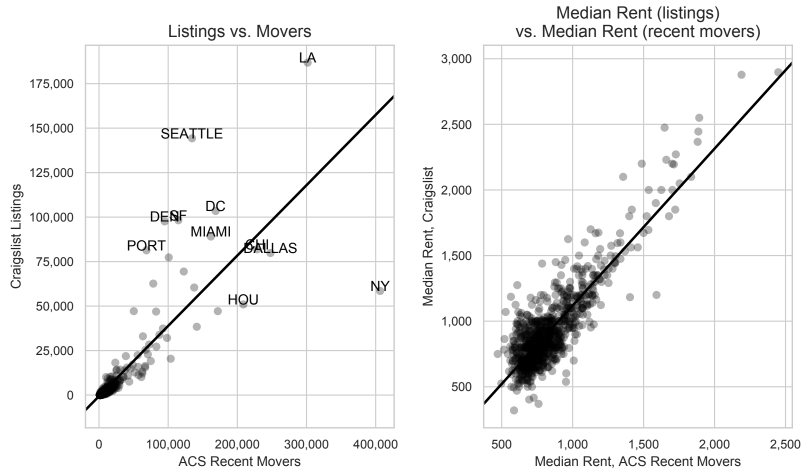

Figure 3.1: Recent mover households comes from ACS table ACS_-17_5YR_B25026, with the assumption that the share of recent mover renter households is the same as the share of recent mover renter population. The median rent ACS estimate covers renters who moved since 2015, per table B25113_002E. ACS = American Community Survey. CBSA = core-based statistical area.

tude/longitude) that have the same size in square feet, the same bedroom count and roughly the same price (within $100 intervals) within a quarter is a duplicate. There will be boundary effects: Should the same listing be offered at the last day of the quarter and then a week later, they will be treated as distinct and kept in the dataset, whereas if both listings had been in the same quarter, they would have been flagged as duplicates.

	Listings	SQFT			Rent		
	count	median	mean	std	median	mean	std
Filtered	2,816,757	967	1,063	523	$1,405	$1,646	$1,003
Geo Deduped	2,845,445	967	1,331	41,665	$1,400	$25,276	$7,843,509
Unique	9,392,930	900	1,084	27,169	$1,324	$10,040	$4,545,939

Table 3.2: Key Descriptives for Dataset Before and After Filtering. Unique data contains one listing per listing ID. Geo Deduped data removes likely geographical duplicates of the same listing. The Outlier Filtered data excludes outliers measured on a rent per square foot basis.

This may falsely identify some listings as duplicates when they are in fact distinct units in larger multifamily buildings, though as the relisting practice appeared to be pervasive, this de-duplication approach was preferable to leaving them in the dataset. Absent a way to uniquely identify units in a building at the national scale, any practical use of such data will have to weigh the trade-offs of discarding too many or too few listings for filtering of the data for the purpose at hand. All said, as seen in Table 3.2, the sample went from 9.3 million to 2.8 million following de-duping and filtering procedures. Further descriptive statistics are provided in Section 3.5, *Data Appendix*.

Data on Opportunity Areas

Researchers have long called for better accounting of what constitutes quality in a neighborhood. As bigger datasets have become available, researchers are better able to come up with measures of neighborhood quality that go beyond the most typical proxies for neighborhood quality such as poverty (Pendall, 2000). To classify listings, I largely follow the approach set out in the HUD interim report, creating a composite index based on census-tract level components obtained from HUD's open data site (Finkel et al., 2017). Opportunity is understood as a resource or amenity available to residents in a given neighborhood.

The components of the opportunity index include:

- A school proficiency index[8] measuring neighborhood performance of fourth-grade students on state exams,
- An environmental health hazard index,[9] measuring potential exposure to harmful toxins at a neighborhood level, including carcinogenic, respiratory, and neurological hazards,
- A jobs proximity index,[10] a gravity-based measure of jobs access within a CBSA,
- A low poverty index,[11] measuring share below the federal poverty limit.

Each is normalized on a scale from 0–100, with 100 considered higher opportunity. All indices are defined at the tract level. I average the components at the tract level to produce the composite opportunity index and then normalize it to a percentile ranking within each FMR area. A tract is accordingly classified in relative terms within the opportunity distribution of each FMR region with the implication that two tracts in different regions can have the same opportunity score though different underlying components. As I am interested in the relative opportunity for voucher holders searching for housing within a region, the normalization is appropriate, and I report on listings availability by four opportunity categories.[12]

[8] http://hudgis-hud.opendata.arcgis.com/datasets/school-proficiency-index.

[9] http://hudgis-hud.opendata.arcgis.com/datasets/c7e2c62560bd4a999f0e0b2f4cee2494_0.

[10] http://hudgis-hud.opendata.arcgis.com/datasets/4e2ef54b88084fb5a2554281b2d89a8b_0.

[11] http://hudgis-hud.opendata.arcgis.com/datasets/3419cb4c7aa144b2bc54671f58b580f4_0.

[12] These are not to be confused with "opportunity zones," which denote areas offering tax preferential treatment to investors. See https://www.irs.gov/newsroom/opportunity-zones-frequently-asked-questions.

3.4 Findings

In the following sections when comparing the two, I refer to area-wide Fair Market Rent areas as MAFMRs, and the ZCTA-based FMRs as SAFMRs to avoid confusion. All other things equal, the expected number of listings below the FMR should represent 40 percent of the rental distribution as that threshold is used in their definition.

General Effect of Transition

Did the introduction to SAFMRs increase unit availability, overall, from MAFMR levels? Figure 3.2, taken as a whole, nationally, I found that the share of listings was 5 percentage points below 40, at 35 percent, slightly smaller than the finding of 37 percent by Boeing and Waddell (2017)).[13]

[13]For FY 2019, only three areas relied on the 50th percentile FMRs, with many of the others having transitioned to SAFMRs. In the assessment of rents relative to FMRs, I use the 40th percentile FMRs for the areas currently using SAFMRs, which will mean poorer performance in those areas.

While the national count is reasonably close to the target 40 percent, many individual FMR areas see well below 40 percent of units available below the FMR level. For the 24 Rule Areas, the share is just 32 percent versus 35 percent for the United States as a whole. That availability is poorer in the 24 Rule Areas is not surprising given the selection criteria's focus on housing stock in relatively high-cost areas (U.S. Department of Housing and Urban Development, 2016b). Consistent with program expectations, per Figure 3.2, I note that the SAFMR transition, in the aggregate, moves availability up to the mid-40s, in percentage terms, for both the 24 Rule Areas and the larger list of 625 metro-based SAFMR regions, with more of an average increase for the 24 Rule Areas: Here, SAFMR would translate to an increase in available units by 14 percentage points given their lower starting point, consistent with the Rule Areas' selection criteria based in part on the low availability of units. Figure 3.2 further suggests benefits for a wider universe of areas than those identified in the Final Rule if the disruptive effects could be mitigated.

In some metropolitan areas, particularly in California, the share of units offered below FMR levels was markedly lower, with Sacramento and Los Angeles having the lowest shares in the state per Figure 3.3. Of those two, Sacramento--Roseville--Arden-Arcade is one of the rule areas, whereas Los Angeles-Long Beach is not. Both areas are in California where the state's legislative analyst's office proclaimed a statewide under-production of housing by 100,000 units, severely impacting the availability of units (Alamo and Uhler, 2015), underlining the importance of supply-side issues as well to the success of the HUD program.

Notably, there is considerable variation with respect to availability even within high-cost areas. For the San Francisco Bay Area, core FMR areas differ considerably in their placement, with San

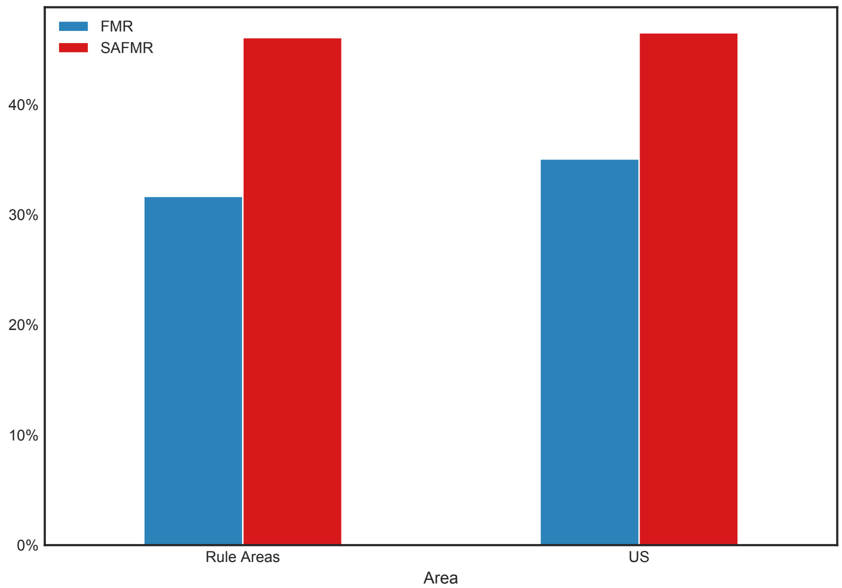

Figure 3.2: Overall Change in Listings Below Fair Market Rent Levels, by Area Category. FMR = fair market rent. SAFMR = small area fair market rent. Sources: Rental listings from Craigslist; FMR/SAFMR data from HUD.

Francisco having around 21 percent of units below FMR levels, while San Jose lands closer to the national average, at 39 percent. Seattle has above-average unit availability, suggesting that it is not simply a matter of the FMR methodology being unable to capture price increases in coastal tech-based economies: here, San Francisco and San Jose differ in how they perform on the FMR score, perhaps due to San Francisco's long-standing rent control policy, which could downward bias the payment standard.[14]

To better appreciate the nature of the transition to SAFMRs in a spatial sense, Figure 3.4 shows, at the ZCTA level of aggregation, the difference between FMR and SAFMRs for the 24 Rule Areas. Negative values, from the left side of the key, show that SAFMRs are *below* the FMR for the subarea, so subsidy payments for units in these areas will go down. The right side of the key denotes an *increase* in subsidy payments.

Overall, the map serves to illustrate the variety of submarkets in each region. In San Diego, for example, coastal areas tend to be the most expensive and inland areas the least, reflecting considerable geographic differences in rental costs; this is tracked more closely by a finer-grained SAFMR standard. Importantly, the submarket-specific location of listings and associated rents on those maps will determine the shift of the overall count of listings below FMR levels. If a plurality of units happens to fall in low-cost areas with a lower payment standard, it would lower the count available below FMR level. Conversely, more units in high-cost areas would mean an overall increase in units available below FMR levels.

[14] At the same time, it is conceivable rent control could upward bias FMR levels for a region insofar as the recent mover adjustment based on 1-year ACS data in the numerator is compared to the baseline rent data based on 5-year ACS data in the denominator. Rent control would likely impact the denominator more, leading to a larger upwards adjustment per the recent mover adjustment factor.

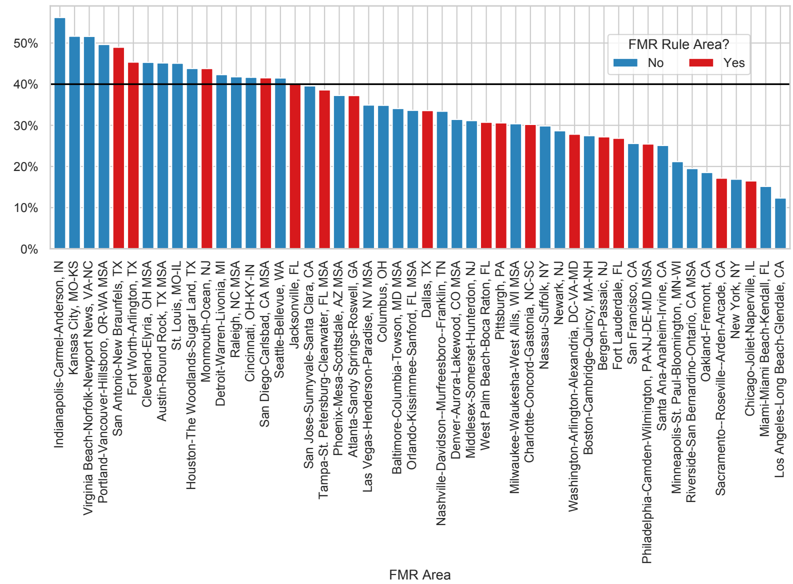

Figure 3.3: Share of Listings, Top 50 CBSAs. CBSA = core-based statistical areas. FMR = fair market rent. MSA = metropolitan statistical area. Notes: For the top 50 CBSAs by population, the share of listings falling below FMRs. CBSAs in the 24 Rule Areas marked in red. Sources: Rental listings from Craigslist; FMR/SAFMR data from HUD.

While the SAFMR data has been made available for a few years, making it possible to compare the specific areas of change (Figure 3.4), those maps only tell a partial story. Areas that may *appear* to see dramatic changes in FMR levels may turn out to lead to ultimately modest changes if few rental units exist there, or if turnover is low. The address-level geographic specificity and ultimately microdata-nature of Craigslist data provides literal weights to those maps, telling us about where listings are, how much they rent for, and where any one particular listing falls in the price brackets defined by both the conventional FMR geography as well as by the potential SAFMR geographies. For example, a listing in an above-average price neighborhood may have been above FMR levels in the area-level schema and thus likely out of reach, but below SAFMR levels in the ZIP Code-based schema. That same listing can be accounted for as having "transitioned" from out of reach to within reach on monetary terms alone. I leverage the microdata nature of the data to analyze those transitions by comparing geocoded listing rents with both the areawide FMRs as well as with the SAFMRs. I subtract FMRs from the listing rent, where 0 means parity, positive means the listing is above (out of reach) FMR levels, and negative means it falls below FMR levels.

As an example of how a particular area has seen a change in the distribution of listings as SAFMRs were introduced, Figure 3.5 shows the shift in units for San Diego, one of the 24 Rule Areas. We see a shift of listings in the lower, pricier rows in the figure where rents are well above FMR levels, to higher ones with SAFMR. Particularly for San Diego, we see a substantial upward shift in the

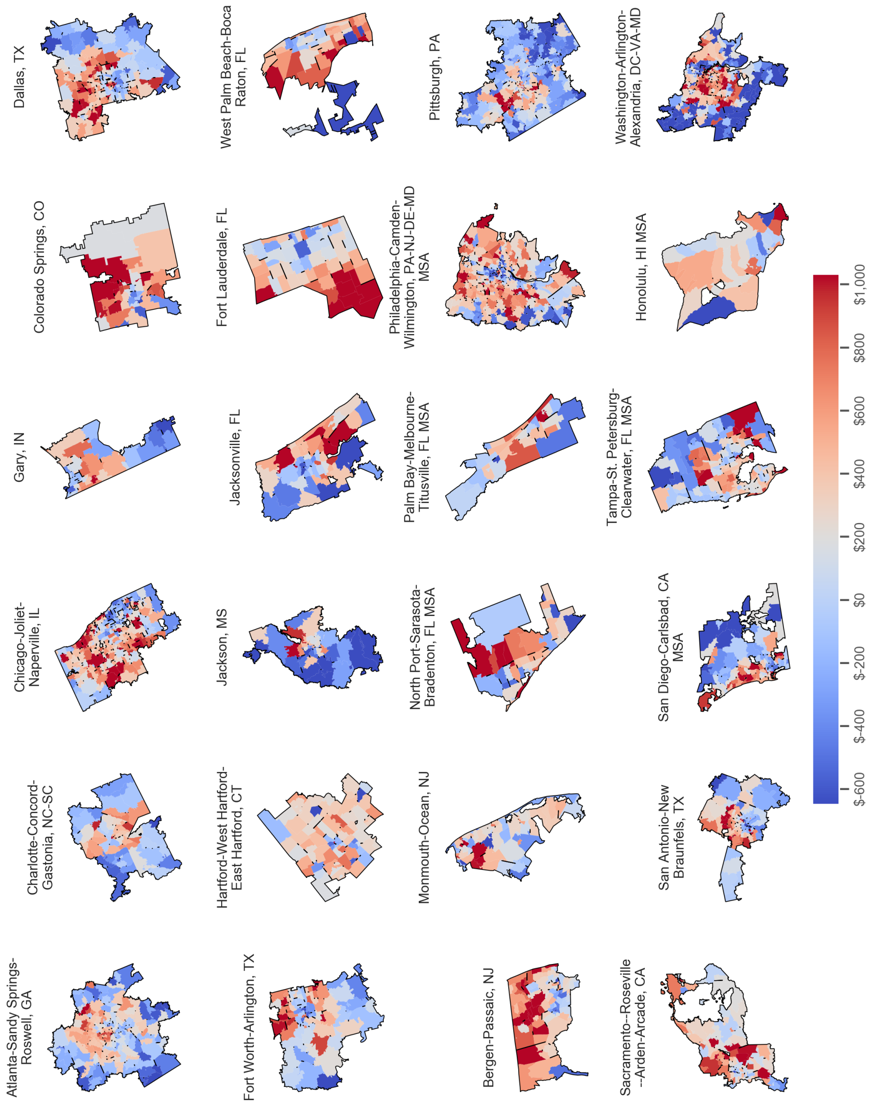

Figure 3.4: Difference at ZCTA Level, SAFMRs Expressed Percent of FMR, in Quartiles for Each Region. FMR = fair market rent. SAFMR = small area fair market rent. ZCTA = Zip Code tabulation area. Note: Maps shows ZCTA-level differences between SAFMRs and FMRs, which in effect is the same as the ratio of the ZCTA-level rent to the FMR-level rent, per HUD's methodology. Sources: Rental listings from Craigslist; FMR/SAFMR data from HUD; ZCTA shapefile from U.S. Census Bureau.

availability of one-bedroom units, owing to listings in areas that are now subject to the higher SAFMRs.

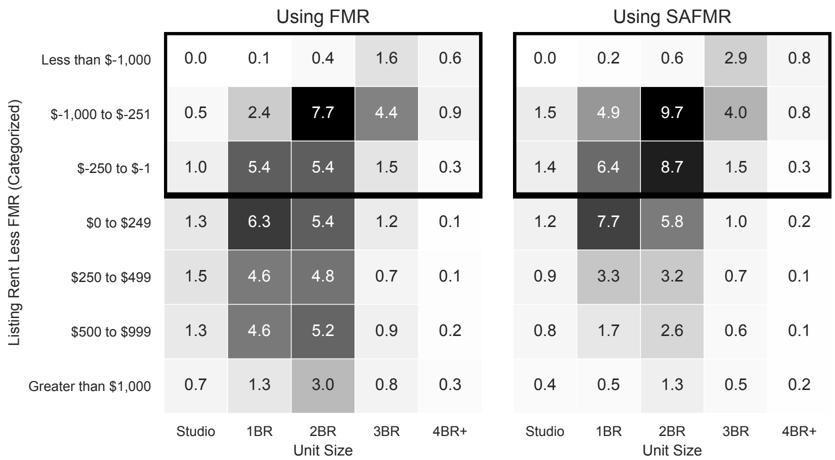

Figure 3.5: Example Distributions, San Diego FMR Area. BR = bedroom. FMR = fair market rent. SAFMR = small area fair market rent. Notes: Listings in thousands. The y-axis is listing rent minus FMR level (left panel) or SAFMR level (right panel). Positive categories (bottom three rows) means the listing rent for more than the prevailing FMR level; the top three rows, marked by a black rectangle, indicate listings costing less than the prevailing FMR level. Labels show count, in thousands, of listings.

To see the general distribution for the 24 Rule Areas, Figure 3.6 shows the areas sorted by share below SAFMR in percentage points below the respective FMR level (FMR and SAFMR). The span between the dots shows the movement for each area. The overall impression is that a SAFMR transition for the 24 Rule Areas leads to a larger share of units falling below FMR levels and thereby being, in principle, accessible to voucher holders, while there is considerable between-area variation. Just 6 of the 24 Rule Areas have *less* than 40 percent of listings available below SAFMR, with Sacramento remaining in the bottom of the list. While SAFMRs shifted availability upwards by nearly 20 percentage points, the levels are substantially lower than what reported using 2012–2013 data, whether due to inflation or data source coverage differences (Palm, 2018). Overall, however, as far as the basis for the payment standard goes, the number of units and areas available to voucher holders has increased.

Effect by Opportunity Areas

How are listing rents relative to FMRs and SAFMRs distributed, and what is the relation to neighborhoods of opportunity? Figure 3.7 compares the distribution of listings in FMR areas but also under SAFMRs.

For each listing, the difference to the applicable FMR is calculated. Zero means parity; a positive value means the Craigslist listing is *more* expensive than the FMR; a negative one means it is priced below FMR. I further segment the data into four different opportunity categories. Each listing inherits the score from the containing census tract. Scores are quartiles at the tract level, but

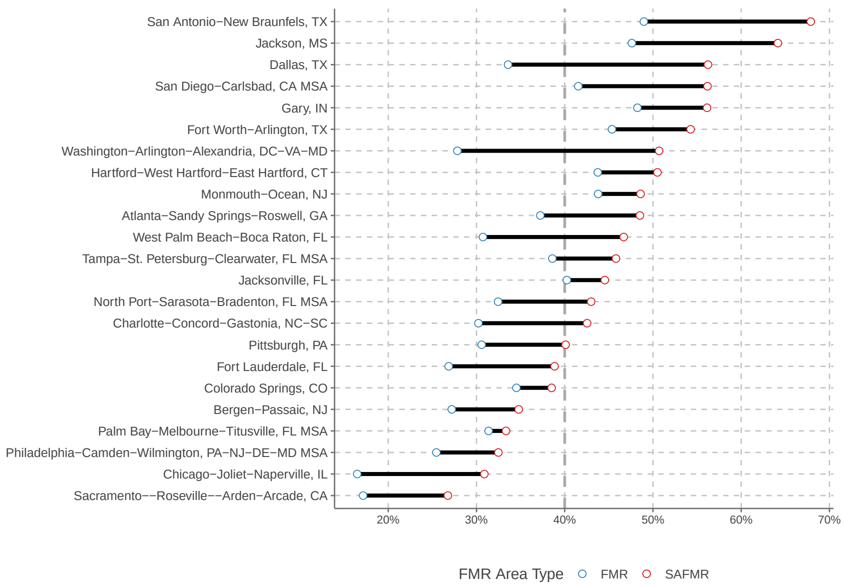

Figure 3.6: HUD Final Rule Areas, Overall Shift in Share of Listings Below FMRs. FMR = fair market rent. MSA = metropolitan statistical area. SAFMR = small area fair market rent. Note: The length of the line denotes the movement in percentage points of listings falling below FMRs in each classification. Sources: Rental listings from Craigslist; FMR/SAFMR data from HUD

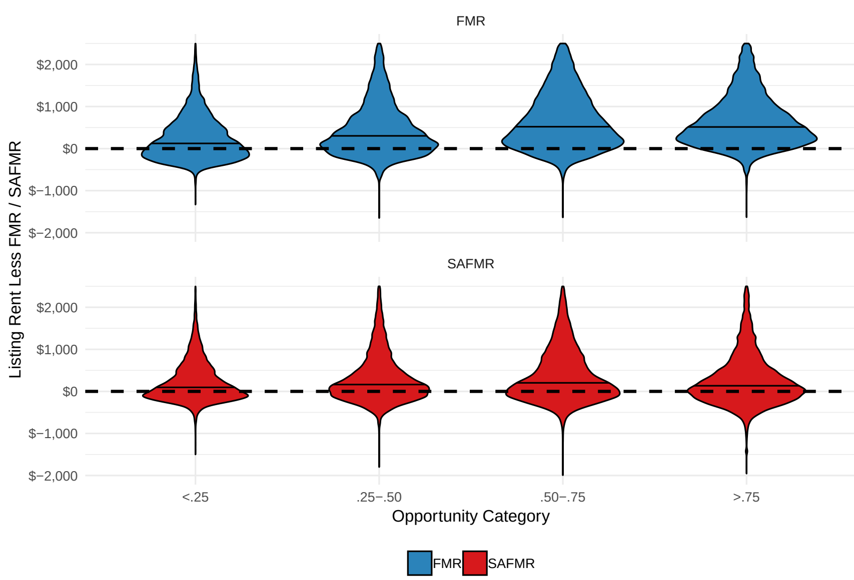

Figure 3.7: Distribution of Listing-Level Difference, to FMR and SAFMR, by Opportunity Index Category. FMR = fair market rent. SAFMR = small area fair market rent. Sources: Rental listings from Craigslist; FMR/SAFMR data from HUD.

not necessarily at the rental listing level, and a panel is devoted to each segment. The left panel of the top row shows that for MAFMR areas, much of the distribution is below the zero line, meaning that listings are typically available at the fair market rent level on offer. The bottom row shows the listings classified according to SAFMR geographies. As we head rightward in the figure, toward higher opportunity areas, the share of units below parity generally drops: fewer units have traditionally been affordable to voucher holders in higher opportunity neighborhoods. This is most noticeable in the top row, with FMRs. The bottom row reveals that, with the SAFMR classification, as we move to higher opportunity categories, the number of units falling below parity *declines much less* than is the case in the top row: as the payment standard goes up in more costly, higher opportunity areas, listings are counted as reachable.

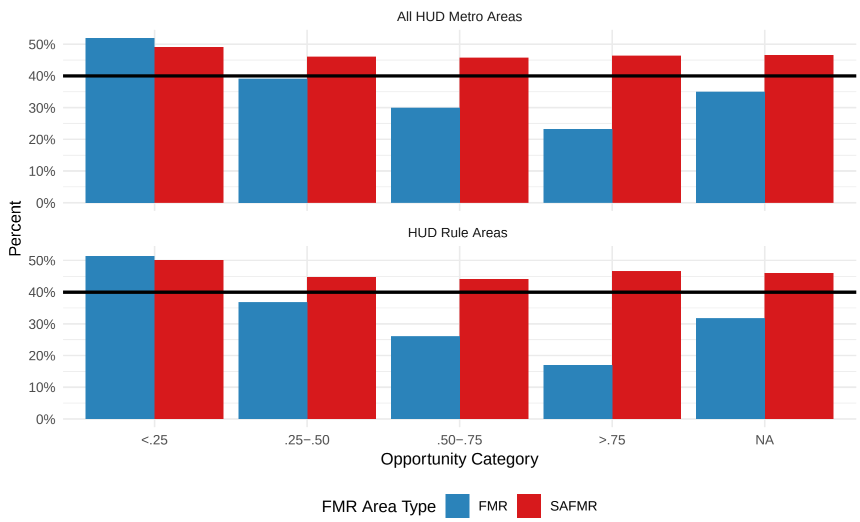

Figure 3.8: Share of Listings Above FMR limits, FMR and SAFMR Variants, by Opportunity Index Category. FMR = fair market rent. SAFMR = small area fair market rent. Sources: Rental listings from Craigslist; FMR/SAFMR data from HUD.

Whereas Figure 3.7 showed distributions of the difference between FMR levels and rent levels by opportunity category, Figure 3.8 shows the number of listings by opportunity category as percentages above or below FMR levels. The top panel accounts for just the 24 Rule Areas, whereas the bottom panel shows the full national sample. As before, there is a clear progression from low to high opportunity categories, with relatively fewer units available, and, within each opportunity quartile, relatively more listings are available in the SAFMR classification. The 24 Rule Areas differ mainly from the national sample in availability per FMR; overall, SAFMR availability shows a remarkable constancy even as we move up opportunity categories. While this may seem a remarkable shift, it just reflects that the payment standard goes up, following higher cost areas more closely.

The last way we explore listings by opportunity areas allows us to track explicitly the number of units changing "state," from above FMR, or unattainable, to below SAFMR, by showing flows as ribbons from one distribution to the next.

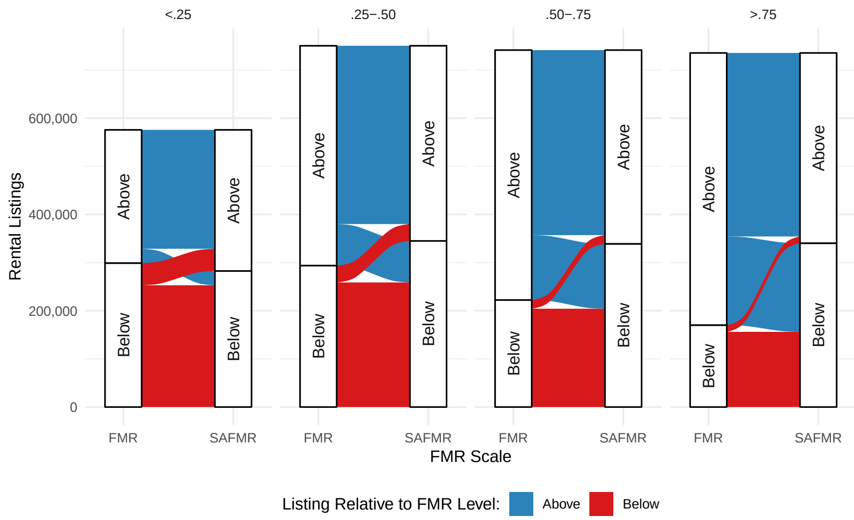

Figure 3.9: Listings, by Change of Status, to Above / Below FMR Level, by Opportunity Category. FMR = fair market rent. SAFMR = small area fair market rent. Sources: Rental listings from Craigslist; FMR/SAFMR data from HUD.

The ribbons show the scale of that transition, with the width of the ribbon proportional to the number of units being reclassified from above FMR to below FMR levels (Figure 3.9). Notably, the middle categories covering the 25th to 75th percentile opportunity area bands show that a lot of units are above the FMR, meaning many units are off-limits. At the same time, the ribbon shows a considerable transition of listings into the *below* SAFMR bucket: Nationally, about 14 percent of listings switch from being unavailable to available in mid- and high-opportunity areas. The bands of key interest are those that originate in "above" but transition to "below," and the biggest switch appears in the higher opportunity areas on the right, with a substantial number of units that transition from above to below FMR levels with SAFMRs.

Figure 3.10 is analogous to Figure 3.9 but instead of segmenting by opportunity category, I show the rental price quartile calculated within each metropolitan area. Overall, the progression from quartile one through four is fairly marked: There are progressively fewer units below FMR levels as we move up the rental cost distribution. Note the transition from above to below FMRs is about equivalent to the transition in the reverse direction for the first quartile. In the second quartile, this is no longer true, and a substantial number of units becomes available below SAFMRs. Similar to what we saw with higher opportunity areas, higher listing price areas, by definition, will have fewer units below the FMR, although SAFMRs still offer more units than would be the case with the areawide FMR system.

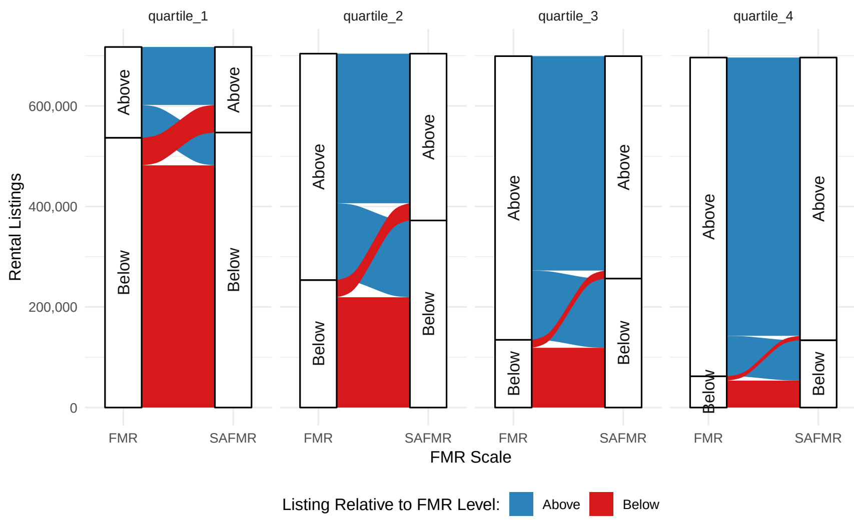

Figure 3.10: Listings, by Change of Status, to Above / Below FMR Level, by Rent Quartile Category. FMR = fair market rent. SAFMR = small area fair market rent. Sources: Rental listings from Craigslist; FMR/SAFMR data from HUD.

While SAFMRs have been applied to a limited number of areas, in part due to concerns related to negative consequences in areas where the payment standard would be lowered, it is nonetheless instructive to briefly explore non-rule areas where considerable counts of listings would switch to being below FMR levels per the new SAFMR system. To do this, I examined non-rule areas with respect to the transition. Of the top 50 FMR non-rule areas by population, I show the top 25 non-rule FMR areas sorted by the percentage point of listings moving to below FMR levels subtracting any units that fell *above* the threshold (Figure 3.11).

The Santa Ana-Anaheim-Irvine, California FMR Area tops the list, with more than one-fourth of its listings crossing the threshold to be reachable below the FMR level. The Seattle-Bellevue, Washington and Oakland-Fremont, California FMR areas are in the top five, as is Houston-The Woodlands-Sugarland, Texas and Birmingham-Hoover, Alabama. The lowest increase on this top 25 list is Riverside-San Bernardino-Ontario, California, with about 12 percent of units transitioning. Overall, the list contains a diverse array of areas and economies, spanning the country, but with the strongest gains seen in some of the more dynamic regional economies. I found a small but positive association between areas with higher personal incomes per capita and the share of listings transitioning to falling below FMRs. Future work should explore which particular characteristics account for this finding.

Discussion

This research uses listing data from Craigslist to offer insights into the transition to SAFMRs for both the 24 Rule Areas and FMR

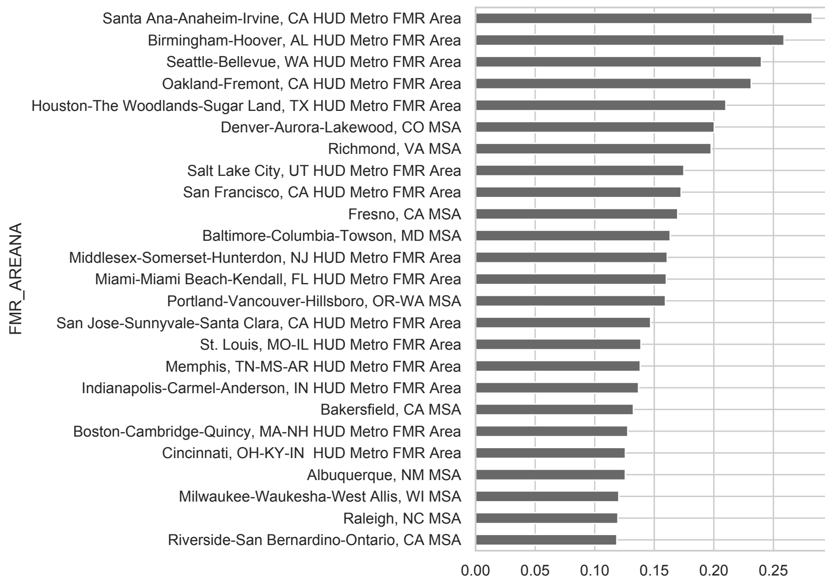

Figure 3.11: Biggest Net Increase of Listings Below FMR, Non-Rule FMR Areas. Net increase compares listings that move "ABOVE FMR" levels and listings that move "BELOW FMR" levels, assuming SAFMRs were applied. The areas with the largest net gains in listing counts are shown.

areas more generally. While the data come with a range of limitations due to their nature as a VGI dataset subject to a number of quality control issues, the data have the advantage of currency and granularity and they also represent what a would-be tenant could actually see when searching for an apartment.

We found that a switch to SAFMRs, consistent with earlier studies and objectives of the program, increases the count of units available in higher cost and higher opportunity areas. While further investigation is needed to better understand the downsides and risks, let alone the considerable variation in benefits associated with transitioning to finer scaled geographies for different types of areas, these findings suggest the switch to SAFMRs could generally prove beneficial not just for the 24 Rule Areas required to use SAFMR as the basis for setting payment standards, but indeed for a larger swath of FMR areas where high costs have persistently been an issue.

The switch to SAFMRs led to a boost of listings available in generally higher opportunity areas with only a relatively minor loss of availability in low opportunity areas. On its face, the upside was considerable, with the highest opportunity area category seeing more than 45 percent of listings falling below SAFMR levels. While this boost was largest for the 24 Rule Areas, it was nonetheless significant for non-rule areas as well, with solid boosts in availability for a range of generally higher cost areas; those areas included the tech hotspots of Seattle, Denver, and the San Francisco Bay Area. Before a wider rollout, it goes without saying that careful safeguards should be included to avoid disruption of *existing* households in areas where payment standards would drop, causing risk to renewals. If the voucher opportunity map changes as implied, and lease-ups in these wider areas prove successful in the coming years, local PHAs may find budgets even more strained, barring more resources to the program overall.

Longer Term Challenges

In many ways, the HCV program shows the limits both of a housing policy heavily focused on demand-side solutions and of how variable the outcomes of the program are. That is not because the program treats FMR areas differently but because FMR areas have substantially different housing markets. The hot coastal markets are much more difficult to fix with demand-side measures when the challenge is a complex mix of low incomes, low supply, and spillover effects from well-to-do tenants. The most critical need is in the areas with the most constrained rental markets where rents are high and availability accordingly low. This is the typical situation in the hot coastal markets, such as Los Angeles and the San Francisco Bay area, where vacancies are low and talk of housing crises perennial. In those cases, the bottom of the housing market cannot be easily remedied with an administrative fix and realignment like SAFMRs. As one PHA official put it, landlords have a choice of tenants, and with rental vacancies hovering around perhaps 2 percent, landlords will have many options to rapidly fill their units without having to face the extra risk, perceived or real, of subsidized tenants. In HUD's phrasing,

> [a] major question regarding the Small Area FMR approach is the willingness of owners with rental units in the higher cost areas to participate in the program. If owners in higher-cost areas have enough demand for their units from higher income unassisted families, they may have little interest or incentive to participate in the HCV program (HUD, 2017b).

It was for this reason that some areas that would otherwise seem great candidates for inclusion in the SAFMR version of the program balked—low vacancies would effectively preclude success and could end up wasting money at the top of the rental distribution while causing disruption for lower-income tenants. Ultimately, in those types of areas where the need may be the greatest, the restrictive supply regime of the expensive coastal areas will remain an impediment to a successful housing policy framework across levels of government—although SAFMRs appear to be a great methodological realignment to allocate scarce resources to higher opportunity areas while limiting landlord subsidies in lower cost submarkets. Whether the program adjustment will be successful and actually translate the increased availability listings reachable by the program into higher lease-up success rates in high-opportunity areas remains to be seen in the coming years. The 24 Rule Areas may in effect help us understand more about the extent to which difficulties leasing up in higher opportunity neighborhoods were of the financial sort, or instead related to a wider set of issues, such as search costs, transportation challenges, or landlord behavior.

3.5 Data Appendix

The data appendix provides key summaries by FMR area of the filtered listings data, including the number of listings, mean or median bedroom counts, asking rent, and rent per square foot. The tables also show the difference between listing rent and MAFMR and SAFMR, respectively. A positive number means the listing rent is above the FMR; a negative means below. The median of this difference is provided. The last four columns show the effect of the transition; the four columns sum to 100 percent and show the four possible states: A listing could be, for MAFMRs and SAMFRs in turn, available or not available at that price point. Some listings would be available or not under both systems, while others would transition to becoming either available or not available.

The two tables differ only in terms of areas covered: Tables 3.3 and 3.4 show the 24 Rule Areas, whereas tables 3.5 and 3.6 present data for the top 50 (by population) non-rule FMR areas.

Table 3.3: Summary Statistics for 24 Rule Areas

FMR_AREANA	Listings size	SQFT median	BDRMs mean	Rent median	$/SQ FT	Listing - FMR median	Listing - SAFMR median
Atlanta-Sandy Springs-Roswell, GA HUD Metro FMR...	47,066	1,100	1.86	1,239.0	1.1	$128	$3
Bergen-Passaic, NJ HUD Metro FMR Area	3,096	1,002	1.77	2,095.0	1.9	$512	$267
Charlotte-Concord-Gastonia, NC-SC HUD Metro FMR...	21,640	1,034	1.81	1,195.0	1.1	$148	$45
Chicago-Joliet-Naperville, IL HUD Metro FMR Area	78,567	900	1.61	1,700.0	1.9	$553	$225
Colorado Springs, CO HUD Metro FMR Area	13,724	936	1.83	1,191.5	1.2	$136	$55
Dallas, TX HUD Metro FMR Area	61,128	925	1.61	1,270.0	1.3	$154	$-52
Fort Lauderdale, FL HUD Metro FMR Area	24,366	1,151	2.08	1,800.0	1.5	$265	$105
Fort Worth-Arlington, TX HUD Metro FMR Area	18,485	920	1.75	1,037.0	1.1	$27	$-25
Gary, IN HUD Metro FMR Area	2,243	996	2.12	905.0	0.9	$8	$-30
Hartford-West Hartford-East Hartford, CT HUD Me...	5,486	1,000	1.90	1,200.0	1.1	$40	$-12
Jackson, MS HUD Metro FMR Area	2,260	1,130	2.15	900.0	0.8	$10	$-90
Jacksonville, FL HUD Metro FMR Area	17,069	1,081	1.93	1,050.0	1.0	$96	$30
Monmouth-Ocean, NJ HUD Metro FMR Area	2,062	1,055	2.10	1,500.0	1.3	$71	$10
North Port-Sarasota-Bradenton, FL MSA	6,822	1,103	2.01	1,299.0	1.2	$115	$40
Palm Bay-Melbourne-Titusville, FL MSA	3,251	1,104	2.05	1,275.0	1.1	$208	$155
Philadelphia-Camden-Wilmington, PA-NJ-DE-MD MSA	38,379	975	1.80	1,472.0	1.5	$325	$160
Pittsburgh, PA HUD Metro FMR Area	11,148	950	1.83	1,015.0	1.1	$175	$70
Sacramento–Roseville–Arden-Arcade, CA HUD Met...	30,720	975	1.91	1,550.0	1.5	$327	$185
San Antonio-New Braunfels, TX HUD Metro FMR Area	28,097	908	1.69	989.0	1.1	$2	$-102
San Diego-Carlsbad, CA MSA	77,357	910	1.76	2,050.0	2.2	$105	$-70
Tampa-St. Petersburg-Clearwater, FL MSA	32,110	1,028	1.95	1,205.0	1.2	$84	$24
Washington-Arlington-Alexandria, DC-VA-MD HUD M...	103,205	882	1.52	1,853.0	2.1	$276	$-13
West Palm Beach-Boca Raton, FL HUD Metro FMR Area	17,416	1,224	2.23	1,725.0	1.4	$200	$20

Note:

FMR = fair market rent. MSA = metropolitan statistical area. SAFMR = small area fair market rent.

Table 3.4: Transitions for 24 Rule Areas

FMR_AREANA	Transitions Out-of-Reach Both	Now In Reach	Out-of-Reach Now	In Reach Both
Atlanta-Sandy Springs-Roswell, GA HUD Metro FMR...	47.82%	14.94%	3.65%	33.58%
Bergen-Passaic, NJ HUD Metro FMR Area	62.24%	10.56%	2.97%	24.22%
Charlotte-Concord-Gastonia, NC-SC HUD Metro FMR...	53.72%	16.06%	3.74%	26.47%
Chicago-Joliet-Naperville, IL HUD Metro FMR Area	67.13%	16.38%	1.98%	14.51%
Colorado Springs, CO HUD Metro FMR Area	51.01%	14.46%	10.47%	24.05%
Dallas, TX HUD Metro FMR Area	41.10%	25.32%	2.67%	30.91%
Fort Lauderdale, FL HUD Metro FMR Area	59.00%	14.15%	2.15%	24.70%
Fort Worth-Arlington, TX HUD Metro FMR Area	39.12%	15.52%	6.61%	38.74%
Gary, IN HUD Metro FMR Area	40.35%	11.41%	3.52%	44.72%
Hartford-West Hartford-East Hartford, CT HUD Me...	46.21%	10.04%	3.28%	40.47%
Jackson, MS HUD Metro FMR Area	31.81%	20.58%	4.03%	43.58%
Jacksonville, FL HUD Metro FMR Area	50.55%	9.20%	4.90%	35.34%
Monmouth-Ocean, NJ HUD Metro FMR Area	49.27%	6.94%	2.13%	41.66%
North Port-Sarasota-Bradenton, FL MSA	52.39%	15.16%	4.62%	27.84%
Palm Bay-Melbourne-Titusville, FL MSA	62.17%	6.46%	4.49%	26.88%
Philadelphia-Camden-Wilmington, PA-NJ-DE-MD MSA	63.39%	11.15%	4.12%	21.33%
Pittsburgh, PA HUD Metro FMR Area	57.06%	12.35%	2.83%	27.75%
Sacramento–Roseville–Arden-Arcade, CA HUD Met...	70.90%	11.94%	2.34%	14.82%
San Antonio-New Braunfels, TX HUD Metro FMR Area	29.93%	21.10%	2.19%	46.78%
San Diego-Carlsbad, CA MSA	33.77%	24.69%	10.06%	31.49%
Tampa-St. Petersburg-Clearwater, FL MSA	50.50%	10.90%	3.70%	34.90%
Washington-Arlington-Alexandria, DC-VA-MD HUD M...	46.42%	25.75%	2.89%	24.95%
West Palm Beach-Boca Raton, FL HUD Metro FMR Area	50.08%	19.18%	3.23%	27.50%

Note:

The four columns sum to 100 percent and show for each of the 24 HUD Rule Areas the distribution of listings in four categories relative to whether they were listed at below FMR in the old MAFMR classification and in the new SAFMR classification.

Table 3.5: Summary Statistics for Top 50 Non-Rule Areas

FMR_AREANA	Listings size	SQFT median	BDRMs mean	Rent median	$/SQ FT	Listing - FMR median	Listing - SAFMR median
Albuquerque, NM MSA	14,288	855	1.68	810.0	1.0	$-13	$-64
Austin-Round Rock, TX MSA	62,621	900	1.67	1,291.0	1.4	$35	$-30
Bakersfield, CA MSA	3,178	1,000	2.12	950.0	0.9	$-31	$-120
Baltimore-Columbia-Towson, MD MSA	25,421	1,000	1.83	1,475.0	1.4	$176	$-11
Birmingham-Hoover, AL HUD Metro FMR Area	4,005	1,075	1.98	925.0	0.9	$40	$-128
Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area	63,525	950	1.85	2,540.0	2.7	$403	$145
Brockton, MA HUD Metro FMR Area	528	1,000	2.11	1,599.0	1.4	$154	$129
Buffalo-Cheektowaga-Niagara Falls, NY MSA	7,250	1,040	2.12	950.0	0.9	$87	$60
Cincinnati, OH-KY-IN HUD Metro FMR Area	12,048	1,000	1.98	926.5	0.9	$50	$-30
Cleveland-Elyria, OH MSA	10,115	1,050	2.10	900.0	0.9	$31	$0
Columbus, OH HUD Metro FMR Area	16,254	1,000	1.90	1,000.0	1.0	$107	$30
Danbury, CT HUD Metro FMR Area	710	1,000	1.72	1,650.0	1.5	$317	$270
Denver-Aurora-Lakewood, CO MSA	97,588	900	1.63	1,562.0	1.7	$167	$-20
Detroit-Warren-Livonia, MI HUD Metro FMR Area	19,891	1,030	2.07	1,002.0	1.0	$73	$19
Fresno, CA MSA	8,864	1,026	2.11	1,225.0	1.1	$144	$15
Houston-The Woodlands-Sugar Land, TX HUD Metro ...	49,073	933	1.68	1,110.0	1.2	$53	$-110
Indianapolis-Carmel-Anderson, IN HUD Metro FMR ...	12,853	997	1.83	860.0	0.9	$-28	$-86
Kansas City, MO-KS HUD Metro FMR Area	15,546	954	1.81	900.0	1.0	$-13	$-45
Las Vegas-Henderson-Paradise, NV MSA	46,922	1,000	1.78	1,129.0	1.1	$134	$70
Los Angeles-Long Beach-Glendale, CA HUD Metro F...	129,255	910	1.61	2,299.0	2.6	$704	$390
Louisville, KY-IN HUD Metro FMR Area	10,163	950	1.90	865.0	0.9	$31	$-5
Memphis, TN-MS-AR HUD Metro FMR Area	7,502	1,034	2.09	840.0	0.8	$-143	$-195
Miami-Miami Beach-Kendall, FL HUD Metro FMR Area	47,317	1,030	1.79	1,950.0	2.0	$548	$240
Middlesex-Somerset-Hunterdon, NJ HUD Metro FMR ...	4,370	1,088	1.80	1,800.0	1.6	$149	$25
Milwaukee-Waukesha-West Allis, WI MSA	12,691	1,000	1.94	1,095.0	1.1	$152	$55
Minneapolis-St. Paul-Bloomington, MN-WI HUD Met...	37,323	970	1.77	1,420.0	1.4	$314	$195
Nashville-Davidson–Murfreesboro–Franklin, TN ...	21,831	1,050	1.87	1,273.0	1.2	$147	$58
Nassau-Suffolk, NY HUD Metro FMR Area	3,846	1,043	1.81	2,250.0	2.0	$410	$265
New Orleans-Metairie, LA HUD Metro FMR Area	10,239	1,000	1.89	1,100.0	1.2	$92	$10
New York, NY HUD Metro FMR Area	28,919	850	1.72	2,550.0	3.1	$675	$450
Newark, NJ HUD Metro FMR Area	4,356	1,000	1.87	1,775.0	1.6	$387	$130
Oakland-Fremont, CA HUD Metro FMR Area	50,763	898	1.78	2,500.0	2.6	$422	$100
Oklahoma City, OK HUD Metro FMR Area	14,851	960	1.95	775.0	0.8	$-111	$-140
Orlando-Kissimmee-Sanford, FL MSA	27,223	1,079	2.00	1,319.0	1.2	$125	$47
Phoenix-Mesa-Scottsdale, AZ MSA	60,433	952	1.81	1,129.0	1.1	$87	$10
Portland-Vancouver-Hillsboro, OR-WA MSA	81,347	915	1.76	1,445.0	1.6	$0	$-115
Providence-Fall River, RI-MA HUD Metro FMR Area	9,001	1,000	1.96	1,400.0	1.3	$340	$235
Raleigh, NC MSA	15,441	1,070	1.89	1,129.0	1.1	$46	$-26
Richmond, VA MSA	13,859	940	1.86	1,125.0	1.2	$63	$-61
Riverside-San Bernardino-Ontario, CA MSA	33,854	1,000	2.06	1,670.0	1.5	$438	$150
Rochester, NY HUD Metro FMR Area	8,403	1,090	2.02	1,100.0	1.1	$145	$55

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FMR_AREANA	Listings size	SQFT median	BDRMs mean	Rent median	$/SQ FT	Listing - FMR median	Listing - SAFMR median
Salt Lake City, UT HUD Metro FMR Area	14,247	899	1.69	1,159.0	1.3	$132	$45
San Francisco, CA HUD Metro FMR Area	47,456	870	1.57	3,450.0	3.8	$530	$143
San Jose-Sunnyvale-Santa Clara, CA HUD Metro FM...	46,972	935	1.77	2,899.0	3.0	$157	$-76
Santa Ana-Anaheim-Irvine, CA HUD Metro FMR Area	57,545	950	1.74	2,087.0	2.2	$188	$-35
Seattle-Bellevue, WA HUD Metro FMR Area	130,398	820	1.50	1,850.0	2.2	$112	$-165
St. Louis, MO-IL HUD Metro FMR Area	19,106	935	1.82	900.0	1.0	$26	$-50
Tucson, AZ MSA	21,892	810	1.70	795.0	1.0	$-28	$-55
Virginia Beach-Norfolk-Newport News, VA-NC HUD ...	15,806	1,000	1.92	1,123.0	1.1	$-14	$-96
Westchester County, NY Statutory Exception Area	2,907	942	1.71	2,197.0	2.2	$422	$265

Note:

FMR = fair market rent. MSA = metropolitan statistical area. SAFMR = small area fair market rent.

Table 3.6: Statistics for Top 50 Non-Rule Areas

FMR_AREANA	Transitions Out-of-Reach Both	Now In Reach	Out-of-Reach Now	In Reach Both
Albuquerque, NM MSA	31.87%	15.16%	2.59%	50.38%
Austin-Round Rock, TX MSA	41.75%	13.10%	4.65%	40.50%
Bakersfield, CA MSA	29.52%	17.24%	4.00%	49.24%
Baltimore-Columbia-Towson, MD MSA	48.05%	17.87%	1.54%	32.54%
Birmingham-Hoover, AL HUD Metro FMR Area	30.61%	28.61%	2.72%	38.05%
Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area	55.06%	17.46%	4.69%	22.80%
Brockton, MA HUD Metro FMR Area	60.04%	7.20%	2.65%	30.11%
Buffalo-Cheektowaga-Niagara Falls, NY MSA	57.32%	7.97%	3.99%	30.72%
Cincinnati, OH-KY-IN HUD Metro FMR Area	42.67%	15.66%	3.09%	38.58%
Cleveland-Elyria, OH MSA	45.94%	8.76%	5.06%	40.24%
Columbus, OH HUD Metro FMR Area	51.24%	13.90%	4.33%	30.53%
Danbury, CT HUD Metro FMR Area	65.92%	5.07%	1.13%	27.89%
Denver-Aurora-Lakewood, CO MSA	45.06%	23.50%	3.46%	27.97%
Detroit-Warren-Livonia, MI HUD Metro FMR Area	49.05%	8.63%	4.29%	38.03%
Fresno, CA MSA	51.55%	18.31%	1.34%	28.80%
Houston-The Woodlands-Sugar Land, TX HUD Metro ...	31.86%	24.34%	3.33%	40.48%
Indianapolis-Carmel-Anderson, IN HUD Metro FMR ...	26.69%	17.12%	3.44%	52.76%
Kansas City, MO-KS HUD Metro FMR Area	38.72%	9.64%	4.16%	47.48%
Las Vegas-Henderson-Paradise, NV MSA	57.00%	8.08%	3.70%	31.23%
Los Angeles-Long Beach-Glendale, CA HUD Metro F...	75.89%	11.79%	1.75%	10.58%
Louisville, KY-IN HUD Metro FMR Area	47.29%	10.47%	2.16%	40.08%
Memphis, TN-MS-AR HUD Metro FMR Area	25.49%	14.82%	1.00%	58.69%
Miami-Miami Beach-Kendall, FL HUD Metro FMR Area	66.35%	18.49%	2.48%	12.68%
Middlesex-Somerset-Hunterdon, NJ HUD Metro FMR ...	49.20%	19.66%	3.57%	27.57%
Milwaukee-Waukesha-West Allis, WI MSA	55.69%	13.93%	1.91%	28.47%
Minneapolis-St. Paul-Bloomington, MN-WI HUD Met...	69.49%	9.33%	2.01%	19.18%
Nashville-Davidson–Murfreesboro–Franklin, TN ...	55.85%	10.73%	2.13%	31.28%
Nassau-Suffolk, NY HUD Metro FMR Area	64.27%	5.88%	2.47%	27.38%
New Orleans-Metairie, LA HUD Metro FMR Area	50.73%	11.34%	2.11%	35.82%
New York, NY HUD Metro FMR Area	73.73%	9.37%	2.55%	14.35%
Newark, NJ HUD Metro FMR Area	59.76%	11.57%	3.03%	25.64%
Oakland-Fremont, CA HUD Metro FMR Area	57.50%	23.96%	0.82%	17.71%
Oklahoma City, OK HUD Metro FMR Area	20.85%	11.43%	1.60%	66.12%
Orlando-Kissimmee-Sanford, FL MSA	54.28%	12.09%	2.95%	30.68%
Phoenix-Mesa-Scottsdale, AZ MSA	47.53%	15.21%	5.51%	31.76%
Portland-Vancouver-Hillsboro, OR-WA MSA	32.78%	17.58%	1.64%	48.00%
Providence-Fall River, RI-MA HUD Metro FMR Area	70.49%	6.69%	2.74%	20.08%
Raleigh, NC MSA	44.58%	13.63%	1.68%	40.11%
Richmond, VA MSA	37.27%	22.40%	2.63%	37.71%
Riverside-San Bernardino-Ontario, CA MSA	65.96%	14.55%	2.70%	16.79%
Rochester, NY HUD Metro FMR Area	56.94%	9.13%	2.80%	31.13%

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FMR_AREANA	Transitions Out-of-Reach Both	Now In Reach	Out-of-Reach Now	In Reach Both
Salt Lake City, UT HUD Metro FMR Area	55.59%	19.51%	2.03%	22.87%
San Francisco, CA HUD Metro FMR Area	55.14%	19.27%	2.02%	23.57%
San Jose-Sunnyvale-Santa Clara, CA HUD Metro FM...	40.72%	19.71%	5.02%	34.55%
Santa Ana-Anaheim-Irvine, CA HUD Metro FMR Area	40.92%	33.97%	5.72%	19.39%
Seattle-Bellevue, WA HUD Metro FMR Area	32.39%	26.11%	2.11%	39.38%
St. Louis, MO-IL HUD Metro FMR Area	39.85%	15.07%	1.19%	43.89%
Tucson, AZ MSA	32.92%	12.07%	2.76%	52.25%
Virginia Beach-Norfolk-Newport News, VA-NC HUD ...	37.15%	11.24%	1.79%	49.82%
Westchester County, NY Statutory Exception Area	70.31%	11.56%	4.37%	13.76%

Note:

The four columns sum to 100 percent and show for each of the top 50 (by population) Fair Market Rent Areas the distribution of listings in four categories relative to whether they were listed at below FMR in the old MAFMR classification and in the new SAFMR classification.

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Essay 4
Shrinking Cities: Fuzzy Concept or Useful Framework?

4.1 Introduction

Aristotle purportedly said that a great city should not be confounded with a populous city (American Assembly, 2011). Yet few people would consider it a sign of particular greatness for a city to over a prolonged period of time lose population. To be sure, a significant strand of North American political economy has been the focus of place-based coalitions consisting of business elites, government officials and major industries banding together to assure preeminence for the local growth agenda (Molotch, 1976), eschewing other often conflicting social and/or environmental agendas (Amin, 2004; Boyer, 2000). Growth is also at least discursively and historically one of the main preoccupations of the planning profession, having been seen as the normal and healthy condition, shrinkage the exception, as evidenced by the focus of planning in the United States to "determine methods to deal effectively with growth and development of all kinds."[1] Nonetheless, a not insignificant number of localities across North America and in particular Eastern Europe are in a situation of population and/or business loss, and this pattern may become a much more prevalent and normal condition to be reckoned with by planners in the not too distant future, including the otherwise invincible towns of the American Sunbelt (**Hollander2011**). In the year 2000, some 45 million people - 15 percent of U.S. population - lived in cities beset by declines in population and employment (Mallach, 2012). Such declines are not new, however. Population loss was fairly commonplace for central cities in the postwar years as American middle classes fled the cities for space and racial homogeneity in the rapidly developing suburbs with the full blessing of the Federal Government (K. T. Jackson, 1985; Beauregard, 2003). But shrinkage is no longer confined to central cities. While suburbs have often been seen as luring financially sustainable individuals causing vast intra-metropolitan inequities (Dreier, Swanstrom, & Mollenkopf, 2001), there is now evidence emerging that suburbs, particularly inner-ring ones, are

[1] See, for instance, http://www.acsp.org/education_-guide/education_and_careers_in_-planning

subject to shrinkage as well, taking us geographically beyond the central city "rust belt" (Hanlon, 2008; Short, Hanlon, & Vicino, 2007; Zakirova, 2010).

Alongside the the emergence of this shrinkage, an academic literature has emerged coming to terms with it. As it is currently coined, the term is fairly inclusive, raising the question of whether it is too much so.

The "consensus" definition for a shrinking city is a densely populated urban area with a minimum population of 10,000 residents that has faced population losses in large parts for more than two years and is undergoing economic transformations with some symptoms of a structural crisis (Zakirova, 2010, my emphasis).[2]

[2] While this is listed as the consensus definitions, some scholars use much larger time horizons when characterizing shrinking cities. Reckien & Martinez-Fernandez use a period of "40–50 years" (Zakirova, 2010).

The geographic context of this scholarship has predominantly been Europe and North America, with focus on processes of economic restructuring and de-industrialization and, in the European case, demographic changes (Martinez-Fernandez, Audirac, Fol, & Cunningham-Sabot, 2012, 2012). There has been some sustained attention to the topic by academics and practitioners, particularly by a number of European researchers[3] but much of the research has been focused on enumerations of population loss over often very short time periods. While these are clearly important milestones in assembling the empirical corpus of knowledge on the topic, more work is needed to chart connections, covariates, challenges, variations and courses of policy action, the division of labor between private and public actors, and, at which scales these might be most effective.

[3] There is an international network of researchers studying the phenomenon under the name of The *Shrinking* Cities International Research Network (*SciRN*), established at UC Berkeley in 2004, and a monograph was issued in 2009, providing a wide-ranging array of articles on the topic.

This paper's aim is more modest: First, to argue for the importance of heterogeneity of expressions of shrinkage, taking Eastern Europe as a launching pad for the discussion, where economic and demographic trends interact to create particularly challenging sets of circumstances of shrinkage. While shrinkage has received sustained federal policy attention in Germany during the past decade, such coordinated action has yet to appear in the American context. The heterogeneity ultimately means that there are many variations on shrinkage, as well as the specific pathways there. Second, the paper aims to offer a sympathetic conceptual critique, mainly focusing on the time dimension, arguing that shrinkage would all other things equal be a stronger concept if it was measured at a wider time scale so as to not be muddled by fluctuations in the economic cycle. A third aim, although this is closely related to the first, is to argue that discussions of shrinkage must be sensitive to the specific genealogies involved of shrinkages in particular spatio-temporal contexts. Before concluding, I will have a few comments on policy.

4.2 Historical and Theoretical Origins

The term "shrinking cities" proper was seemingly first used in a German article by Häussermann & Siebel 25 years ago, written as a commentary to the de-industrializing Ruhr area of Germany where the coal and steel sector, after a formidable boom during the 1960s and early 1970s found itself in a deepening structural crisis of lower productivity, technological change, and international competition (Häussermann & Siebel, 1988). While this was a case of restructuring and decline in what was then West Germany and much of Western Europe across many industries, there is also a significant strand that is associated with the specificity of the post-socialist transition, where the supposed "catch-up-modernization" of market-driven growth and expansion of infrastructure and amenities would often give way to tales of depopulation, industry closure and erosion of services (cf. Grossmann, Haase, Rink, & Steinführer, 2008). The concepts of restructuring and shrinkage traveled well across the Iron Curtain, and with remarkable speed.

There is some variation which calls for distinguishing features specific to the European and American contexts. Chiefly, while some processes clearly overlap, others are highly context-specific, such as what one might refer to as arrested suburbanization in former communist countries which in many cases was tightly restricted until around 1990 at which point suburbanization proceeded in some cases very rapidly (Nuissl & Rink, 2005). This way, the economic restructuring wrought by the introduction of market regimes coincided with significant residential mobility away from central cities as suburban living increasingly became a residential possibility, fundamentally challenging the existing residential geographies of the region. While central city population loss can result from rampant suburbanization, shrinkage in and of itself can accelerate suburbanization, too (Nuissl & Rink, 2005).

On the more economic side, in Marxian accounts, urbanization ties up excess capital, thereby temporarily resolving the issue of capital over-accumulation, avoiding an economic crisis in the process. This infrastructure is, in turn, needed for the (capitalist) economy to function (bridges, (rail-)roads, buildings, telegraphs) and thus serves as a 'spatial fix,' specific to the (accumulation) needs at that particular moment in time, and, by implication, inching closer to obsolescence–or shrinkage–once constructed (Harvey, 1981, 2010). From the perspective of neoclassical urban economics, cities are made up of businesses and residents for whom it is economically optimal and efficient to be in that particular place–if it weren't so, the story goes, they would be somewhere else, moving to optimize their personal utility functions (Glaeser & Gottlieb, 2006). Prices are here the universalizing mechanism adjusting to ensure locational equilibrium, meaning, for example, that desirable, amenity-laden places cost more than undesirable, crime ridden ones. Businesses, for their part, enter to cater to specific markets or access parts of the supply chain; to learn of new markets or business practices and benefit from locating to other businesses in kindred or complementary industries. If markets and products change, the business structure and locational parameters may quickly become obsolete as may be the case in the shift from a manufacturing to an information-based economy. When relying on shipping frequent and heavy materials, locating near waterways is prudent. When buying and selling information, such concerns are less important, which helps explain why we have seen a shift towards amenities as drivers of urban growth commensurate with the presumed increased mobility of the creative set as much as the footloose nature of businesses themselves (Florida & Mellander, 2009; Nevarez, 2002; Wenting, Atzema, & Frenken, 2010).

Regardless of perspective (Marxian, neoclassical, amenities variant), it is not controversial to say that capital is needed to build cities; and that segments related to real estate and finance profit from doing so (Scobey, 2002), and that a city's financial sustainability is ultimately dependent on the presence of markets to sustain it (even if transfer payments from other areas may mask problems for a while). By the same token, the sudden loss of access to such markets, coupled with the exodus of large segments of the tax-paying population heralds tougher times ahead for either the city, region or both.

Breaking Cycles of Decline by "Shrinking to Greatness"

A declining economy puts all manner of pressures on a local community, but there are also "accelerators" which may exacerbate a decline beyond what the economic decline itself would justify. There are many reasons why dramatic population loss is worthy of sustained attention by policy makers. If a population declines, so will the labor pool all other things equal, making it harder to attract new companies as well as decrease the likelihood that a new one might start up in the first place. While we typically connect shrinkage with the urban scale, the problem of shrinkage is not just an urban problem but a drag on the overall economy beyond the sum of its parts due to agglomeration effects unravelling, losing not just the basic industries (the tradable sector), but the services they used to support, or the non-tradable sector. This is the economic multiplier effect in reverse (Moretti, 2012),OSullivan, 2012). The housing market, being a major investment reservoir, further adds to the challenges. If population drops and the housing stock remains constant, or even expands slightly, there will be the threat of a deflationary spiral where households will be disinclined to purchase property because of the expectation of future decline, thus in effect helping to materialize it (Mankiw & Weil, 1989). In addition to this psychological effect, because the housing stock is relatively fixed in the short and medium term, a loss of population is typically not met by a decrease in the housing supply, leading to disproportional drops in price even as wages may only dip slightly (J. E. Gyourko, 2009). Further, some analysts have suggested that abandonment of housing can spread as an epidemic, and, by implication, should be prevented from starting in the first place (Wallace, 1989). At the same time, fixed infrastructure systems made for much larger populations will all other things equal become more expensive to maintain per capita. For all these reasons, it may be costly to do nothing as economic and demographic trends take a turn for the worse. Indeed, some cities have come to recognize the need to accept a smaller demand for housing than during peak times and shrink it accordingly. It is worth remembering that while properly aligning housing supply and demand is clearly a ”housing market problem” and accordingly that reducing the housing stock and downsizing neighborhoods may be a necessary step to avoid further deflationary cycles and to contain service costs, shrinkage is ultimately a problem that goes much beyond the scale and scope of the capacities of any one local government, particularly in former East Germany where problems of depopulation and industrial decline are rampant (Glock & Haussermann, 2004). While expressed most clearly at the scale of each urban area, shrinkage reflects much wider problems in the geography of industrial organization, or what Doreen Massey referred to as spatial divisions of labor more than 30 years ago, arguing that such divisions had national and international scales of operation, and accordingly that regional solutions to economic upheavals would ultimately prove inadequate (Massey, 1979). Such scalar concerns and the implied need for coordinated policy does not mean a local government is entirely impotent with respect to addressing some aspects of shrinkage. The city of Leipzig demolished 20,000 vacant units, and a similar idea is being pursued in Youngstown, Ohio, the only city in America to have a plan for downsizing (**Hollander2011**). This strategy Ed Glaeser referred to as ”shrinking to greatness,” shedding excess buildings to focus on human capital instead 2011b, trying to re-frame loss as a strategic opportunity.

Glaeser’s sentiment here is shared by other observers. For example, Hollander & Nemeth call for a paradigm shift within planning practice towards recognizing that prosperity can be uncoupled from a singular focus on ever-increasing growth (**Hollander2011**; Hollander & Németh, 2011). Wiechmann reports a similar recognition of change in context for the City of Dresden, where the strategic plan is no longer oriented around growth, but rather an attractive, compact center, more efficient services and a stable population closer to the revitalized center (Wiechmann, 2009). Reckien and Martinez-Fernandez (2011) note the great opportunity of re-framing and re-purposing a shrinking city away from polluting industries to more livable and greener cities.

4.3 Variable Shrinkage

The American case of urban contraction has predominantly been viewed as a rust belt phenomenon; an affliction intrinsically connected to the specificities of industrial decline in a handful of rust belt states, so named for the precipitous decline of the steel industry since at least the 1970s. However, the phenomenon has been more widespread, if not as dramatic, as in accounts of the rust belt. A simple counting exercise at the level of counties show that shrinkage in terms of population[4] is relatively commonplace even at a scale of measurement much larger than the typical definition of cities reprinted in the introduction.[5] As expected, the Midwest Census region saw declines at the county level at the decadal time scale most frequently of the four regions, but even the South was declines. Except for the Northeast region, there was substantial variation over time, with the 1980s showing most counties shedding population in all regions. While the last decade of the 20th century reveals that fewer counties saw a loss of population, the first decade of the 21st century shows population loss in more than half of Midwestern counties.

The restructuring has also been much wider than in just steel and raw materials as changes in organizational forms and more distributed firm structures have decentralized much of the country's economic structure away from the earlier strongholds (Frey, 1987) , and the resulting contractions in places such as Detroit, Buffalo and Philadelphia is by now well known. A part of the picture of shrinkage in the American context is also the observation that residents in general are more frequent movers, or "internal migrants" than their European counterparts (Greenwood, 1997). While this may be good news at the scale of the national economy to the extent the moves signal the labor market skill matching process at work (Borjas, 1999), the implications at the local level of such dislocations may be profound.[6] The early 1980s, which saw losses in many counties in particular in the Midwest was also the period which saw domestic migration exceed 20 percent for the first time in 20 years (Frey, 2009). Shrinkage is clearly related to, if not predetermined by, the macroscopic (domestic) migration patterns which have seen the shift of population towards the American west in much of the 20th century. It remains a topic of debate if these migrations respond to employment opportunities or if it is more the other way around, although it seems jobs follow people (Hoogstra, Florax, & Dijk, 2005; Steinnes, 1978; Stevens & Owen, 1982). Migration thus seems to predate growth in employment which may help explain the

[4] Shrinkage by what metric? You seem to be conflating the terms multiple means that you just discussed both as population and as industry loss. Can you clearly articulate what the differences are and then highlight how each type of shrinkage plays out in each of the cases (eastern Europe and the US)? - Ariel Bierbaum, April 2, 2013 9:43 PM

[5] Couties were intended to be a measure of not just whether a central city lost population to its suburbs; i.e. a more internal restructuring. If population was lost at the county level it would suggest a wider and more structural shift.

[6] With major plant closures, it should be added, the implications are profound if there is a large outmigration as a consequence, but impacts may be no smaller if such a migration fails to occur.

appearance, during the past decade, of an increased research focus on amenities for middle class workers in order to explain new spatial patterns in residential and business location decisions, with the perhaps best known being Richard Florida's focus on the rise of the "Creative Class" as a force to be reckoned with, the presence or absence of which acts as a litmus test to the fortunes and prospects of aspiring urban centers (Clark, Lloyd, Wong, & Jain, 2002; Storper & Scott, 2009).

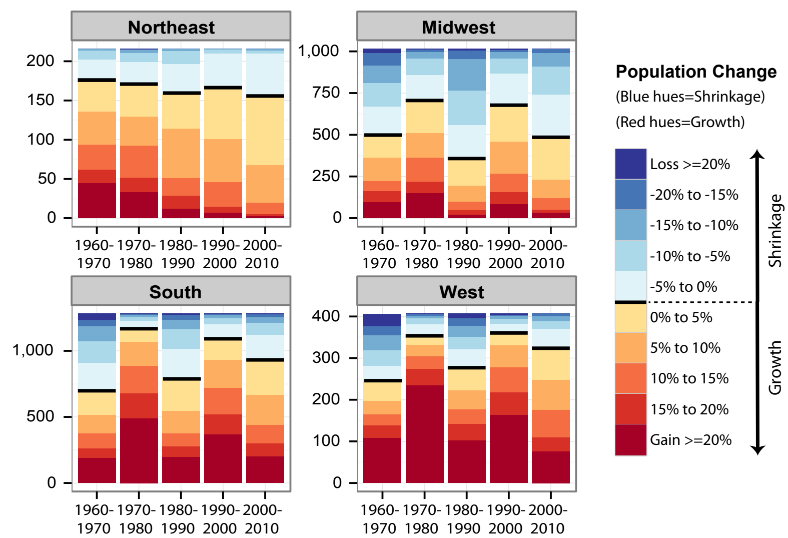

Figure 4.1: Number of US Counties Experiencing Shrinkage 1960-2010, By Census Region

One of the key laboratories for shrinking cities has indeed been Eastern Europe, but it is a laboratory beset with a very specific set of circumstances which must be borne in mind when attempting comparisons. One aspect that has particularly caught the attention of researchers is the post-socialist transition to an array of market regimes across the continent, leading to substantial numbers of bankruptcies, and relocations of businesses and residents across the old Iron Curtain. In the wake of the collapse of the communist regimes following 1989, as mentioned earlier, many regions of Eastern Europe experienced rampant suburbanization, made possible by liberalized land markets and decentralized planning regulations (cf. Brade, Smigiel, & Kovács, 2009), but also widespread population and economic decline, even within small geographical distances. This geographical proximity of growth and decline Wiechmann and Pallagst refer to as "a patchwork of prosperity and decline" (Wiechmann & Pallagst, 2012), a notion also encapsulated in the term "perforated city" (Florentin, 2010), referring to a strong core but with pockets of decline in other parts of the city (see also Kühn & Liebmann, 2007). That shrinkage were to become a widespread occurrence seems inevitable in retrospect, considering the scale and scope of the challenge to extant industries. In East Germany in the six years following the fall of the Berlin Wall, between 70%-90% of industrial jobs disappeared, suddenly not being competitive within the re-scaled context of a larger Germany, let alone Europe (Nuissl & Rink, 2005).[7] Faced with such a cataclysmic restructuring over such a short time span, opportunities for households are limited, and migration forms the household equivalent of the "fight or flight" response. Scholarship in migration tells us that migratory flows respond to both push factors (e.g. a surplus of labor) and pull factors (e.g. greater opportunities elsewhere) (Greenwood, 1985; Todaro, 1969) and helps equalize labor supply across regions (cf. Borjas, 1999; Greenwood, 1997). As it happened, many households did relocate out of the former German Democratic Republic, and by the turn of the century the region had lost some 1.6 million, or 10 percent, of its residents and had more than one million, or 14%, vacant housing units, with half of those being permanently off the market (Glock & Haussermann, 2004; Lintz, Müller, & Schmude, 2007). To the German federal government, it was clear that this was a problem of national urgency and scale that wasn't going to go away on its own, and thus requiring a longer term strategic and coordinated partnership across levels of government to address. Federal officials had long expressed the preference of balancing growth in the core with peripheral cities pursuant to an overall principle of national spatial cohesion (Wiechmann, 2009). The German bundesregierung responded with a 2.5 billion Euro, eight-year restructuring program of its own, Stadtumbau Ost ("City Rebuild East"), the core of which was to restore the attractiveness of the region's cities and stabilize housing markets through demolishing some 300,000 housing units across 400 participating municipalities, and the evaluation report issued in 2008 noted that the region had witnessed population growth, however slight, instead of a loss, and that a more cross-sectoral, integrated urban development policy had been established, leaving a better set of institutions to deal with the challenges of shrinkage moving forward (Bundesministerium für Verkehr Bau und Stadtentwicklung, 2008).

[7] The effects on the collective psyche of a nation of overnight irrelevance of an old system of doing things was captured in the satirical film Goodbye Lenin! from 2004.

Demographic Interactions

At the most basic level, countries and their planners need to reckon with the demographic identity equation in order to provide services, public and private, whether the issue is aging, immigration imbalances, or baby booms. All these society-wide challenges become even more salient at the local and regional level where infrastructure is actually built and services provided (Müller & Schiappacasse, 2009).

It is evident from the demographic identity above that a change

$$\text{Population}_{t+1} = \text{Population}_t + \text{Births}_t - \text{Deaths}_t + \text{Immigration}_t - \text{Emigration}_t$$

in the ratios of birth to death and immigration to emigration will condition the size of the population at any given point in time, and that each of these are in turn the result of somewhat distinct processes and policy interfaces. Thus, while the net effects–lower population in cities–may be the same, the pathways may be quite varied. A drop in population, it follows, may be attributable to in turn a decline in fertility rates (aging population); an increased rate of mortality (younger population); a larger emigration rate and a decreased immigration rate (aging population). The same net relation can be achieved either through a situation of low births/deaths or the converse, high births and deaths. These components may each be related to ongoing economic changes–with strong economies tending to attract migrants, weak ones repel them, all other things equal, but migration patterns need not mirror fertility patterns. A region can certainly witness dropping fertility, but strong in-migration, in which case the workforce may still be growing in the medium term.

While mortality rates have not changed significantly in Eastern Europe, the region have witnessed drops in fertility rates to levels "unprecedented in human history" in relatively short order (Mykhnenko & Turok, 2008). However, the "second demographic transition," the process of destabilization of traditional patterns of marriage and more fluid life trajectories and single households (Buzar, Ogden, & Hall, 2005) had already begun in earnest well before the fall of the wall (Florentin, Fol, & Roth, 2009), and falling birth rates are by no means specific to Eastern Europe but are common throughout Organisation for Economic Co-operation and Development (OECD) countries, and beyond (World Bank, 2013). This suggests that declines in fertility is more of an "across-the-board"-effect at work in many regions rather than the specific cause of decline or shrinkage. Still, it compounds problems of economic upheavals and population losses at several time scales, leaving a potential time bomb for some affected cities, set to detonate in earnest in a generation or so, barring major changes to migration patterns. This suggests the contours of an inter-generational interaction between (post-socialist) restructuring and urban shrinkage in which the scarcity of children today will compound the urban challenges of tomorrow. These demographic shifts coupled with the onset of "post-socialist suburbanisation" in much of Eastern Europe (Brade et al., 2009) and in the former East Germany (Buzar, Hall, & Ogden, 2007; Nuissl & Rink, 2005) further still compounded the effect on the central cities, with echoes on the patterns seen in US cities in the postwar years (Weaver, 1977). Together, outmigration, changes to fertility, and even changes of the mean age of child bearing can lead to substantial mismatches between the housing stock and the demand for it (Bongaarts & Feeney, 1998). Not surprisingly, and notwithstanding the prominent role of industrial restructuring, demographic forces has been seen as a key component of the overall landscape of urban change in Eastern Europe.

4.4 Emerging Geographies of Shrinkage in the US

As suggested on Figure 1, an interesting new twist has appeared in the analysis of shrinking cities in the work of a few scholars. In the past decade or so, we have seen reports of shrinkage not just in the rust belt, but in the otherwise hot market areas of the so-called "sun belt" states, commonly defined as states below the 37th parallel ((Hollander & Németh, 2011; Wiechmann & Pallagst, 2012). Wiechmann and Pallagst offer a wide-ranging survey relating shrinkage to the broader (re-)structuring imperatives of globalization of production. They interpret shrinkage not so much as a matter of suburbanization hollowing out a central city as in the postwar contractions, but rather as expressions of "problematic development paths" and larger societal transformations in Europe and the United States wrought by the process of globalization in one of two processes: the decline of manufacturing, on the one hand, and the so-called 'post-industrial transformations of a second generation,' referring to more recent dislocations in the high tech industry. They map 20 shrinking US cities and show, in the top five, Detroit, Cincinatti, New Orleans, San Francisco and Flint.[8] While arguably made to be fairly comprehensive and to not just anecdotally select "known shrinkers", inclusiveness in this case appears to diminish both the analytical and descriptive value of the shrinking cities concept by grouping together cities as diverse as San Francisco and Detroit in the same category. In a similar study seemingly based on the same data, (Pallagst, 2009) prints the same map of 20 shrinking cities with San Francisco at number 4 but doesn't include San Jose on the list, but proceeds with a case study of its shrinkage based on short term contractions in employment following the dot-com bust around 2000. The question remains, though, what such a listing tells us?

[8] It is not entirely clear whether the study refers to shrinkage in employment or population, or both, or whether the geographical designation refers to the Metropolitan Statistical Area (MSA), *Core Based Statistical Area* (CBSA) or city.

4.5 Challenges to the Concept: Temporal and Definitional

In this section I take issue with this very analytical time scale, but also with a conceptual problem. But first the temporal dimension. There are two issues with this particular usage. Perhaps the most important one, the data cover the period from 2001-2004 half of which coincides with the 2001-2002 recession. While shrinkage can be observed at any (spatio-)temporal scale, I would argue that analytical usage should be based on more structural changes, as opposed to cyclical volatility. This does not imply that structural forces are not at work in the short term–surely they are–but my critique here is more practical: If we adopt the short term cycle as the temporal standard as per the "consensus definition" quoted in the introduction, we could well end up classifying many of the country's urban areas as shrinking every 7 years or so, serving to diminish the concept's usefulness for analytical and policy purposes. Moreover, taking into account changes in household size in San Jose, which has been declining over the same period and thus all other things equal entails fewer people in the same number of units–the effect of shrinkage largely disappears as noise: While the rate of population decline was at about two per thousand in 2002 and 2003, the number of occupied units appears to have increased over the same period at a rate of 7 per thousand to 1 percent (California Department of Finance, 2013).

The second issue is one of context and exposes one of the limitations of a label that Wiechmann and Pallagst themselves note in the same paper: that shrinking cities have "many different attributes". Case in point: By 2004 at the end point of shrinkage included in their data, both the San Jose-Sunnyvale-Santa Clara and the San Francisco-Oakland-Fremont MSA's were in the national top 5 on the regional GDP metric. While even tall trees can fall, the contexts are so different as to only marginally be related to the same underlying processes discussed earlier, even allowing the distinction to manufacturing decline Pallagst and Wiechmann made with respect to the 'post-industrial transformations of a second generation', reserved presumably for just such cases as those in the Bay Area to make the concept 'fit'. Ultimately, a concept that seeks to encapsulate places as different as San Jose and Detroit in the same top five list is hardly descriptive let alone analytically relevant or useful as a heuristic, and all but meaningless for policy prescription purposes. It appears to meet the requirements for the labeling of a "fuzzy" concept (Danson & Markusen, 2007), and that is a pity, given how arguably important it is as a lens for understanding the spatiality of current restructuring processes. In sum, there is clearly a story about recessions and their at times dramatic effects on cities, even in boom towns, but I would argue it is a different story entirely–and a compelling one at that–conceptually, analytically, practically and politically from that of a shrinking city.

Conceptual Considerations/The Analytical Dilemma

To rank cities in such different social, economic and geographical contexts by shrinkage extent is only useful insofar as it disabuses us of the notion of shrinkage as an issue strictly associated with erstwhile steel towns. Still, it is a bit like the doctor seeing a patient with a cough, proceeding to prescribe antibiotics without asking whether the patient has a simple sinus infection, pneumonia or a more serious underlying autoimmune disorder. It raises an analytical dilemma: Should shrinkage as a classification measure or and/or typology be applied to encapsulate a descriptive state of being (i.e. population or job loss) regardless of the underlying set of causes? Or should it be tightly construed and associated with specific ”genetic” conditions leading towards an outcome observed as shrinkage? In other words, should it be weighted towards process or outcome? And what are the analytical (and policy) consequences of each stance?

If we have an inclusive term (which I will use to refer to the case where shrinkage is applied to any shrinkage in spite of the specific genealogy involved) as I would say captures the usage of Pallagst and Wiechmann, and to some extent Hollander and Németh (2011), we run the risk of identifying what could be called ”false positives”, or a concept which ultimately becomes too amorphous to have a specific analytical and practical meaning. If we conversely favor a narrowly construed term, the risk runs in the other direction; namely the identification of false negatives, of failing to appreciate that there is no inherent reason that only cities in the rust belt should see structural economic and demographic changes. A mere change in latitude or weather does not an economy make.

Which ”risk” one is more inclined to choose will depend on the specific analytical purpose. If one were crafting federal urban policy along the lines of the Stadtumbau Ost, erring on the side of inclusion might be prudent, although it increases the requirements of the program if it were to address a wider array of conditions of shrinkage. Perhaps there may be instructive lessons to be had by thinking of urban transformation not so much in descriptive terms–this city is growing, or that city is shrinking–but rather in analytical terms giving more credence to the sub-components of the flows and circuits with respect to which a city is situated, which ultimately become manifest as a change in population or economic activity. I am here thinking as an example of how medical conditions are typically classified by the organ or subsystem involved (such as respiratory; digestive; nervous systems) as an organizing principle (World Health Organization, 2010). Another approach is that used in the North American Industrial Classification System (NAICS), which in the middle of the 1990s was introduced in order to better reflect cross-border trade (NAFTA), an increasingly service-based economy and, most important for our purposes, the shift to a focus on related process of production rather than the product produced (Office of Management and Budget, 1999). While this process focus is somewhat incongruous with the IDC-10 classification of diseases mentioned above, they both capture the key dimensions of variability in their respective domains. An analogous parsing of the domain of shrinkage (or growth) would add some analytical precision, while allowing a flexibility in terms of time and space.

Is the concept adequately flexible and meaningful for allowing us to use it in different contexts if it is still so generic? I concur with Großmann et al. in their call for "developing a qualitative typology [consisting of] shrinking cities which have a similar complex of causes and consequences (Grossmann et al., 2008), with a particular focus on the long term loss of population. Strategies and interventions will depend on the underlying causes, whether economic, demographic, short term or more structural. For this reason we need to carefully distinguish the types of shrinkage and less see it as a unifying phenomenon but as a multi-faceted expression of a number of different processes, some of which are related to globalization, some to demographic processes, but all to some economic and geographic restructuring process. Policy contexts and governmental structures are clearly substantially different in the European and the North American cases. However, as the economic system is increasingly globalized (Dicken, 2003) we should expect to see more shrinkage, and the public policy rationale for addressing it will only increase with time.

4.6 Discussion and Conclusion

Cities grow while others decline, even if it may represent a break in how planners think of their roles as stewards of the development process. The shrinking cities discourse has become a strong presence in urban studies, and there is an increasing recognition that there is a challenge which requires some sort of coordinated action, even if this recognition is more advanced in Europe than in the United States. A number of studies have emerged which have started to go beyond the descriptive and contextualize the numbers, including case studies for specific geographic contexts. This is necessary starting point if we are to entertain ways to address this as a matter of policy. For while we may need the overall map(s) of shrinkage(s) to identify uplinks with national policy and thus where a national policy framework might be appropriate,[9] demographic processes of fertility, migration along with economic conditions vary tremendously at the local level and need to be at the forefront of any policy proposal. That local conditions vary does not mean shrinkage should be thought of as a mere local problem, or that the scale of intervention is necessarily exclusively found at that scale. For this to be the case our cities would have to be far less networked in terms of industry and labor markets than they actually are (Castells, 1996; Massey, 1979). As it is, a region's livelihood is considerably determined by decisions made elsewhere.

In Eastern Europe, populations are forecast to shrink in several countries by 2050, and economic restructuring in the context

[9] Joseph Stiglitz, former Chief Economist at the World Bank once said that [i]f there is a single accident on a road, one is likely to look for a cause in the driver, his car, or the weather. But if there are hundreds of accidents at the same bend of the road, then questions need to be raised concerning the construction of the road itself (Amin, 2004; Boyer, 2000). The "accidents" are of course in our usage, shrinking cities.

of globalization appears to be there for the long haul which will keep on challenging existing and established spatial fixes, existing infrastructures and built landscapes. Often, problems will be compounded by their co-presence. For example, regions that are shrinking and / or deindustrializing will also have trouble attracting in-migration. The demographic challenge is a fundamental one in regions of Europe and beyond where the total fertility rate has fallen dramatically below replacement level. Cities are here faced with not only economic upheavals, but smaller populations to carry the increasing per capita costs of running large sunken-cost infrastructure systems.

In the United States, on the other hand, the problem is more one of economic restructuring more so than it is about fertility declines; the demographic patterns are much different than in Eastern Europe, with both higher fertility rates and larger foreign in-migration, even if migration is highly geographically selective as it largely bypasses shrinking cities.

On the conceptual side, the new geographical mappings from some researchers revealing shrinkage beyond the rust belt are an important addition to the existing scholarship and, in effect, a wake-up call for planning practice. The message from that call is that growth is not perpetual even in the US Sunbelt states, but that that changing economic fortunes also brings strategic opportunities for realignment, re-framing and a recognition of the necessity of downsizing if the conditions call for it, and getting beyond the 'stigma' (Beauregard, 2003) of shrinkage. Hollander coined a pendant to smart growth, but in the reverse–smart decline, and similarly identified the need, still very much pronounced in the US context, of planners to recognize that all is not growth (Hollander & Németh, 2011). This certainly seems to be necessary from a planning perspective as one of the very first steps, even if economic development offices will continue apace to seek new businesses and residents, although as noted, this type of analysis tends to essentialize planning as the key domain, and the local government the appropriate scale, of addressing problems of shrinkage, which seem likely to come up short as a matter of national urban policy, which was certainly recognized in Germany. There is, however, some increased urgency by at least academics and prominent policy forums, including the American Assembly, a public policy group founded by President Eisenhower in 1950 and now affiliated with Columbia University, which made the issue of shrinkage the topic of their 110th meeting in 2011 (American Assembly, 2011). It is perhaps worth noting that while the latter fully recognizes the imperative of shrinkage, the focus is decidedly on "changing the investment climate" and attracting businesses and residents anew, which, to be sure, is "the old" model. And while there is clearly a message for state and federal governments in changing the framework for how regions grow; how land and property is taxed; income is shared, much of the message appears to be directed towards the local level, with the seeming implication that it is a problem which has, or must have a local solution, given the right visions, partnerships, and resources. This may de facto be the status quo–localities are ultimately on their own, and no government has the power to fundamentally reverse the economic tide, certainly in the long term. But to settle for this is to ignore that a myriad of policies and politics, including at the local, but also regional to national scales, constantly assert pressures and enticements for jurisdictions to relocate a business, lure with a tax break, enter a ”right to work”-state and minimize costs, at all costs. Given that the number of businesses that actually relocate is dimishingly small during any given year (Kolko & Neumark, 2007), and finding of Bartik that the benefits of business incentives are typically smaller than the costs (Bartik, 2005), the focus and incentive monies would be better on nurturing home grown businesses and the long term educational infrastructure that supports it, rather than luring them from elsewhere.

My conceptual critique pertained to a number of studies of the Sunbelt, each based on very short study horizons. I argued that the concept has been stretched to include situations and cities far too diverse and heterogeneous based on far too little or short term data to be meaningfully captured by any singular concept. In particular, Hollander, Pallagst, Schwarz, and Popper (2009) reports, with a map showing top 20 ”shrinkers,” with San Francisco sandwiched at number 4 between New Orleans and Flint, the ”perhaps atypical” case of San Jose, California after the burst of the dot-com bubble in the early 2000s. While the condition of shrinkage was observable in a strict sense of jobs vanishing overnight and what can only be described as a marginal population decline, I argued that it makes the concept too fuzzy if it is to encompass all drops in population and/or employment, however short (i.e. within one economic cycle) and however caused (over-building vs de-industrialization), even if it might ultimately make it easier to assemble political support if it is seen as a wider and thus shared problem across the nation’s cities. I then went on to discuss whether the concept would be most useful as a narrowly or broadly construed term, with the former risking false negatives, i.e. overlooking emerging nodes of shrinkage, while the latter entailed false positives, i.e. counting too many cities as shrinking, watering down the concept and the scope for political intervention.

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Overall Conclusions

In this dissertation I explored different aspects of the urban map as cities change, sometimes by planners, but often by larger economic processes largely outside the control of individual actors, certainly planners, acting with relatively mundane tools such as zoning.

In the essay growing the region, I traced decades of projections work as a window into planning practice and found that the work–along with the planning practice–has become more visible and assertive in tandem with changes in state policy towards regions. Projections blend a variety of forms of knowledge and while there is much focus on big data and quantitative models and reproducibility, planning has a design- and future-focused part of its DNA, precluding the projections work becoming a technical exercise alone. Projections, as planning in general, fits squarely in the more collaborative planning practices that have emerged in recent decades, and it is all the more important to support this transition given the much more free flow of information in today's planning context.

What planners do is something I take up again with the chapter focused on infill development and housing supply where in the context of the very realignment that changed the base conditions for doing projections work also realign regional planning towards a more activist and infill-focused planning practice. As that happens, more growth is expected by regional planners to fall in existing urban neighborhoods, prompting practical and certainly political questions about price effects. In recent years, a practical and to some extent academic debate has arisen about the wisdom of producing market rate development in high cost areas, as concerns about gentrification and displacement permeate many discussions of regional housing policy. While some argue that market rate development in and of itself serves as a catalyst for gentrification, others suggest new supply is invariably part of the housing puzzle, along with stabilization and preservation. I investigate empirically whether spillover effects, or rubbing off effects from building can be documented and quantified, following such reports from Singapore. I found mixed evidence, with both negative effects suggesting new supply lowers prices, but with some heterogeneity with respect to size and price tier developed.

Urban housing markets change also as a function of federal housing policy. For the lowest income residents, what matters is not just such neighborhood-scale dynamics, but how policies governing subsidies are set in Washington. One of the most successful programs is the housing choice voucher program supporting 2.4 million households nationwide. The program relies on a map for each metropolitan area showing the upper limit for how much subsidy will be available. As those maps set one level for a metro area, it meant many neighborhoods were effectively off limits, leading to households caught in the areas of least opportunity. A policy change in 2016 meant some regions transitioned to a much more fine grained map of subsidies, allowing it to track much more closely actual price changes, meaning a new map of where subsidies can go. We evaluate this change using data from Craigslist, and account for the number of households who can now move into higher opportunity neighborhoods.

Lastly, we examine the urban map from a different vantage point; namely that of the absence of growth as is characteristic of shrinking cities. As national economies realign supply chains and sometimes rapidly in the context of changing trade agreements and and associated local comparative advantages, population flows to some extent reflect such macro-economic changes, and cities become the sites where such shifts are keenly observable. As the interest in shrinking cities has grown and come to encompass cities beyond the rust belt, I engage the conceptual discussion, arguing the concept is at risk of being too watered down if it includes not only "legacy" cities such as Flint, MI, but also San Jose, CA, the heart of silicon valley, which momentary lost population after the 2001 dot-com bust. While having a wider map of shrinkage is welcome, I argue the concept ought to be able to better distinguish cities according to their trajectories and base conditions, lest it lose policy relevance.

The urban map is changing at different geographic scales, from the macro-level national urban shifts, to the within-neighborhood dynamics of growth and decline. This dissertation has explored a few of these under the wider umbrella of urban political economy.