Essays in Economics and Institutions

by

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A dissertation submitted in partial satisfaction of the
requirements for the degree of
Doctor of Philosophy

in

Economics

in the

Graduate Division

of the

University of California, Berkeley

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Fall 2010

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Abstract

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This dissertation incorporates institutional analysis in the examination of a number of questions that are relevant for the economic literature, touching on issues of public policy, demography, transition, and organized crime. It is composed of three chapters that can be read separately. First, I evaluate the nexus between public works expenditures in post-war Italy and internal migration. Using nonlinear differences-in-differences, I present evidence that one of the goals of the *Cassa per il Mezzogiorno*—mitigating out-migration from the South of Italy—was, at best, a failure, and possibly exacerbated the problem. This evaluation is relevant for public policy that aims to address differentials between regions. Next, I re-examine the common finding that institutional quality is a determinant of foreign direct investment (FDI) in the context of transition economies. Using various measures of institutional quality, I find that more parsimonious and more commonly used models in evaluating FDI suggest that the previous findings are sensitive to specification. While this should not be considered as falsification of the notion that institutional quality is important in attracting FDI, it is a cautionary tale for those attempting to incorporate institutional measures in their work. Finally, after a careful consideration of the institutional environment of the Mafia in Italy, I propose a simple game-theoretic model to explain violence as an equilibrium outcome in such organizations.

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Chapter 1

Public Works and Interregional Migration in Post-War Italy

Abstract

Italy's *Cassa per il Mezzogiorno*, or Southern Development Fund (SDF), sought to address gaps between Northern and Southern Italy, among them the large flows of migrants from the South to the North. This paper employs the conditional logit framework of Davies, Greenwood, and Li (2001) to identify the role that public works plays in migration choices. In contrast to GDP, public works expenditures are found to enter as a repelling force, although these results are weakened with a cluster-robust approach to standard errors. Similarly surprising is the finding that a policy shift, changing the focus to direct planned industrialization, *exacerbated* out-migration from the South, notably South-to-North migration.

1.1 Introduction

This paper seeks to address the question of whether and how public works affect migration in the context of a case study of the *Cassa per il Mezzogiorno* (Southern Development Fund, SDF henceforth). Although similar to the welfare magnet hypothesis, whereby potential migrants (notably poor migrants) choose the region with the greatest welfare entitlements (Allard and Danziger, 2000; Levine and Zimmerman, 1999; Lurie, 1998; Peterson and Rom, 1990; Berry, Fording, and Hanson, 2003), this paper evaluates the effectiveness of a public works project via one of the symptoms of the underlying problem: migration. For example, did public works expenditures in a region mitigate the propensity to leave that region (as was part of the motivation for such spending)? The initial focus of the SDF was so-called "pre-industrial" development, including infrastructure and reclamation projects. A significant policy change occurred in 1960 after policymakers determined that the desired results were

not materializing. The focus of the SDF then shifted toward direct planned industrialization in the South, an important policy shift in an already considerable public works program. This paper uses two measures to discern the effect of public works and compares the measures that arise from a linear model with those that arise from a non-linear model. The first measure is the marginal effect of public works expenditure on migration and the second is a differences-in-differences approach, focusing on the effects on migration due to a policy shift that occurred in 1960.

The SDF was an ambitious and large public works program instituted in the South of Italy after the Second World War. One of the goals of the program was to reduce South-to-North migration, a symptom of the chronic differences between the North and the South of Italy. Expenditures devoted to the SDF averaged 0.8 per cent of Italy's total GDP annually and, for the Southern target regions, they averaged between 3.5 per cent and 3.9 per cent of GDP annually (Podbielski, 1978). By comparison, total spending on the United States Interstate Highway System, the largest public works project in the United States, constituted about 3.5 per cent of a *single year's* GDP (that is, the entire decades-long project could have been funded with about 3.5 per cent of a single year's GDP). Annual spending on the Works Progress Administration, a program largely identified with the New Deal, constituted less than one-fiftieth of one percent of GDP per year. Total spending on New Deal programs from 1933 to 1940 averaged less than one per cent of GDP annually. Figure 1.1 shows public works expenditure as a percentage of GDP in both the North and the South, demonstrating the great difference in public works expenditures in the two regions, largely accounted for by the SDF.

There is a large and ever-growing literature on the differences between the North and South of Italy; research institutes in Italy such as CRENOS, SVIMEZ, and the Bank of Italy continue to explore past and current differences between the North and South of Italy. While much of this literature is a testament to the magnitude of the SDF, the overall conclusion is that the SDF failed to eliminate the differences between the North and the South, or somewhat less ambitiously, to even significantly reduce the differences between the North and South. More generally, examination of the effects of public policy is common, including public policy that is intended to improve the prospects for target regions (Bartik, 1991; Glaeser and Gottlieb, 2008). In this respect, the SDF can be seen as a brave and substantial effort to counter the agglomeration effects experienced in the industrial centers in the North.

Migration has long been seen as an equilibrating force, mitigating, for example, labor shortages in the North and excess labor in the South or wage differences across regions (Harris and Todaro, 1970; Rostow, 1991), or, at the very least, being responsive to such differences (Barro and Sala-i-Martin, 1992). The SDF was adapted to address migration after an initial period of "pre-industrial" development spending not only failed to mitigate gaps in output and income, but also saw a great increase in migration from the South to the North (Podbielski, 1978; IBRD, 1965). However, the persistent differences between, for example, GDP and migration in the North and South of Italy and the public policy attempts to close such gaps, raise the question of public policy's ability to affect migration.

Figure 1.1: Public Works Expenditures as Percentage of GDP

This paper models migration behavior as the result of human action to maximize utility, using components of a gravity model for migration within a conditional logit framework to analyze the effect of public works expenditures on migration. In some cases greater public works expenditure at the region of origin is found to increase out-migration and, likewise, greater public works expenditure at potential destination regions is found to decrease out-migration to such potential destination regions. However, this finding is sensitive to specification and to the application of the multi-way clustering approach to standard errors. As such, this otherwise surprising result may be dismissed as insignificant. However, the change of focus to direct planned industrialization is found to have exacerbated out-migration from target regions. The overall conclusion is surprising in that, while public works are meant in part to decrease out-migration from lagging areas, they may, in fact, contribute to out-migration. The prevailing finding of gravity models of migration (as well as the dominant view) is that GDP is a force that attracts potential migrants to potential destinations and retains potential migrants at the migrants' origin. The results of the conditional logit estimates are consistent with this, suggesting that the surprising results are not spurious. Furthermore, robustness checks based on various specifications, including a linear logit model, confirm the findings. Bootstrap methods further reinforce the validity of the results.

A unique approach to robust standard errors is applied, using multi-way clustering as suggested by Cameron, Gelbach, and Miller (2006). It is this approach to standard er-

rors that renders the positive relationship between public works expenditures and migration insignificant. Within this same framework a differences-in-differences approach is applied, focusing on (1) the difference in out-migration in general before and after the policy shift and (2) the difference in out-migration to the North from Southern regions before and after the policy shift. The results are robust to specification and even with multi-way clustering for robust standard errors, the results remain significant. These findings suggest that the policy shift exacerbated out-migration from the South, in particular, out-migration from Southern to Northern regions.

These counter-intuitive results may be a result of a number of factors. For example, it may be the case that institutional development was worsened by the massive intervention. The subsequent deterioration of institutions may have then prompted the exodus. The intervention, directed largely from a centralized bureaucracy, may have prompted the substitution of—rather than the supplementation of—institutions in the South. In a region in which institutions are commonly acknowledged to be deficient, this possibility requires careful consideration (Banfield, 1958; Putnam, Leonardi, and Nanetti, 1994; Levi, 1963; Gramsci, 2006). Moreover, uncertainty regarding the institutional framework may have been a contributing cause (e.g., uncertainty arising from the expropriation of land and the imposition of changing requirements on new landholders (Dickinson, 1954; Camarda, 1999)).[1]

Another possibility is that the results are merely an artifact of the targeted intervention. The SDF was directed at the Southern regions precisely because of the South's poor performance, part of which is reflected in the large out-migration flows from the South. Furthermore, an initially poor institutional framework, whether made worse or not, may have simply blunted potential positive effects that may otherwise have occurred in the presence of a better institutional framework. However, a number of controls, various specifications, and robust standard errors provide reassurance that the results, however counter-intuitive, are not spurious.

The question of the possible impact of public works programs on migration is important for policymakers who wish to understand how their methods affect one of the outcomes they wish to address. This paper's findings are somewhat surprising in that they indicate that public works have an undesirable effect on migration, at least from the typical point of view of policymakers; that is, there is a positive relationship between a public works project that focused, in part, on mitigating out-migration and out-migration itself. Or, in other words, this well-intentioned shift in the focus of a massive public works project acted as a force of repulsion rather than one of attraction. This suggests that the nexus between public works and migration deserves greater attention by policymakers and researchers interested in these topics.

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[1]Temin writes that, "There have been endless analyses of individual economic policies; there has been little attention to changes in policy regimes" (Temin, 1991). The numerous policies that constituted the *Cassa per il Mezzogiorno* might be thought of as an on-going policy change.

1.2   Related Literature

The question addressed in this paper is similar to an early study of Rodgers (1970) who studies the influence of industrial development on migration. He asserts that (government-stimulated) industrial development is "possibly the most important single force" affecting migration and that the slowing of migration from the South is attributable to government intervention. The empirical analysis, however, is limited and misses the joint downward trend of migration flows and public investment over a longer period. Most of the analysis is graphical; regressions are simple, usually indicative of correlations rather than causation. The author explains the importance of industrialization because of its role as the primary target of subsidies and the primary source of employment opportunities. The author's assessment is quite typical of the sanguine evaluations of the SDF at the time.[2]

Krugman's (1991) seminal article in the New Economic Geography (NEG) introduced a simple means of explaining the endogenous development of core and periphery regions which aptly describes the North and South of Italy. Crozet (2004) employs a NEG framework to consider the influence of agglomeration effects on migration. Crozet borrows the analytical framework of Hanson (2005) based on Krugman's (1991) model. Crozet concludes that there is sufficient evidence that market potentials do, in fact, have an effect on migration. Crozet also asserts that a "sudden emergence of a core-periphery pattern is unlikely within European countries," (Crozet, 2004) while ignoring pre-existing disparities such as that in Italy.

In studies of Canadian internal migration, Day (1992) finds that inter-provincial migration is influenced by government spending, while Islam and Rafiquzzaman (1991) consider not only the effects of government spending, but also of taxation, on inter-municipal migration. Another more focused study in this vein is that of Ellis, Barff, and Markusen (1993), in which the authors study the pattern of the migration of labor and defense spending. The present paper is similar to such studies, but differs in that the public expenditures in this case were intended to both directly and indirectly affect migration.

More broadly, the question under consideration falls under the rubric of public economics; more specifically, it deals with one of the effects of public policies that focus resources on particular regions with the intent of either directly or indirectly creating growth and development in the target region. In this regard it is similar to questions raised by authors such as Glaeser and Gottlieb (2008) and Bartik (1991). This paper asks how place-making policies affect a specific outcome that is considered to be a symptom of divergent paths of development.

This paper contributes to the literature by directly analyzing the causal relationship between public policy—specifically public works and development projects—and inter-regional migration. This area is important for several intertwined reasons; it considers the role that public policy plays in the individual's utility maximization decision. That is, it is a study of

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[2]Other contemporary optimistic evaluations include Carey and Carey (1955), Davis (1959), Hildebrand (1955), La Malfa (1953), and McNee (1955); cf. Saville (1965) and Diem (1963) for more measured contemporary views.

a potential so-called determinant of migration, contributing to the literature on migration. Furthermore, it a case study of a large public works policy and the effects of this policy on migration. As such, this question should be of considerable importance to policymakers. Furthermore, it is an analysis of so-called place-making policies and their effects on what is seen as a symptom of an underlying problem that such policies are meant to address.

1.3 The *Cassa per il Mezzogiorno*

After the Second World War, Italy took measures to address the divide that had long existed between its economically vibrant Center-North and its backward South, or Mezzogiorno (Carlyle, 1962). Measures taken earlier in the century had been cut short by the onset of the First World War (Zamagni, 1993). Following the First World War, the "Southern Question" gained more attention from intellectuals such as Antonio Gramsci (2006). However, the South did not get much attention from the central government in the interwar period. Levi (1963), in *Christ Stopped at Eboli*, writing about a year spent in internal exile in a Southern Italian village, describes the surprise of finding a "monumental" public toilet with four compartments delivered from Turin. The toilet, however, was never properly installed and was used by only by livestock (to drink from it) and children (to float paper boats in it). The adults used it only as a perch from which to watch the fireworks on a feast day celebration. In this account—and many others—Levi suggests that not only was the South neglected by the central government, but that the Southerners lacked the institutions to address their own problems.

Such observations are repeated in studies such as Banfield's *The Moral Basis of a Backward Society* (1958). It was Levi's book, however, published after the war, that helped to bring greater attention to the South. Levi's account opened the eyes of intellectuals and non-intellectuals alike to the often shocking differences between the North and the South. Figure 1.2 gives a clear view of the on-going difference in per capita GDP between the North and the South that was already well-known at that time. However, it was the revelations of the general backwardness of the South that prompted many to action.

In addition to the historical gap in performance, the Center-North regions were also concerned with the issue of migration (LaPalombara, 1966). Migration was a double-edged sword: From the industrialists' point of view it served to relieve any labor shortages that may have otherwise occurred and put a check on labor costs; Northern laborers' perspective was, naturally, opposite to this. They saw migration as a downward pressure on wages and employment opportunities. Other considerations of migration were more cynical, with some Northerners' (as well as some other Europeans') prejudiced view of Southern Europeans. In short, they were motivated by the desire to keep the Southerners in the South. Regardless of the motivation for the SDF, the possible effects (intended or not) of policies directed, in part, at mitigating out-migration from the South deserve attention. This is especially true for the shift in policy in 1960, taken in part because of the increasing migration from
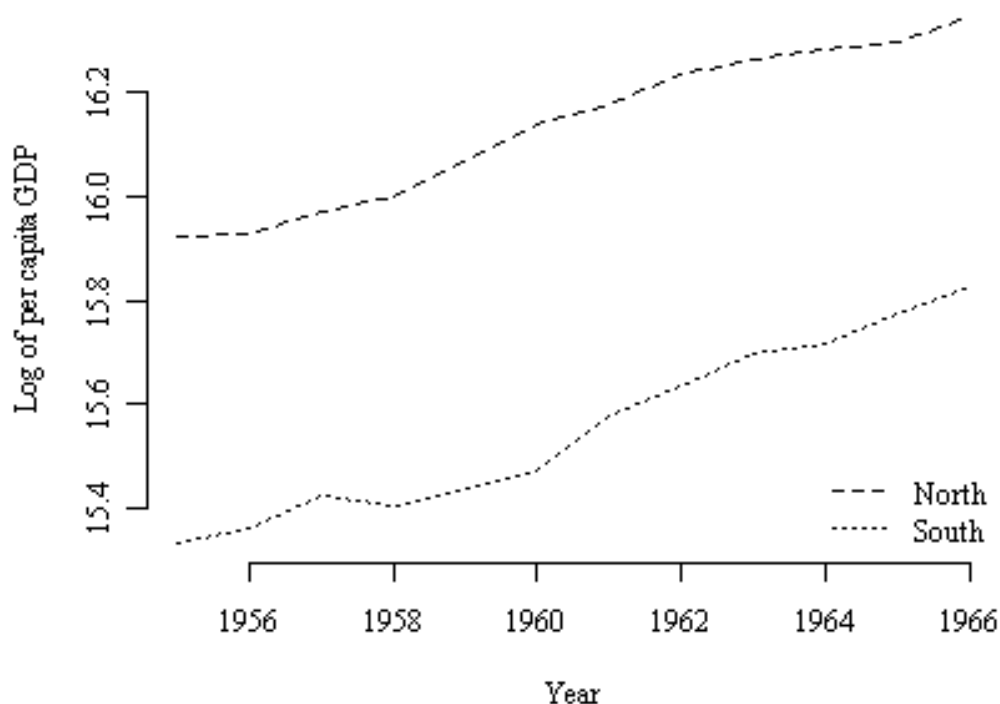
Figure 1.2: Log of per capita GDP

the South (Podbielski, 1978). Figure 1.3 shows out-migration from both the North and the South over the period 1955 to 1966.

The *Cassa per il Mezzogiorno*, or SDF, was a massive undertaking intended to address the myriad of issues that contributed to a general lack of convergence between the North and the South (La Cassa per il Mezzogiorno, 1955). The chronic differences between the North and South stem from and are perpetuated by a wide variety of natural and historical sources. The territory of the South suffers from inadequate natural water sources, which contributed to lower agricultural development in the South (IBRD, 1955, 1958). The presence of malaria in the South was not uncommon in the early post-war period; fighting malaria was an ongoing concern for some time (IBRD, 1956). Furthermore, peasant settlements were concentrated due in part to the past prevalence of pirates and bandits in the countryside. Combined with poor roads and difficult terrain, peasants were often forced to live several hours from their fields.

The transition from feudalism was impeded by a number of factors, including the development of latifundia, successive periods of foreign rule, and a general lack of development of civil society. Even unification brought further difficulties to the South, including the imposition of personal taxes, resulting in disproportionally higher tax burdens for most Southerners. Moreover, government expenditures in the South were not even commensurate with their tax contributions (La Cassa per il Mezzogiorno, 1955).
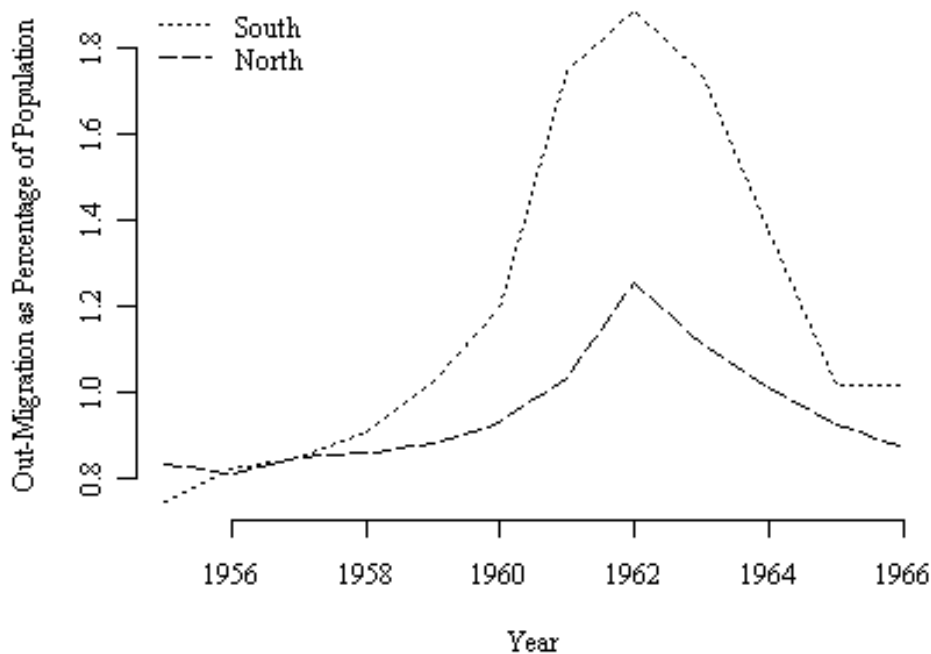
Figure 1.3: Out-Migration as Percentage of Population

The South's economic development was slow in absolute terms; comparisons with the North only magnified the hardships of the South. The post-war government committed itself to remedying these chronic differences with a comprehensive plan comprised of many projects coordinated with the intention to synergistically enhance the development prospects for the South. The law of August 1950 created the *Cassa per Opere Straordinarie di Pubblico Interesse nell'Italia Meridionale* more commonly known as *Cassa per il Mezzogiorno* (IBRD, 1953) (i.e., the SDF). The SDF operated independently of government departments, but the SDF committee of ministers coordinated its actions with existing government departments. The committee of ministers was charged with the analysis of investment plans and with differentiating between extraordinary investment (to be addressed by the SDF) and ordinary investment (to be addressed by government departments) (IBRD, 1951). The stages of planning were to develop annual investment plans, work up specific project plans, screen and approve projects, award contracts, and, finally, execute approved plans.

The first ten-year plan allocated approximately 70 per cent of its funds to land reclamation and transformation, 10 per cent to acqueducts, 10 per cent to roads, 5 per cent to railways, and less than 3 per cent to tourist promotion. As is apparent from the distribution of funds, the initial program was devoted primarily to projects for flood and erosion control, land reclamation, irrigation, land-use transformation, electricity grids, acqueducts, and sewers. The first five years of the SDF saw 11,000 kilometers of roads improved, raising the percentage of properly surfaced roads in the South from less than 14 per cent to over 64

per cent. Moreover, an additional 580 kilometers of roads were constructed in this period. The SDF accounted for over 100 million working days in its first five years. In addition to alleviating unemployment (or at least increasing recorded employment, another direct and indirect concern of the SDF, not unrelated to out-migration), the SDF created dozens of technical schools and provided scholarships for attendance at these schools (La Cassa per il Mezzogiorno, 1955).

True to its name (*intervento straordinario*[3]), the first ten years of the SDF constituted an extraordinary intervention in the development of the South. In spite of the successes credited to the SDF, by the end of the first ten-year plan, the committee of ministers determined that the intervention had not achieved as much as was anticipated. While hopes remained high, the failure of the SDF to narrow the gap between the North and the South was widely noted (Carlyle, 1962). To the end of remedying this failure, the focus of the SDF shifted after 1960 to direct planned industrialization of the South.

The change of focus that occurred in 1960 represented a dramatic shift, most notably with funds being allocated directly to planned industrialization. More quantitatively, the allocation of funds to infrastructure went from nearly 85 per cent to less than 25 per cent with nearly 60 per cent then being allocated to industrialization. The focus on direct planned industrialization of the South involved instituting specially targeted growth areas, establishing local associations to encourage industrial development, and creating incentives for companies to invest in the South (Bull and Newell, 2006). The large role for the state was justified not only by the failure of the private sector to spontaneously develop, but also by the notion that it was the responsibility of the state to oversee natural monopolies and to coordinate the modernization of strategic industries (Dunford and Greco, 2006).

It is this dramatic shift in policy—from "pre-industrial" infrastructure development projects to direct planned industrialization—and its effect on migration that is the focus of this study.

1.4 Data

The data ultimately come from Istituto Nazionale di Statistica (ISTAT), Italy's statistical bureau.[4] The migration data describe flows from each of Italy's 20 regions to each of the other 19 regions on a yearly basis, from 1955 to 1993, comprising 380 flows. International migration is omitted. Data on both GDP and public works expenditures are in constant 1985 market prices.

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[3]Literally, "extraordinary intervention," another common term for the SDF (The World Bank, 2008)

[4]The data are not available from ISTAT in a ready electronic format. The ISTAT migration and population data (from Annuario di Statistiche Demografiche) were provided by Dr. Frank Heins (Istituto di Ricerche sulla Popolazione e le Politiche Sociale-IRPPS); public works expenditures by Professor Miriam Golden (UCLA-Political Science); and GDP data by CRENOS (Centro Ricerche Economiche Nord Sud, www.crenos.it). For distances between regions http://goitaly.about.com/library/bl_distances-italy.htm was consulted.

The migration data certainly comprise a great source, providing yearly region-to-region flows, but the data do suffer from some weaknesses. The data are gathered from population registries, wherein the migrant must unregister from his province of origin and subsequently register in his destination province when changing residence. This aspect of the data will neglect "undocumented" moves. However, this limitation is likely to be small given the high level of compliance with these requirements.

Two separate sets of dummy variables are considered. The first, more saturated one, includes dummy variables identifying the origin-destination pair. The second set consists of dummy variables for the destination regions. Each set is a set of fixed effect dummy variables, with the set of dummies for pairs subsuming the one for destination regions. The inclusion of these dummies is intended to account for any unobserved heterogeneity among pairs or destinations. In particular, the time invariant fixed effects will mitigate any spurious geographic effects. Such effects might include those that result from the omission of geographic effects such as endogenous program placement, as well as the omission of any non-geographic, yet spatially auto-correlated region or pair characteristics.

The two variables of interest for this study are public works expenditures (PW) and an interaction term, δ, that will yield a treatment effect (see Footnote 8 on Page 16). This interaction term is the product of a dummy that indicates whether the region was a target of the industrial intervention, G, and a dummy indicating the post-intervention period, T. This dummy will indicate whether and how the propensity to migrate changed following the shift in policy.

Other variables enter as controls, including standard demographic variables. The two most common variables present in a gravity model are distance and either population or population density. Population or population density is often considered to be a measure of the quality or quantity of opportunities. A common measure for economic opportunities is GDP or per-capita GDP. Per-capita GDP is employed in this study, but, since GDP includes public works expenditures, the GDP variable is GDP minus public works expenditures. An additional measure considered, in the spirit of the NEG, is market potential.[5]

In addition to the above variables, variables describing demographic characteristics and labor market characteristics are included as controls. Variables describing demographic characteristics include the percentage of population that is male, the percentage of population that are youths, and the percentage of population that is of retirement age. Labor market characteristics include the participation rate and the percentages of the labor force employed

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[5]Market potential, as described by Harris (1954), is analogous to population potential, another measure of opportunities at a location present in the demography literature. It is similar in spirit to the gravity model itself, with its origins in physics to describe the strength of a field (such as a gravitational field). Market potential is the summation of markets available at a location weighted by a decreasing function of distance from that location. Such a measure can account for agglomeration effects beyond those described merely by per-capita GDP or population density. A formulation from Hanson (2005) is used in the present study, $\mathrm{MP}_j = \sum_{k \in K} Y_k e^{-d_{jk}}$ where MP_j is the market potential at location j, Y_k is the size of the market at location k, and d_{jk} is the distance between j and k.

in industry, agriculture, market services and non-market services. A final variable used as a control is percentage of vote won by the Christian-Democratic (DC) party. The inclusion of these variables helps to mitigate any bias that may arise from omitted variables.

Lags of the time-variant variables are used to avoid the use of determinants of migration that would otherwise be contemporaneous with the decision to migrate; this use of lagged regressors avoids simultaneity between the regressors and the regressand. Intuitively, the decision to migrate is considered to be made with already available information.

Summary statistics of the key variables are given in Tables 1.2 and 1.3.

1.5   Methodology

1.5.1   Conceptual Framework

The goal of this paper is to determine whether public works expenditures (or public works projects) affect migration, specifically out-migration from Italy's Southern regions, and if so, how. A number of approaches to this question are considered. The over-arching model, whether stated explicitly or not, is the gravity model. That is, potential migrants in a given region are subjected to forces of attraction and repulsion in both their present region and in potential destinations. Gravity models in migration, whether implicitly or explicitly, take as a premise the neoclassical notion of utility maximization.

Migrants are utility maximizers and make a conscious choice to migrate or not with the goal of maximizing utility. Choosing to migrate to a given region implies that the expected utility of having done so was greater than the expected utility of either migrating to any other region or of remaining in the region of origin. Likewise, non-migration—remaining in a region—implies that the expected utility of remaining in that region is greater than the expected utility of migrating to any other region. This concept is well modeled by discrete choice models, my ultimate choice of model.

Measures of migration are inherently arbitrary; one can consider a number of measures besides out-migration, including in-migration, net migration, and stream effectiveness (Siegel and Swanson, 2004). In-migration is the number of migrants who enter a region. Another common expression for this is as a rate, expressed as the ratio of the number of in-migrants into a region to the population of the receiving region. A criticism often leveled against the in-migration rate as a measure of migration is that there is no clear reason to use the receiving region's population as the denominator. Net migration is the difference between in-migrants and out-migrants—again, typically expressed as a rate. Again, a criticism leveled against this measure is the choice of the receiving region's population as the denominator. Stream effectiveness is analogous to net migration, but rather than dividing by the receiving region's population, the difference between in-migration and out-migration is divided by the sum of in-migration and out-migration. The motivation behind this measure is that the migration between two region's is more "efficient" if the flows are largely in one direction.

Thus, numbers, in absolute value, approaching one are more "efficient" (i.e., all the flow is in one direction), while numbers approaching zero are less "efficient" (i.e., the two regions are merely trading similar numbers of people). Out-migration, similar to in-migration, is the number of migrants who are leaving a region. The rate is this number divided by the region's population.

The choice of out-migration rates is motivated by the fact that migration is, by and large, a phenomenon of individual—or possibly household—choice; that is, it is a micro choice. Moreover, as suggested by Tiebout (1956), in a spatial economy, agents must reveal their locational preference. A common criticism of net migration is that there are no "net migrants." While, conceptually, this is true, it is not entirely convincing to abandon it as a measure. Some salient weaknesses in this measure are related to the inability of net migration to reflect human action. The no "net migrant" argument falls into this category, but more important is the possibility—frequently encountered—of the failure of net migration measures to recognize large migration flows. As such, it is, in a sense, a residual of the actual migration choices. Also, net migration rates do not lend themselves to interpretation as probabilities or propensities to migrate. Finally, the construction of an already arbitrary measure is made even more arbitrary by the choice of the denominator. Should the denominator reflect only the population of the region in question? Or should the denominator also take into consideration the populations of the sending regions? For all of the above regions, out-migration is the preferred measure. Moreover, this measure reflects the behavioral side that drives the model of discrete choice in a conditional logit model.

1.5.2   Idealized Experiments

An ideal experiment might have public works expenditures distributed to individuals, although, to the extent that such expenditures are meant to provide public goods (broadly speaking), such an experiment is unrealistic. Considering this, another experiment that comes to mind is the random administration of public works expenditures to regions, rather than being directed at Southern regions. This is the sort of experiment that will be contemplated evaluating the effects of public works expenditures on migration, with counterfactuals including different levels of public works expenditures. A similar sentiment applies to the change in policy from "pre-industrialization" to direct, planned industrialization. While the data available are limited to that after the start of the SDF, the data do include a period prior to the change in policy that occurred in 1960. The counterfactual in this case is the absence of such a program shift. As such, this change in policy motivates the differences-in-differences approach that will be utilized to analyze the effect of this shift in policy on migration.

1.5.3 Methodological Approach

This paper applies a conditional logit framework to the analysis of migration and the role played by public works in potential migrants' decisions. A conditional logit analysis models choice behavior based on alternative-specific attributes, as opposed to agent-specific attributes. As such, a conditional logit framework is appropriate for examining whether and how public works expenditures or a specific policy change affect potential migrants' decisions.

The conditional logit model provides an agent-based decision model that is built upon a neoclassical framework of individual utility maximization while also allowing a straightforward manner of treating alternatives. With this approach the decision to migrate can be treated in a much richer way than a mere binomial choice. Moreover, the conditional logit model allows the alternative of staying (i.e., not migrating) to be included among the choices of potential destinations. In general, as McFadden notes, we wish to describe behavior in terms of the alternatives available to agents, the observed attributes of agents, and the models by which agents make choices as well as the distribution of these models among agents (McFadden, 1974). However, the primary focus of this paper is the role of public works expenditures and as such, the model will focus on the attributes of the alternatives available to agents.

Davies, Greenwood, and Li (2001) note that the conditional logit model resolves a problem of prior migration studies. For example, previous studies sometimes yielded unanticipated signs on variables such as unemployment rates. The conditional logit approach of Davies, Greenwood, and Li yields statistically significant estimates of the expected sign. The authors cite the ability of the conditional logit framework to account for the characteristics of all of the potential destinations rather than merely the chosen destination to yield correct estimation results for characteristics included in the regression. Like Davies, Greenwood, and Li, this study uses as regressors the ratios of origin-specific attributes to destination-specific attributes.[6] Ratios are the preferred choice for at least two reasons. First, they satisfy the requirement for a conditional logit model, in the sense that the characteristics (now ratios) vary across choices. Second, they represent the natural comparison of origin characteristics to potential destination characteristics. As such, they summarize the differences between origin and potential destination and the role such differences play in the migration choice.

Broadly speaking, two goals are pursued. The first goal is the direct assessment of the effect of public works expenditures on migration. The primary approach to making this assessment is simply identifying how the propensity to migrate varies with per-capita

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[6]Davies, Greenwood, and Li considered two other alternatives: (1) using only the characteristics of potential destinations and (2) interacting origin variables with destination dummies. The first option is rejected because it fails to consider the characteristics of the origin. In the context of utility maximization and migration, comparing one's current location to potential locations is an essential part of the choice. The second (rejected) alternative is rejected for two reasons. First, the number of parameters to be estimated is greatly increased. More substantively, the interaction of origin characteristics with destination dummies in the conditional logit framework yields a multinomial model; parameters for these origin characteristics vary across choices.

public works expenditures, or, more precisely, with *differences* in per-capita public works expenditures. The second goal is an evaluation of the effects on migration brought about by a marked shift in policy towards direct, planned industrialization. In both cases this paper exploits variation across regions and over time.

Overall, in the spirit of Holland (1986), the focus is on the "*effects of causes*," and, more specifically, on the effects on migration due to causes associated with public works, whether that be the level of expenditures or the presence of a public works program. There are a myriad of causes of migration, but this paper seeks to address the role that public works programs (notably one that consciously took into consideration migration) play in migration outcomes. This is somewhat in contrast with many studies in demography that attempt to account for the determinants of migration. Similarly, there are countless effects of public works programs, and this paper focuses only on the effects on migration. Again, there is already a large literature on the SDF and its effects on, for example, convergence between the North and the South.

1.6   Econometric Model

The basis for logit models for choice behavior, including the conditional logit model for migration, lies in a neoclassical economic assumption of utility maximization; such models are represented by a random utility model (Cameron and Trivedi, 2005; McFadden, 1974). In the context of migration choices, an individual residing in region i has J destination choices, including remaining in region i (i.e., not migrating) or migrating to region $j \neq i$. Let the utility of a person in region i choosing region j to be

$$U_{ij} = V_{ij} + \epsilon_{ij} = \boldsymbol{\beta}^T \mathbf{X_{ij}} + \epsilon_{ij}$$

where, V_{ij} is the deterministic part of utility, ϵ_{ij} is the stochastic element of utility, $\boldsymbol{\beta}^T \mathbf{X_{ij}}$ represents a linear function describing the deterministic part of utility, and $\mathbf{X_{ij}}$ is a vector of choice-specific attributes. It is worth mentioning that, as mentioned in Section 1.5.3, $\mathbf{X_{ij}}$ consists, in part, of ratios,[7] with attributes such as distance or dummies entering directly. For an individual residing in region i to choose to migrate to region j, it must be the case that the utility of doing so is greater than the utility from all other choices. That is, utility U_{ij} is the greatest among all J regions, i.e., $U_{ij} > U_{ik} \ \forall k \neq j$. As such, using the above decomposition, we can represent the probability of an individual in region i choosing to migrate to region j as

$$
\begin{align}
P(y_i = j) &= P(U_{ij} > U_{ik} \forall k \neq j) \tag{1.1} \\
&= P(V_{ij} + \epsilon_{ij} > V_{ik} + \epsilon_{ik} \ \ \forall k \neq j) \tag{1.2} \\
&= P(\epsilon_{ik} < \epsilon_{ij} + V_{ij} - V_{ik} \ \ \forall k \neq j) \tag{1.3}
\end{align}
$$

---

[7]For example, the ratio of origin per-capita GDP to destination per-capita GDP, $GDP_{ij} = \frac{GDP_i}{GDP_j}$

The logit formula for choice probabilities implies that unobserved utility is distributed as extreme value and, conversely, the extreme value distribution implies the logit formula. Since the cumulative distribution function for the type I extreme value function is $F(\epsilon_{ik}) = e^{-e^{-\epsilon_{ik}}}$, we can rewrite the above cumulative distribution function for ϵ_{ik} evaluated at $\epsilon_{ij} + V_{ij} - V_{ik}$, assuming ϵ_{ij} is known. Also, since the disturbances are independent, this is the cumulative distribution over all $j \neq i$ and can be represented as the product of the individual cumulative distributions. We get

$$P(y_i = j | \epsilon_{ij}) = \Pi_{j \neq i} e^{-e^{-(\epsilon_{ij}) + V_{ij} - V_{ik}}}$$

But we do not know ϵ_{ij}. To remove the conditioning on ϵ_{ij}, we must weight the conditional distribution by the probability density function of ϵ_{ij} over all possible values of ϵ_{ij}. The type I extreme value probability density function is $f(\epsilon_{ij}) = e^{-\epsilon_{ij}} e^{-e^{-\epsilon_{ij}}}$, so we get

$$P(y_i = j) = \int \left(\Pi_{j \neq i} e^{-e^{-(\epsilon_{ij}) + V_{ij} - V_{ik}}} \right) e^{-\epsilon_{ij}} e^{-e^{-\epsilon_{ij}}}$$

The disturbances of the J choices are independent and identically distributed with a type I extreme value distribution if and only if the probability of an individual in region i choosing region j is (McFadden, 1974; Train, 2003)

$$P(y_i = j) = \frac{e^{\beta^T \mathbf{x_{ij}}}}{\sum_k e^{\beta^T \mathbf{x_{ik}}}}.$$

The log-likelihood function for all individuals moving from region i to region j is

$$\ln L = \sum_i m_{ij} \ln P(m_{ij} = 1)$$

where $m_{ij} = 1$ if an individual in region i chooses destination region j.

Migration is analyzed among the twenty regions of Italy, yielding 20 destination choices (with one "destination choice" being the origin, i.e., the option of non-migration) for each individual in a given region. Likewise, there are 20 regions of origin from which individuals may choose to migrate. The log-likelihood function that describes the totality of migration is

$$\ln L = \sum_{t=1956}^{1965} \sum_{i=1}^{20} \sum_{j=1}^{20} N_{ijt} \ln P(m_{ijt} = 1)$$

where N_{ijt} is the number of migrants from region i to region j in year t and

$$P(m_{ijt} = 1) = \frac{e^{\beta^T \mathbf{x}_{ijt}}}{\sum_{k=1}^{20} e^{\beta^T \mathbf{x}_{ikt}}}$$

represents the probability of moving from region i to region j in year t. A dummy variable is included to represent the case when the region of origin is the same as the potential destination region, i.e., the case of non-migration.

The empirical analysis of the effect of the shift in policy on migration outcomes is motivated by the potential outcome approach often attributed to Rubin (1974; 1978). In particular, differences-in-differences are used to identify and measure the effect of the shift in policy on two (similar) outcomes of interest (Todd, 2007). The first outcome of interest is simply out-migration in general (i.e., to any region), as opposed to the second outcome of interest, out-migration restricted only to that directed towards Northern regions. Differences-in-differences approaches in nonlinear models, such as the conditional logit, are analogous to those in linear models (Athey and Imbens, 2006; Puhani, 2008).[8]

The standard errors reported are calculated using multi-way clustering as detailed in Cameron, Gelbach, and Miller (2006). The asymptotic variance matrix is a sandwich estimator,

$$\mathrm{Var}[\hat{\boldsymbol{\beta}}] = \hat{\mathbf{A}}^{-1}\tilde{\mathbf{B}}\hat{\mathbf{A}}^{-1}$$

where

$$\hat{\mathbf{A}} \equiv \sum_{i=1}^{N} \frac{\partial \mathbf{h}_i}{\partial \boldsymbol{\beta}}\bigg|_{\hat{\boldsymbol{\beta}}},$$

and

$$\tilde{\mathbf{B}} \equiv \sum_{\|\mathbf{r}\|,\mathbf{r}\in R}^{N} (-1)^{k+1}\tilde{\mathbf{B}}_r,$$

and $\tilde{\mathbf{B}}_r$ is defined as

$$\tilde{\mathbf{B}}_r \equiv \sum_{i=1}^{N}\sum_{j=1}^{N} \hat{\mathbf{h}}_i\hat{\mathbf{h}}_j^T I_r(i,j), \quad \mathbf{r}\in R$$

where $\mathbf{h}(\boldsymbol{\beta})$ is the score function and $I_r(i,j)$ is a matrix of indicators picking out when i and j are in the same cluster for cluster r.

In particular, for the three-way cluster of year, origin, and destination, $\tilde{\mathbf{B}}$ can be represented as

$$(\tilde{\mathbf{B}}_{(Y)} + \tilde{\mathbf{B}}_{(O)} + \tilde{\mathbf{B}}_{(D)}) - (\tilde{\mathbf{B}}_{(Y,O)} + \tilde{\mathbf{B}}_{(Y,D)} + \tilde{\mathbf{B}}_{(O,D)}) + \tilde{\mathbf{B}}_{(Y,O,D)}$$

where Y, O, and D stand for year, origin, and destination, respectively.

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[8]To ease the notational burden, refer to the above probability, $P(m_{ijt} = 1)$ as $P_{ijt}(\boldsymbol{\beta}\mathbf{x}_{ijt})$. To accommodate a differences-in-differences approach, write this as $P_{ijt}(\boldsymbol{\beta}\mathbf{x}_{ijt} + \mu \cdot T_{ijt} + \gamma \cdot G_{ijt} + T_{ijt} \cdot G_{ijt} \cdot \delta)$, so that δ is the coefficient that identifies the sign of the treatment effect, T_{ijt} is a dummy for the post-intervention period, and G_{ijt} is a dummy for membership in the group subjected to intervention. This coefficient, δ, is the log of the odds ratio. The treatment effect can be represented as $\tau_{ijt} = P_{ijt}(\boldsymbol{\beta}\mathbf{x}_{ijt} + \mu \cdot T_{ijt} + \gamma \cdot G_{ijt} + \delta) - P_{ijt}(\boldsymbol{\beta}\mathbf{x}_{ijt} + \mu \cdot T_{ijt} + \gamma \cdot G_{ijt})$. Another representation is the percentage difference in the probability of out-migration, $\tau_{ijt}^{\%\Delta} = \frac{P_{ijt}(\boldsymbol{\beta}\mathbf{x}_{ijt} + \mu \cdot T_{ijt} + \gamma \cdot G_{ijt} + \delta) - P_{ijt}(\boldsymbol{\beta}\mathbf{x}_{ijt} + \mu \cdot T_{ijt} + \gamma \cdot G_{ijt})}{P_{ijt}(\boldsymbol{\beta}\mathbf{x}_{ijt} + \mu \cdot T_{ijt} + \gamma \cdot G_{ijt})}$. In the case of a binary logit, this second representation is equal to $e^{\delta} - 1$, which is also equal to the odds ratio minus one. For small δ, $e^{\delta} - 1 \simeq \delta$. This is given in Tables 1.5 and 1.6.

1.7 Results

The results of the empirical exercise, including coefficient estimates of common "determinants of migration" as well as the primary variables of interest—per capita public works expenditures and the differences-in-differences coefficient, δ—are given in Tables 1.4, 1.5, and 1.6. In most cases, the results for the common "determinants of migration" are strong and significant across specification. For example, the coefficient estimates for the ratio of per capita GDP and distance are consistent with typical results from gravity models of migration. Higher levels of per capita GDP in the region of origin are associated with a decreased propensity for out-migration from that region (likewise, lower levels of per capita GDP in potential destination regions are associated with a decreased propensity for out-migration); that is, per capita GDP is a force of attraction. Similarly, greater distance between a region and a potential destination is associated with a decreased propensity for out-migration.

A striking result that occurs is a positive relationship between per capita public works expenditures and out-migration. That is, higher per capita public works expenditures in a region of origin are associated with increased out-migration from that region (likewise, lower per capita public works expenditures in a potential destination are associated with a decreased propensity for out-migration to that destination). However, this result is strongest and most consistent when only a single non-migration dummy is included in the regression.[9] This counter-intuitive result largely disappears when additional non-migration dummies for each year are included to account for time effects. This result (see the first column of Table 1.4), although only present in the less saturated model with destination dummies (as opposed to that with pair dummies), runs counter to intuition and to policymakers' likely intentions. For example, the story told by Bartik (1991) is that one of the benefits of a local development policy such as the SDF is the increase in employment in the target region. As was the case with the SDF, many of the jobs created were low-skill jobs, which provides the most striking contrast to expectations. Bartik argues that low-skill workers are less mobile and that the result of a policy such as the SDF will be a relatively small increase in in-migration to the target region, with a sizable benefit accruing to those already in the region, leading to large unemployment reductions, and, consequently, a decrease in out-migration.

There are a number of ways of interpreting this result. A familiar way is to consider marginal effects. Unlike marginal effects for most linear models, the coefficient estimates are not a direct measure of the marginal effect in a conditional logit model. Moreover, marginal effects are not constant across observations. For the conditional logit model the

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[9]Non-migration-year dummies are used instead of typical year dummies due to the structure of the conditional logit. Let ϕ_y denote the coefficient on a year dummy t_y, with the sum as $\boldsymbol{\phi}\mathbf{t}$. Write the probability to include year dummies: $P(m_{ijt} = 1) = \frac{e^{\boldsymbol{\beta}^T \mathbf{x}_{ijt} + \boldsymbol{\phi}\mathbf{t}}}{\sum_{k=1}^{20} e^{\boldsymbol{\beta}^T \mathbf{x}_{ikt} + \boldsymbol{\phi}\mathbf{t}}} = \frac{e^{\boldsymbol{\phi}\mathbf{t}} e^{\boldsymbol{\beta}^T \mathbf{x}_{ijt}}}{e^{\boldsymbol{\phi}\mathbf{t}} \sum_{k=1}^{20} e^{\boldsymbol{\beta}^T \mathbf{x}_{ikt}}} = \frac{e^{\boldsymbol{\beta}^T \mathbf{x}_{ijt}}}{\sum_{k=1}^{20} e^{\boldsymbol{\beta}^T \mathbf{x}_{ikt}}}$. In general, attributes shared at the origin level are not identified.

direct marginal effect for origin i and destination j is

$$\frac{\partial p_{ij}}{\partial \mathbf{x}_{ij}} = p_{ij}\left(1 - p_{ij}\right)\boldsymbol{\beta}.$$

Because of this variation across observations, the average of the marginal effects must be taken. However, unsurprisingly, given the low statistical significance of the parameter estimates, these average marginal effects for public works expenditures are not statistically significant.

The conditional logit model offers another means of interpreting this result with the cross-marginal effect. The cross-marginal effect can be understood as the effect on the probability of moving from region i to region j caused by a change in the attributes of region k, an alternative destination. The cross-marginal effect is $-\frac{\partial p_{ij}}{\partial x_{ik}} = -p_{ij}p_{ik}\boldsymbol{\beta}$, where p_{ij} is the probability of moving from region i to region j, p_{ik} is the probability of moving from region i to region k, and $\boldsymbol{\beta}$ is the coefficient on $\mathbf{x}$. The magnitudes of the cross-marginal effects are quite small and, again, are not statistically significant. Even when translated into the typical "per thousand" measurements, the cross-marginal effects of a change in public works expenditures in a Southern region on migration to a Northern region are very small.

Finally, another interpretation of this result is to compare per capita public works expenditures to a more common variable such as per capita GDP. However, rather than simply comparing coefficient values or even marginal effects, consider an iso-probability curve in per capita public works expenditures—gdp space. The probability of moving from region i to region j is held constant and so

$$\frac{dGDP}{dPW} = \frac{\partial p_{ij}}{dPW} \Big/ \frac{\partial p_{ij}}{dGDP} = -\frac{\beta_{PW}}{\beta_{GDP}},$$

where GDP represents the origin-to-destination ratio of per capita GDP and PW represents the origin-to-destination ratio of per capita public works expenditures.

For the one case in which the coefficient on PW is statistically significant, this value is 0.21. This means that if the ratio of per capita public works expenditures between origin i and destination j increases by one, then, to keep the probability of migrating from region i to region j constant, the corresponding ratio of per capita GDP needs to rise by 0.21. Seen another way, if the per capita GDP ratio between origin i and destination j increases by one, it would take nearly a 400 per cent increase in the origin-to-destination ratio of per capita public works expenditures to keep the probability of migration constant. Due to the sensitivity to specification and the statistical insignificance of the result, one must conclude that the relative magnitudes of public works expenditures do not play a role in the migrant's decision.

The differences-in-differences approaches yield striking results as well, but these results are far more robust and consistent than the effects from the relative magnitudes of public works expenditures. Two differences-in-differences measures are considered, given in Tables

1.5 and 1.6. The first is for out-migration in general; the differences are out-migration between South and North, after the policy change and before the policy change. The regression coefficient for this difference-in-difference, δ, is positive in all statistically significant results. This suggests that out-migration from the South increased due to the policy change. Similarly, the second approach is for out-migration to the North (i.e., to a Northern region). The differences in this case are with respect to out-migration to the North, comparing the South and the North, after the policy change and before the policy change. These differences are significant in all cases, leading to the similar conclusion that out-migration to the North from the South increased due to the policy change.

For total out-migration with pair dummies, given in the third column of Table 1.5, the coefficient δ is 0.39. As noted in Footnote 8, this is the log of the odds ratio; that is, it is the log of the ratio of the odds of out-migration with the intervention to the odds of out-migration without intervention. In the conditional logit, the change in probability varies over observations, so the average must be considered. For out-migration to the North, the average percentage change (from the case with no shift in policy to the case with a shift in policy) in the probability of out-migration is 42.5 per cent with destination dummies and 30.3 percent with pair dummies. In either case, the presence of the intervention leads to a significant increase in the probability of out-migration from the South to the North. In the case of out-migration from the South in general, only the case with pair dummies leads to a statistically significant result for δ. In this case, the percentage change in the probability of out-migration from the South in general is 17.6 per cent.

Overall, these results suggest that the dramatic shift in policy in an already massive program—intended, in part, to address the increases in out-migration—had an adverse effect on migration, one of its intended targets. Moreover, this result was not accompanied by a convergence in other aspects (such as per capita GDP) that may have (otherwise) been cause for relief on the part of policymakers.

1.8   Robustness Checks

As a robustness check, a number of different specifications are considered, including a linear logit model for side-by-side comparisons with the conditional logit model. First, a direct assessment of public works expenditures is considered in both the conditional logit framework and the linear logit model; i.e., dummies for out-migration are not included. The results are given in Table 1.4, with the label *CL* for the conditional logit model, estimated using MLE, and the label *Linear Logit* for the linear logit model. These results include specifications with destination dummies and specifications with pair dummies as listed at the bottom of the tables. The results in Tables 1.5 and 1.6 include models with dummies for the differences-in-differences estimation of out-migration in both the conditional logit model and the linear logit model. (See Section 1.6 on Page 16.) Two sets of differences-in-differences for out-migration are considered. The results in Table 1.6 refer to the differences-

in-differences for out-migration to Northern regions, while the results in Table 1.5 refer to the differences-in-differences for overall out-migration. These robustness checks suggest that relative differences in public works expenditures are not a factor in the migration decision. The differences-in-differences estimates, however, are not sensitive to specification.

The linear logit model is the basic logit specification, i.e., the log of the odds, linear in parameters, as given in Equation (1.4). In general, the argument in the logit function, p_{ij}, is given by $p_{ij} = \frac{m_{ij}}{n_i}$, where n_i is the number of observations corresponding to x_i. In this case, the number of potential migrants from a given region, m_{ij} is the number of migrants, i.e., the number of potential migrants who chose to migrate from region i to region j. The logit transformation avoids the pitfalls of the linear probability model in which the probability is expressed as $p_{ij} = \mathbf{x_{ij}}^T \boldsymbol{\beta}$, notably the possibility of predicted probabilities lying outside of the $[0, 1]$ range. Weights are calculated according to the method outlined by Maddala (1999).

$$\text{logit}(p_{ij}) = \ln\left(\frac{p_{ij}}{1 - p_{ij}}\right) = \mathbf{x}_{ij}^T \boldsymbol{\beta} \tag{1.4}$$

Other robustness checks conducted include alternative specifications of the variables included and excluded. For example, unlagged explanatory variables are used instead of lagged explanatory variables. Results are similar, but often of low statistical significance. Additionally, leads of the explanatory variables are also used; these results often differ qualitatively and are not of statistical significance. Finally, as indicated above, the specifications using destination dummies and pair dummies serve as further robustness checks.

1.9 Conclusion

This paper applies a conditional logit framework to estimate a model of inter-regional migration in Italy during the early part of the SDF. This model permits the computation of marginal effects, summarized in average marginal effects, as well as the comparison of a common "determinant of migration," per-capita GDP, to the variable of interest, per-capita public works expenditures. Furthermore, the model also makes available an application of differences-in-differences in a non-linear setting. This approach allows an examination of the effect that a marked change in policy had on out-migration.

Most prior studies of migration focus on a broad spectrum of potential "determinants of migration" with the goal of compiling a list of valid causes of an effect. This study differs with its focus on a specific potential "determinant of migration" that is intentionally employed by policymakers to, in part, affect migration outcomes. This study also differs from typical policy evaluation studies in that the present study focuses on the effects of a policy on migration rather than on, say, growth or unemployment. It also differs from studies that consider migration-related topics such as the welfare magnet hypothesis, as such studies examine the undesired effects of welfare generosity that are recognized before

changing welfare policy, while this study focuses on a public policy's success in addressing one of its objectives, finding an undesired effect.

The primary objective of this study is to examine the role of public works expenditures in migration decisions. The conditional logit results are consistent with those that arise from a linear logit model. A weak result is that the effect of public works expenditures on migration appears to be positive in the sense that increased per capita public works expenditures at a region are associated with greater out-migration from that region (or, similarly, greater per capita public works expenditures at a potential destination are associated with less out-migration to that region). However, a stronger and more robust result is obtained from a differences-in-differences approach. The results suggest that a shift in focus from "pre-development" infrastructure investment to direct planned industrialization that occurred in 1960 exacerbated out-migration from the regions that were intended to benefit from this change in policy.

Not only is this an effect that public policy is generally trying to avoid, it is commonly thought that such public works programs have the exact opposite effect. That is, it is commonly expected that public works projects in a region, especially those designed to reduce unemployment, are a means of mitigating out-migration from a region. The differences-in-differences results suggest that the shift in policy to direct, planned industrialization exacerbated out-migration.

The channels by which public works expenditures appear to affect migration are not clear. However, given the results of this study, one must consider possible reasons that public works projects may positively affect out-migration (in the sense that the presence of a project, or, at the very least, a shift in the priorities of a project, increases out-migration from the region it is intended to help). This phenomenon may be related to, for example, the manner in which the benefits of public works expenditures are distributed. Given the legacy of political patronage in Italy, the benefits of public works expenditures may have accrued to bureaucrats and politicians rather than to the most "at-risk" potential migrants. Such "at-risk" potential migrants may have become ever more discouraged with their prospects, seeking opportunities elsewhere, possibly where political patronage was perceived to be less of a factor. Such perceptions of "at-risk" potential migrants may have already existed but merely been exacerbated, or the high-profile nature of the SDF may have brought attention to problems of political patronage that otherwise would not have been visible to some "at-risk" potential migrants. A similar explanation is that the bureaucracy was simply inefficient, if not incompetent, either at the local level, the central level, or both, and was simply unable to put the funds to effective use. A more cynical view is that the centralized efforts intended to improve the lot of Southerners were simply counter-productive, perhaps because any "development" that was brought about by the SDF was not organic or because bureaucrats simply lack the knowledge to emulate spontaneous development (especially when attempting to accelerate such development), with results interfering with development rather than augmenting it. Finally, the increasingly ad hoc measures to address the goals of the SDF may have contributed to a highly uncertain institutional framework in the South. Such

uncertainty may have contributed to a failure of spontaneous development and an increased propensity to out-migrate from the South. Overall, the likely "cause" that is indicated by the shift in policy to planned, direct industrialization may not be the shift in policy, *per se*, but rather the various forms that constituted this shift in policy. That is, increased political patronage, bureaucratic inefficiency, crowding out of spontaneous development, and institutional uncertainty are more likely causes reflected in the change in policy.

One view of the results of this study is to suggest that further study of public works as a determinant of migration is due. That public works projects may be an important factor in migration deserves attention by policy makers. Of great importance, but far more challenging, is revealing channels by which public works affect migration. However, another view of the results, in the spirit of LaLonde (1986), is simply that this may be a cautionary tale for those conducting program evaluation. If, for example, the results of this study are spurious, in spite of robustness checks and the inclusion of methods for avoiding such bias, it may be the case that an *ex post* bias in estimation is arising from an unobserved *ex ante* selection, in spite of efforts to control for such an outcome. In either case, this study should not be seen as the final word on the SDF's effect on migration, not to mention public works' effect on migration in general. Rather, it should be seen as a first step toward determining the effects of public works on migration decisions.

1.A   Region Abbreviations

Abbreviation	Region Name
PIE	Piemonte
VDA	Valle D'Aosta
LOM	Lombardia
TAA	Trentino Alto Adige
VEN	Veneto
FVG	Friuli Venezia Giulia
LIG	Liguria
EMR	Emiglia-Romagna
TOS	Toscana
UMB	Umbria
MAR	Marche
LAZ	Lazio
ABR	Abruzzo
MOL	Molise
CAM	Cambria
PUG	Puglia
BAS	Basilicata
CAL	Calabria
SIC	Sicilia
SAR	Sardegna

Regions are listed roughly from north to south. See Figure 1.4 for regions' location.

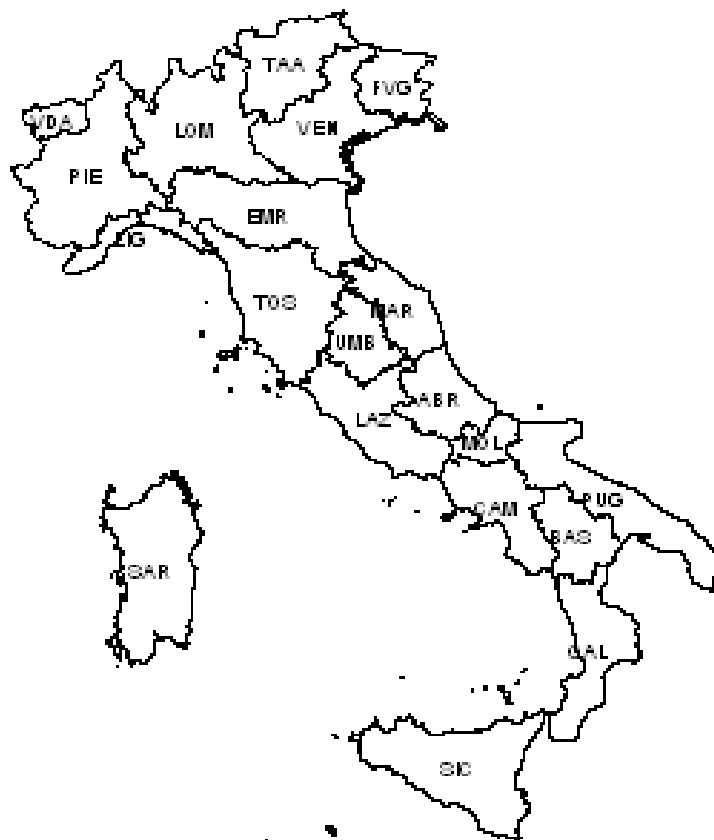Table 1.1: Region Abbreviations

1.B   Map of the Regions of Italy

Figure 1.4: Map of the Regions of Italy

1.C   Summary Statistics

	PIE	VDA	LOM	TAA	VEN	FVG	LIG	EMR	TOS	UMB	MAR	LAZ
Average Out-Migration Rate (per 1000 of origin population)[ac]												
	0.457	0.586	0.32	0.334	0.345	0.389	0.513	0.315	0.293	0.465	0.398	0.374
	(0.47)	(1.204)	(0.284)	(0.518)	(0.77)	(0.594)	(0.605)	(0.448)	(0.303)	(1.002)	(0.689)	(0.268)
Average per-capita GDP (1000s of lire)[ab]												
	19934	24494	22321	20984	19206	18890	19365	21165	18678	15898	17554	19405
	(6991)	(6019)	(8321)	(8549)	(8257)	(8211)	(6614)	(8915)	(7123)	(6861)	(7038)	(7074)
Average Growth of per-capita GDP[a]												
	2.60%	1.73%	2.86%	2.95%	3.51%	3.41%	2.78%	3.43%	3.21%	3.44%	3.08%	2.88%
	(0.43%)	(0.54%)	(0.38%)	(0.40%)	(0.46%)	(0.45%)	(0.44%)	(0.44%)	(0.38%)	(0.48%)	(0.45%)	(0.31%)
Average per-capita Public Works Expenditures (1000s of lire)[ab]												
	294	1586	250	813	306	459	448	396	344	369	372	375
	(108)	(955)	(67)	(420)	(96)	(201)	(188)	(121)	(87)	(145)	(136)	(93)
Average Growth of per-capita Public Works Expenditures[a]												
	3.00%	1.21%	2.66%	3.90%	2.19%	0.72%	3.10%	3.29%	2.27%	2.38%	0.98%	1.22%
	(2.47%)	(6.82%)	(2.84%)	(4.09%)	(3.61%)	(4.13%)	(3.93%)	(3.32%)	(3.24%)	(4.85%)	(6.66%)	(3.66%)

The twelve Northern regions are given in this table. See Table 1.1 for abbreviations and 1.4 for their location.

[a] Averages are over the twelve-year period from 1955 to 1966 with standard deviations in parentheses.

[b] Prices are in constant 1985 lire.

[c] Out-migration rate is average of rates from that region to all other regions. That is, for region i, the figure given is $1000 \times \frac{1}{T} \sum_{t=1}^{T} \sum_{j \neq i} \frac{m_{ijt}}{n_{it}}$, where j indicates other regions, m_{ijt} is migration from region i to region j in year t, and n_{it} is the population of region i in year t.

Table 1.2: Summary Statistics for Northern Regions

	ABR	MOL	CAM	PUG	BAS	CAL	SIC	SAR
Average Out-Migration Rate (per 1000 of origin population)[a,c]								
	0.438	0.656	0.438	0.52	0.814	0.702	0.455	0.471
	(0.73)	(0.878)	(0.561)	(0.869)	(1.223)	(1.09)	(0.752)	(0.732)
Average per-capita GDP (1000s of lire)[a,b]								
	13793	12246	11838	12134	11298	10519	11641	13321
	(6942)	(5443)	(4016)	(4403)	(4650)	(3885)	(4310)	(4687)
Average Growth of per-capita GDP[a]								
	4.00%	3.38%	2.79%	3.03%	3.37%	3.06%	3.07%	2.84%
	(0.75%)	(0.57%)	(0.36%)	(0.53%)	(0.83%)	(0.66%)	(0.50%)	(0.43%)
Average per-capita Public Works Expenditures (1000s of lire)[a,b]								
	457	606	299	310	995	556	393	582
	(178)	(371)	(64)	(115)	(400)	(219)	(135)	(155)
Average Growth of per-capita Public Works Expenditures[a]								
	1.14%	0.94%	0.72%	1.35%	0.01%	0.35%	0.07%	0.55%
	(2.67%)	(6.71%)	(2.43%)	(3.24%)	(4.19%)	(3.45%)	(2.83%)	(2.97%)

The eight Southern regions are given in this table. See Table 1.1 for abbreviations and 1.4 for their location.

[a] Averages are over the twelve-year period from 1955 to 1966 with standard deviations in parentheses.

[b] Prices are in constant 1985 lire.

[c] Out-migration rate is average of rates from that region to all other regions. That is, for region i, the figure given is $1000 \times \frac{1}{T} \sum_{t=1}^{T} \sum_{j \neq i} \frac{m_{ijt}}{n_{it}}$, where j indicates other regions, m_{ijt} is migration from region i to region j in year t, and n_{it} is the population of region i in year t.

Table 1.3: Summary Statistics for Southern Regions

1.D Regression Tables

	CL[a]	Linear Logit	CL[a]	Linear Logit
nonmigrate	6.53	11.27	6.24	16.81
	(0.147)***	(0.139)***	(15.725)	(20.585)
borders	0.92	0.93	0.97	10.82
	(0.014)***	(0.102)***	(13.978)	(22.139)
distance	-1.73	-0.74	-3.62	54.18
	(0.535)***	(0.470)	(48.584)	(180.966)
distance^2	2.02	1.37	2.62	-43.97
	(0.446)***	(0.351)***	(60.113)	(151.513)
GDP[bc]	-1.99	-1.05	-9.17	-3.60
	(0.244)***	(0.404)**	(5.569)*	(12.725)
PW[bc]	0.41	0.47	-0.61	-0.22
	(0.203)*	(1.203)	(1.006)	(0.785)
Destination Dummies	Yes	Yes	No	No
Pair Dummies	No	No	Yes	Yes

Robust (three-way clustered) standard errors, clustered on origin, destination, and year, are in parentheses. See Section 1.6.

Period covered is 1956-1965 due to inclusion of lags.

[a] Conditional logit using maximum likelihood estimation

[b] As described in Section 1.5.1, these variables are ratios of origin to destination.

[c] Underlying figures for the ratios are in constant 1985 lire.

Table 1.4: Comparison of MLE Conditional Logit (CL) and Linear Logit Models

	CL[a]	Linear Logit	CL[a]	Linear Logit
nonmigrate	6.56	10.14	6.56	12.25
	(0.103)***	(0.342)***	(0.505)***	(19.163)
borders	0.92	-0.84	0.90	5.28
	(0.08)***	(0.237)***	(0.875)	(20.723)
distance	-1.69	-11.61	-3.75	11.81
	(0.403)***	(2.164)***	(2.969)	(168.615)
distance^2	2.01	9.12	2.54	-8.66
	(0.348)***	(1.837)***	(2.547)	(141.183)
GDP^{bc}	-2.01	-3.35	-6.45	-0.99
	(13.354)	(0.818)***	(2.237)**	(11.614)
PW^{bc}	0.15	-0.45	-0.13	0.08
	(3.049)	(2.444)	(1.154)	(0.723)
δ^{d}	-0.10	0.95	0.39	0.45
	(0.120)	(0.332)**	(0.191)*	(0.124)***
$e^{\delta} - 1$	-0.10	1.59	0.48	0.57
	(0.109)	(0.858)*	(0.282)*	(0.194)**
Destination Dummies	Yes	Yes	No	No
Pair Dummies	No	No	Yes	Yes

Robust (three-way clustered) standard errors, clustered on origin, destination, and year, are in parentheses. See Section 1.6.

Period covered is 1956-1965 due to inclusion of lags.

[a] Conditional logit using maximum likelihood estimation

[b] As described in Section 1.5.1, these variables are ratios of origin to destination.

[c] Underlying figures for the ratios are in constant 1985 lire.

[d] δ is the coefficient for the differences-in-differences estimator. See Footnote 8 on Page 16.

Table 1.5: Differences-in-Differences for Total Out-Migration

	CL[a]	Linear Logit	CL[a]	Linear Logit
nonmigrate	6.60	8.18	6.54	10.1
	(0.115)***	(18.106)	(0.518)***	(0.300)***
borders	0.91	1.17	1.06	-0.71
	(0.080)***	(19.636)	(0.934)	(0.238)**
distance	-2.06	-21.96	-3.66	-11.39
	(0.441)***	(159.075)	(2.623)	(2.099)***
distance^2	2.21	19.52	2.82	8.74
	(0.349)***	(133.1)	(2.348)	(1.795)***
GDP[ab]	-1.95	1.19	-5.66	-3.42
	(13.202)	(10.917)	(2.222)**	(0.792)***
PW[ab]	0.65	0.29	0.08	-0.01
	(2.994)	(0.735)	(1.236)	(2.363)
δ[c]	0.36	0.64	0.57	1.57
	(0.243)	(0.128)***	(0.163)***	(0.264)***
$e^\delta - 1$	0.43	0.90	0.77	3.81
	(0.348)	(0.243)***	(0.289)**	(1.268)**
Destination Dummies	Yes	Yes	No	No
Pair Dummies	No	No	Yes	Yes

Robust (three-way clustered) standard errors, clustered on origin, destination, and year, are in parentheses. See Section 1.6.

Period covered is 1956-1965 due to inclusion of lags.

[a] Conditional logit using maximum likelihood estimation

[b] As described in Section 1.5.1, these variables are ratios of origin to destination.

[c] Underlying figures for the ratios are in constant 1985 lire.

[d] δ is the coefficient for the differences-in-differences estimator. See Footnote 8 on Page 16.

Table 1.6: Differences-in-Differences for Out-Migration to the North

1.E   Notes

1.E.1   Conditional Logit

The log-likelihood function is

$$\mathcal{L} = \sum_{t=1956}^{1965} \sum_{i=1}^{20} \sum_{j=1}^{20} m_{ijt} \ln p_{ijt}$$

For notational simplicity, the following will focus on a single year, thus dropping the t subscript. Noting that the probability in the conditional logit model is $p_{ij} = e^{\mathbf{x}_{ij}^T \boldsymbol{\beta}} / \sum_{l=1}^{20} e^{\mathbf{x}_{il}^T \boldsymbol{\beta}}$,

differentiate the probability with respect to the parameter vector, $\boldsymbol{\beta}$.

$$
\begin{align}
\frac{\partial p_{ij}}{\partial \boldsymbol{\beta}} &= \frac{e^{\mathbf{x}_{il}^T \boldsymbol{\beta}}}{\sum_{l=1}^{20} e^{\mathbf{x}_{il}^T \boldsymbol{\beta}}} \mathbf{x}_{ij} - \frac{e^{\mathbf{x}_{il}^T \boldsymbol{\beta}}}{\left(\sum_{l=1}^{20} e^{\mathbf{x}_{il}^T \boldsymbol{\beta}}\right)^2} \sum_{l=1}^{20} e^{\mathbf{x}_{il}^T \boldsymbol{\beta}} \mathbf{x}_{il} \tag{1.5} \\
&= p_{ij} \mathbf{x}_{ij} - p_{ij} \sum_{l=1}^{20} p_{il} \bar{\mathbf{x}}_i \tag{1.6} \\
&= p_{ij} \mathbf{x}_{ij} - p_{ij} \bar{\mathbf{x}}_i \tag{1.7} \\
&= p_{ij} \left(\mathbf{x}_{ij} - \bar{\mathbf{x}}_i\right), \tag{1.8}
\end{align}
$$

where $\bar{\mathbf{x}}_i = \sum_{l=1}^{20} p_{il} \mathbf{x}_{il}$.

With this, a compact expression for the gradient is

$$
\begin{align}
\frac{\partial \mathcal{L}}{\partial \boldsymbol{\beta}} &= \sum_{i=1}^{20} \sum_{j=1}^{20} \frac{m_{ij}}{p_{ij}} \frac{\partial p_{ij}}{\partial \boldsymbol{\beta}} \tag{1.9} \\
&= \sum_{i=1}^{20} \sum_{j=1}^{20} \frac{m_{ij}}{p_{ij}} p_{ij} \left(\mathbf{x}_{ij} - \bar{\mathbf{x}}_i\right) \tag{1.10} \\
&= \sum_{i=1}^{20} \sum_{j=1}^{20} m_{ij} \left(\mathbf{x}_{ij} - \bar{\mathbf{x}}_i\right) \tag{1.11}
\end{align}
$$

Using this same notation a compact expression for the Hessian is

$$
\begin{align}
\frac{\partial^2 \mathcal{L}}{\partial \boldsymbol{\beta} \partial \boldsymbol{\beta}^T} &= -\sum_{i=1}^{20} \sum_{j=1}^{20} m_{ij} \frac{\partial \bar{\mathbf{x}}_i}{\partial \boldsymbol{\beta}^T} \tag{1.12} \\
&= -\sum_{i=1}^{20} \sum_{j=1}^{20} m_{ij} \frac{\partial \sum_{l=1}^{20} p_{il} \mathbf{x}_{il}}{\partial \boldsymbol{\beta}^T} \tag{1.13} \\
&= -\sum_{i=1}^{20} \sum_{j=1}^{20} m_{ij} \sum_{l=1}^{20} \frac{\partial p_{il}}{\partial \boldsymbol{\beta}^T} \mathbf{x}_{il} \tag{1.14} \\
&= -\sum_{i=1}^{20} \sum_{j=1}^{20} m_{ij} \sum_{l=1}^{20} p_{il} \left(\mathbf{x}_{il} - \bar{\mathbf{x}}_i\right) \mathbf{x}_{il}^T \tag{1.15} \\
&= -\sum_{i=1}^{20} \sum_{j=1}^{20} m_{ij} p_{ij} \left(\mathbf{x}_{ij} - \bar{\mathbf{x}}_i\right) \mathbf{x}_{ij}^T \tag{1.16} \\
&= -\sum_{i=1}^{20} \sum_{j=1}^{20} m_{ij} p_{ij} \left(\mathbf{x}_{ij} - \bar{\mathbf{x}}_i\right) \left(\mathbf{x}_{ij} - \bar{\mathbf{x}}_i\right)^T \tag{1.17}
\end{align}
$$

Equality (1.16) uses the following:

$$\sum_{j=1}^{20} m_{ij} \sum_{l=1}^{20} a_{il} = \sum_{j=1}^{20} \sum_{l=1}^{20} m_{ij} a_{il} \tag{1.18}$$

$$= \sum_{j=1}^{20} m_{ij} a_{ij} \tag{1.19}$$

because for $l = j$, $m_{ij} = m_{ij}$, while for $l \neq j$, $m_{ij} = 0$. Equality (1.17) uses the following:

$$\sum_{j=1}^{20} m_{ij} p_{ij} \left(\mathbf{x}_{ij} - \bar{\mathbf{x}}_i \right) \bar{\mathbf{x}}_i^T = \sum_{j=1}^{20} m_{ij} \left(p_{ij} \mathbf{x}_{ij} - p_{ij} \bar{\mathbf{x}}_i \right) \bar{\mathbf{x}}_i^T \tag{1.20}$$

$$= \sum_{j=1}^{20} m_{ij} p_{ij} \mathbf{x}_{ij} \bar{\mathbf{x}}_i^T - \sum_{j=1}^{20} m_{ij} p_{ij} \bar{\mathbf{x}}_i \bar{\mathbf{x}}_i^T \tag{1.21}$$

$$= \sum_{j=1}^{20} m_{ij} \bar{\mathbf{x}} \bar{\mathbf{x}}_i^T - \sum_{j=1}^{20} m_{ij} \bar{\mathbf{x}}_i \bar{\mathbf{x}}_i^T \tag{1.22}$$

$$= \mathbf{0} \tag{1.23}$$

since $\sum_{j=1}^{20} p_{ij} = 1$.

Marginal effects in the conditional logit model are not constant across observations. Taking the derivative of the probability with respect to the regressors yields the following.

$$\frac{\partial p_{ij}}{\partial \mathbf{x}_{ij}} = \frac{e^{\mathbf{x}_{ij}^T \beta}}{\sum_{l=1}^{20} e^{\mathbf{x}_{il}^T \beta}} \boldsymbol{\beta} - \frac{e^{\mathbf{x}_{ij}^T \beta}}{\left(\sum_{l=1}^{20} e^{\mathbf{x}_{il}^T \beta} \right)^2} e^{\mathbf{x}_{ij}^T \beta} \boldsymbol{\beta} \tag{1.24}$$

$$= \frac{e^{\mathbf{x}_{ij}^T \beta}}{\sum_{l=1}^{20} e^{\mathbf{x}_{il}^T \beta}} \left(1 - \frac{e^{\mathbf{x}_{ij}^T \beta}}{\sum_{l=1}^{20} e^{\mathbf{x}_{il}^T \beta}} \right) \boldsymbol{\beta} \tag{1.25}$$

$$= p_{ij} \left(1 - p_{ij} \right) \boldsymbol{\beta} \tag{1.26}$$

Similarly, marginal effects in the linear logit model are not constant across observations. First, solve the for the probability, then take the derivative with respect to the regressors.

$$\ln\left(\frac{p_{ij}}{1-p_{ij}}\right) = \mathbf{x}_{ij}^T\boldsymbol{\beta} \tag{1.27}$$

$$\frac{p_{ij}}{1-p_{ij}} = e^{\mathbf{x}_{ij}^T\boldsymbol{\beta}} \tag{1.28}$$

$$p_{ij} = (1-p_{ij})\,e^{\mathbf{x}_{ij}^T\boldsymbol{\beta}} \tag{1.29}$$

$$p_{ij} + p_{ij}e^{\mathbf{x}_{ij}^T\boldsymbol{\beta}} = e^{\mathbf{x}_{ij}^T\boldsymbol{\beta}} \tag{1.30}$$

$$p_{ij}\left(1+e^{\mathbf{x}_{ij}^T\boldsymbol{\beta}}\right) = e^{\mathbf{x}_{ij}^T\boldsymbol{\beta}} \tag{1.31}$$

$$p_{ij} = \frac{e^{\mathbf{x}_{ij}^T\boldsymbol{\beta}}}{1+e^{\mathbf{x}_{ij}^T\boldsymbol{\beta}}} \tag{1.32}$$

$$\tag{1.33}$$

Now take the derivative with respect to the regressors.

$$\frac{\partial p_{ij}}{\partial \mathbf{x}_{ij}} = \frac{\partial}{\partial \mathbf{x}_{ij}}\frac{e^{\mathbf{x}_{ij}^T\boldsymbol{\beta}}}{1+e^{\mathbf{x}_{ij}^T\boldsymbol{\beta}}} \tag{1.34}$$

$$= \frac{e^{\mathbf{x}_{ij}^T\boldsymbol{\beta}}\left(1+e^{\mathbf{x}_{ij}^T\boldsymbol{\beta}}\right)\boldsymbol{\beta} - e^{\mathbf{x}_{ij}^T\boldsymbol{\beta}}e^{\mathbf{x}_{ij}^T\boldsymbol{\beta}}\boldsymbol{\beta}}{\left(1+e^{\mathbf{x}_{ij}^T\boldsymbol{\beta}}\right)^2} \tag{1.35}$$

$$= \frac{e^{\mathbf{x}_{ij}^T\boldsymbol{\beta}}\boldsymbol{\beta}}{\left(1+e^{\mathbf{x}_{ij}^T\boldsymbol{\beta}}\right)^2} \tag{1.36}$$

$$= \frac{e^{\mathbf{x}_{ij}^T\boldsymbol{\beta}}}{1+e^{\mathbf{x}_{ij}^T\boldsymbol{\beta}}}\frac{1}{1+e^{\mathbf{x}_{ij}^T\boldsymbol{\beta}}}\boldsymbol{\beta} \tag{1.37}$$

$$= \frac{e^{\mathbf{x}_{ij}^T\boldsymbol{\beta}}}{1+e^{\mathbf{x}_{ij}^T\boldsymbol{\beta}}}\frac{1+e^{\mathbf{x}_{ij}^T\boldsymbol{\beta}}-e^{\mathbf{x}_{ij}^T\boldsymbol{\beta}}}{1+e^{\mathbf{x}_{ij}^T\boldsymbol{\beta}}}\boldsymbol{\beta} \tag{1.38}$$

$$= p_{ij}\left(1-p_{ij}\right)\boldsymbol{\beta} \tag{1.39}$$

Note that this is the same as for the conditional logit.

In addition to marginal effects, cross-marginal effects can be considered in the conditional logit model (but not in the linear logit model). The cross-marginal effect is, like the marginal effect, the effect on the probability of changing regressors, but, as opposed to the marginal effect (and in the context of migration), it is the effect on the probability of migrating from region i to region j due to a change in the attributes of region k.

$$\frac{\partial p_{ij}}{\partial \mathbf{x}_{ik}} = \frac{-e^{\mathbf{x}_{ij}^T \boldsymbol{\beta}}}{\left(\sum_{l=1}^{20} e^{\mathbf{x}_{il}^T \boldsymbol{\beta}}\right)^2} e^{\mathbf{x}_{ik}^T \boldsymbol{\beta}} \boldsymbol{\beta} \tag{1.40}$$

$$= \frac{-e^{\mathbf{x}_{ij}^T \boldsymbol{\beta}}}{\sum_{l=1}^{20} e^{\mathbf{x}_{il}^T \boldsymbol{\beta}}} \frac{e^{\mathbf{x}_{ik}^T \boldsymbol{\beta}}}{\sum_{l=1}^{20} e^{\mathbf{x}_{il}^T \boldsymbol{\beta}}} \boldsymbol{\beta} \tag{1.41}$$

$$= -p_{ij} p_{ik} \boldsymbol{\beta} \tag{1.42}$$

To get the marginal rate of substitution between per capita GDP and per capita PW, consider an iso-probability curve in per capita-GDP—per capita-PW space; i.e., find the marginal rate of substitution by taking the total derivative of probability and setting it equal to zero.

$$\frac{dp_{ij}}{dPW} = 0 \tag{1.43}$$

$$\frac{\partial p_{ij}}{\partial PW} + \frac{\partial p_{ij}}{\partial GDP} \frac{dGDP}{dPW} = 0 \tag{1.44}$$

$$\frac{dGDP}{dPW} = -\frac{\frac{\partial p_{ij}}{\partial PW}}{\frac{\partial p_{ij}}{\partial GDP}} \tag{1.45}$$

$$\frac{dGDP}{dPW} = -\frac{p_{ij}\left(1 - p_{ij}\right)\boldsymbol{\beta}_{pw}}{p_{ij}\left(1 - p_{ij}\right)\boldsymbol{\beta}_{GDP}} \tag{1.46}$$

$$\frac{dGDP}{dPW} = \frac{-\boldsymbol{\beta}_{PW}}{\boldsymbol{\beta}_{GDP}} \tag{1.47}$$

1.E.2 Tests of the Independence from Irrelevant Alternatives (IIA) Assumption

The IIA assumption is considered to be one of the most significant limitations of the conditional (and other) logit models. This assumption or property is a consequence of the logit model, wherein the ratio of probabilities of two alternatives j and k depends only on $\mathbf{x}_{ij}$ and $\mathbf{x}_{ik}$, and, as such, is independent of the characteristics of other alternatives or even the very presence of other alternatives.

$$P(m_{ij} = 1)/P(m_{ik} = 1) = \frac{\frac{e^{\boldsymbol{\beta}^T \mathbf{x}_{ij}}}{\sum_{l=1}^{20} e^{\boldsymbol{\beta}^T \mathbf{x}_{il}}}}{\frac{e^{\boldsymbol{\beta}^T \mathbf{x}_{ik}}}{\sum_{l=1}^{20} e^{\boldsymbol{\beta}^T \mathbf{x}_{il}}}} = e^{\boldsymbol{\beta}^T (\mathbf{x}_{ij} - \mathbf{x}_{ik})}$$

Tests of IIA are conducted using a Hausman-type specification test suggested by Hausman and McFadden (1984). This form of test of the IIA assumption takes the form of a test of

whether the parameter estimates from a model with all alternatives differ significantly from the parameter estimates from a model with a subset of alternatives deleted. The test fails to reject the IIA assumption if the two sets of parameters do not differ systematically. With 20 regions as alternatives, the number of subsets to consider is large; therefore I choose to test only subsets consisting of one region. The test statistic, following Hausman and McFadden (1984), is

$$T = \left(\widehat{\boldsymbol{\beta}}_S - \widehat{\boldsymbol{\beta}}_F\right)^T \left(\widehat{\boldsymbol{\Omega}}_S - \widehat{\boldsymbol{\Omega}}_F\right)^{-1} \left(\widehat{\boldsymbol{\beta}}_S - \widehat{\boldsymbol{\beta}}_F\right)$$

where F indicates estimates from the full set of alternatives, S indicates estimates from the alternatives including a subset of alternatives, $\widehat{\boldsymbol{\beta}}$ is the coefficient parameter estimate, and $\widehat{\boldsymbol{\Omega}}$ is the estimate of the asymptotic covariance matrix. This test statistic follows a χ^2 distribution with p degrees of freedom, where p is the rank of $\left(\widehat{\boldsymbol{\Omega}}_S - \widehat{\boldsymbol{\Omega}}_F\right)$. In all tests, p is equal to 35 and the corresponding critical value is 46.1 at the 10 percent significance level. In all cases the test statistic does not exceed 11, therefore the IIA assumption is not rejected and, as such, the tests fail to provide evidence against applying the conditional logit model.

1.E.3   Bootstrap Results

A bootstrap approach is used to examine the stability of the parameter estimates. The focus is on the estimates of the treatment effect coefficient, δ. The method employed was to take the initial division of migrants and non-migrants from a given region—as a proportion of the population—and use those proportions to simulate subsequent divisions of migrants and non-migrants. Each simulation was the result of a random draw from a multinomial distribution, each using the initial proportions as parameters.

Histograms for the bootstrap results for the treatment effect coefficient, δ, are given in Figure 1.5 for total out-migration (corresponding to δ in column 3 of Table 1.5) and Figure 1.6 for out-migration to the North (corresponding to δ in column 3 of Table 1.6). For each pair, the left-hand graph is the full range of results, with a density function overlaid and the right-hand graph is focused on the greatest portion of the results. The 99 per cent bootstrap confidence interval for the treatment effect for total out-migration is (0.3824, 0.3903); the 99 per cent bootstrap confidence interval for the treatment effect for out-migration to the North is (0.5646, 0.5752).
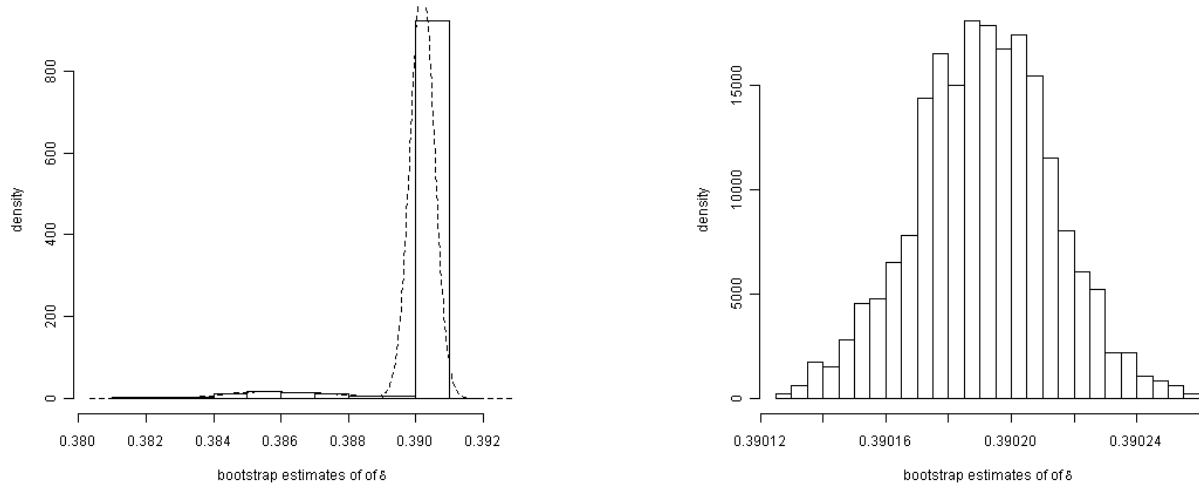
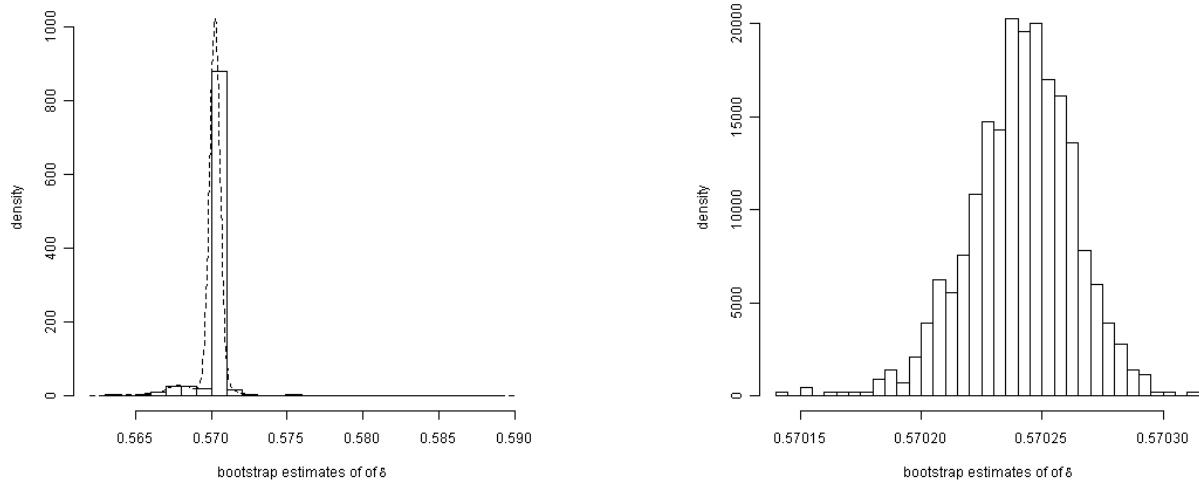Figure 1.5: Bootstrap Results for Total Out-Migration

Figure 1.6: Bootstrap Results for Out-Migration to North

Chapter 2

Do Institutions Matter for Foreign Direct Investment in Transition Countries?

Abstract

A common finding in the literature on transition economies is that institutions are an important factor for multi-national enterprises (MNEs) when making investment decisions. Such findings are appealing on an intuitive level and gibe with the notion that institutions are important for economic development and progress in general. This paper assesses the robustness of such findings and, by extension, the causal effect that is often implied. One of the primary results is that these findings are sensitive to a number of issues, most notably to the application of dynamic models. As such, the conclusions of these studies are suspect and call for a more careful analysis of this question. Furthermore, the widely-accepted view that institutions are important in MNEs' decisions and the sensitivity of these findings demands that more thorough methods of incorporating institutional analysis into formal (especially econometric) models be developed. Developing appropriate methods for integrate institutional elements in formal models is necessary in order to avoid what North described as "inadequate and frequently misleading notion[s] about the relationship between formal constraints and performance" (North, 1990).

2.1 Introduction

A common finding in the literature on transition economies is that institutions are an important factor for multi-national enterprises (MNEs) when making investment decisions.

An oft-cited model through which institutions affect foreign direct investment (FDI) is Dunning's (1977) ownership-location-internalization (OLI) paradigm. The relationship that is asserted works in the location channel, wherein institutions attract FDI and, conversely, FDI, via the action of MNEs, fosters institutions. The argument is appealing on an intuitive level and conforms with the notion that institutions are important for economic development and progress in general.[1] This essay is an assessment of the robustness of such findings and, by extension, the causal effect that is often implied. One of the primary results is that these findings are sensitive to a number of issues, most notably to the application of dynamic models. As such, the conclusions of these studies are suspect and call for a more careful analysis of this question.

As noted by various European Bank for Reconstruction and Development (EBRD) reports and EU enlargement assessments, as well as others (e.g., Caves, 2007), transition economies not only welcome FDI, but also take pains to attract FDI with their reforms. More importantly, a number of recent works in both the transition studies and business literature discuss the importance of institutions for FDI and find a positive relationship between institutions and FDI. Table 2.1 provides a sample of some of the studies, the types of institutions considered, the proxies used, the number of countries used, and the time periods considered. Fabry and Zeghni (2006) conclude that FDI is "sensitive to specific and institutional arrangements," and that "market creating institutions" (as measured by the EBRD's enterprise reform index) is "the most important FDI attractor." Pournarakis and Varsakelis (2004) contend that, while market size is important, institutions are a significant factor in explaining FDI and that progress in institutional development makes a country more attractive. Bevan, Estrin, and Meyer (2004) argue that it is a specific set of formal institutions that influence FDI, including private ownership reforms, banking sector reform, and foreign exchange and trade liberalization. More important, they assert that it is not the overall instutional framework, but rather these limited formal institutions that are impor-

---

[1]The study of institutions, whether in those terms or not, has been a topic of study from the ancients to the present. Plato, conducting a comparative analysis of institutions, notes the importance of various institutions and how the entire interwoven product of institutions shapes behavior (e.g., Plato, *Laws III*, 677-680 and *Laws VII*, 793-800, 1953). Aristotle also observes the interrelated nature of custom and law (e.g., Aristotle, *Rhetoric*, Book I, Chapter 13, 1373b, 1984). Aquinas discusses the evolution of law and custom and how each relates to the other (e.g., Aquinas, *Summa Theologica*, Part II, Sec. IV, Question XCVII, 1947 [1274]). Montesquieu argues that a society's institutions not only reflect, but also shape, the character of that society (e.g., Montesquieu, *The Spirit of Laws*, Book XVIII, Chapters 7 and 8 2001 [1748]). Ferguson discusses "establishments" (i.e., institutions) that "are indeed the result of human action, but not the execution of any human design"(Ferguson, *An Essay on the History of Civil Society*, Part Third, Section II, 2001 [1767]). Karl Marx, too, in discussing the estrangement (or alienation) of labor, notes that institutions (in particular, the institutions of capitalism) constitute the constraints within which agents act and, like Ferguson also observes, that these institutions are the result of human action, but not necessarily of deliberate human design (Marx, *Economic and Philosophic Manuscripts*, Estranged Labor 1964 [1844]). Similarly, J.S. Mill reflects that institutions are "the work of men," whether consciously or not, and that (expressed in contemporary language) institutions constitute the set of constraints within which agents make choices (e.g., Mill, *Representative Government*, Chapter I, 2005 [1862]).

tant. However, their claim regarding the lack of importance of informal institutions relies on being measured by the EBRD index of legal effectiveness. Similarly, Kostevc, Redek, and Sušjan (2007) also find a significant relationship between various institutional measures and FDI, concluding that the institutional environment appreciably influences the level of FDI in transition economies.

At first glance, there does seem to be reasonable support for these findings. Beyond studies that are common in the New Institutional Economics (NIE) that highlight the importance of high-quality institutions for growth and development, the available measures of institutional quality seem to suggest that the narrative of high-quality institutions attracting FDI is plausible (not to mention easy to believe). Most institutional measures tend to exhibit a high degree of correlation with FDI. A number of commonly-used institutional measures are plotted against FDI (see left-hand side of the pairs of figures in Figures 2.1-2.12). However, as noted by many (e.g., Holland, (1986)), correlation does not imply causation.

The right-hand side of these pairs of figures (Figures 2.1-2.12) plot, instead, the change in the institutional measure against FDI. If there were a causal relationship between a given institutional measure and FDI, we would expect to see a significant relationship between the change in a given institutional measure and the change in FDI. The plots on the left-hand side of the pairs of figures illustrate the cross-sectional correlation of institutions and FDI. This is the approach that is taken in the studies mentioned above. What is likely to be more informative in the context of institutions and institutional change is variation within a given country. That is to say, the important question is whether a given country attracts more FDI as institutions improve, *ceteris paribus*. The right-hand side of the pairs of figures fail to show a significant relationship between institutional improvement and increases in FDI. This suggests that the relationship in levels may be due to a common omitted factor affecting a country's institutional variables and the country's attractiveness for FDI, such as, say, cultural factors that allow the spontaneous development of informal solutions to exchange problems (North, 1990).

2.2 Data

For the sake of continuity and comparison with the other studies and much of the literature focusing on institutions in transition countries, I use the EBRD's institutional measures, Transparency International's Corruption Perceptions Index (CPI), and Freedom House's Civil Liberties Index (CL). The EBRD indices are taken from the EBRD's yearly Transition Report and range from 1 to 4.3 (from 1 to 4+ in the EBRD's terminology). A higher score indicates a higher quality of the institution under consideration. Following Barro (1999) Acemoglu, et al. (2005), and Acemoglu, et al. (2008), this is transformed to a 0 to 1 scale.

Transparency International's CPI is a measure of the perception of corruption in the public and political sector based on a survey of surveys. The minimum possible score is zero, corresponding to a case in which "business transactions are entirely dominated by kickbacks,

Study	Category	Proxy
Fabry and Zeghni (2006) 11 Countries 1992-2003	Market Creating Institutions	EBRD Enterprise Reform Index
	Market Regulating Institutions	EBRD Competition Policy Index
	Market Stabilizing Institutions	TI Corruption Perception Index
	Market Legitimizing Institutions	EBRD Expenditures on Education and Health as Percentage of GDP
	Democracy	Freedom House Index of Civil Liberties
Bevan, Estrin, and Meyer (2004) 12 Countries 1994-1998	Institutional Development	EBRD (Aggregate) Transition Index
	Privatization and More Advanced Private Sector	EBRD Small-Scale Privatization Index
		EBRD Large-Scale Privatization Index
		EBRD Private Sector Share of GDP
	Financial Market Infrastructure	EBRD Banking Sector Reform Index
		EBRD Non-Banking Financial Institutions Reform Index
	Liberalization of Domestic and International Markets	EBRD Price Liberalization Index
		EBRD Forex and Trade Liberalization Index
	Developed Regulation and Competition Policy	EBRD Competition Policy Index
	Extensive Legal System	EBRD Legal Extensiveness Index
	Effective Legal System	EBRD Legal Effectiveness Index
Kostevc, Redek, and Sušjan (2007) 24 Countries 1995-2002	Institutional Quality (FDI Climate Variable)	Principle Component of Heritage Foundation Variables
	Insider Privatization	Indicator
Pournarakis and Varsakelis (2004) 11 Countries 1997-2001	Integration into Global Economy	Exports and International Trade as Percentage of GDP
	Institutional Quality	Freedom House

Table 2.1: Studies of FDI and Institutions in Transition Economies

extortion, etc." (Explanatory Note, Transparency International, 1995), and ten, a case in which corruption is completely absent. As above, scores are transformed to a 0 to 1 scale. Freedom House's CL is a measure of the extent of civil liberties in a country. Countries with scores from 1 to 2.5 are considered "free," those with scores from 3 to 5 are considered "partly free," and those with scores from 5.5 to 7 are considered to be "not free" (Freedom House, 2010). Again, these scores are transformed to a 0 to 1 scale; however, the scores are transformed such that a score of zero corresponds to "not free," while a score of one corresponds to "free." The data on FDI and GDP come from the EBRD, which, in turn, retrieves the information from the IMF, World Bank, and EuroStat.

The data consist of yearly observations from 1989 to 2009 for most variables. Transparency International did not begin its CPI until 1995. Even in 1995, not all countries under consideration in the present study were evaluated until some years later. Also considered in the present study are four-year observations. Four-year observations are used rather than four-year averages due to the serial correlation that is introduced by the use of averages.

2.3 Results

An overview of regressions of several commonly used measures of both formal and informal institutions is given in Table 2.2. The ordinary least squares (OLS) regressions suggest that the findings of many of the studies are not unfounded, *per se.* However, refining the model to include, for example, fixed effects removes much of the apparent relationship between institutions, broadly speaking, and FDI. Moreover, modeling FDI in a dynamic framework, a common approach in other studies of FDI, further reduces any relationship between institutions and FDI. Finally, including a commonly accepted "determinant" of FDI, GDP per capita, in the regression all but removes any relationship between institutions and FDI.

Pooled OLS regressions such as those in the previously mentioned studies fail to include the lagged value of the dependent variable, i.e., they do not include FDI_{t-1}. Such regressions yield statistically significant results for all institutional variables (with the exception of health and education expenditures) for both the annual data and the four-year data. I present pooled OLS regressions that include the lagged value of the dependent variable to demonstrate this ostensible relationship that is often encountered in studies examining the relationship between institutions and FDI. The lagged value of FDI is included as a preliminary and naïve means to incorporate the dynamic nature of FDI flows. While this will be refined later, the reason for including the lagged value of FDI is to correct a fundamental model misspecification. The pooled OLS regressions in columns 1 and 2 of Table 2.2 give a summary of the results from estimating the following equation:

$$FDI_t = \beta_{FDI}FDI_{t-1} + \beta_{INST}INST_{t-1} + \mu_t + \epsilon_{it},$$

where FDI_t is the log of FDI per capita in period t and $INST_t$ is the institutional measure in period t. The time dummies, μ_t, reflect shocks and trends in FDI that are common across

countries. This is similar to the form that often appears in the studies previously mentioned. The other studies use, instead, contemporary values of the measure of institutions. Results are similar, but I present those using lagged variables in order to provide a simple means of mitigating simultaneity bias. Using lagged variables also incorporates the notion that FDI in time t might be, in part, a reaction to the institutional framework in time $t-1$. As such, the main parameter of interest is β_{INST}, which is interpreted as the effect of the institutional measure in question on FDI. As expected from previous studies, most of the measures show a significant relationship with FDI. Detailed results for Freedom House's Civil Liberties Index are given in column 1 of Table 2.3 without including FDI_{t-1} as a regressor and in column 2 of Table 2.3 including FDI_{t-1} as a regressor.

Decomposing the error term as $\epsilon_{it} = \eta_i + \nu_{it}$ and estimating an unobserved effects model,

$$FDI_t = \beta_{FDI}FDI_{t-1} + \beta_{INST}INST_{t-1} + \mu_t + \eta_i + \nu_{it},$$

where η_i is the unobserved effect, results in only one measure having statistical significance (large-scale privatization in the case of the four-year data and price liberalization in the case of the annual data). The fixed-effects approach to unobserved effects is employed to account for the likely correlation between the unobserved effects, η_i, and the regressors. Summary results are given in columns 3 and 4 of Table 2.2. Detailed results for Freedom House's Civil Liberties Index are given in column 4 of Table 2.3 without including FDI_{t-1} as a regressor and in column 5 of Table 2.3 including FDI_{t-1} as a regressor.

Incorporating (log) GDP per capita into the pooled OLS model,

$$FDI_t = \beta_{FDI}FDI_{t-1} + \beta_{INST}INST_{t-1} + \beta_{GDP}GDP_{t-1} + \mu_t + \epsilon_{it},$$

where GDP_t is the log of per capita GDP in period t reduces the statistical significance of many of the institutional measures. Summary results are given in columns 5 and 6 of Table 2.2. Detailed results for Freedom House's Civil Liberties Index are given in column 3 of Table 2.3. In the fixed effects model that includes GDP, the same two measures are found to have statistical significance along with another institutional measure, Transparency International's Corruption Perceptions Index (CPI). However, in this case there is a *negative* relationship between CPI and FDI. These results are given in columns 7 and 8 of Table 2.2. Detailed results for Freedom House's Civil Liberties Index are given in column 6 of Table 2.3.

It is important to note that including the lagged value of the dependent variable as a regressor causes both OLS and the unobserved effects model to be inconsistent. As such, panel data methods that appropriately account for the dynamic nature, such as that attributed to Arellano and Bond (1991), are considered. I will refer to this estimator, often called the Arellano-Bond difference estimator, as the AB difference estimator. Like the fixed-effects approach, the AB difference estimator sweeps out the unobserved effect by transforming the variables by means of first differencing. The resultant difference equation is

$$\Delta FDI_t = \beta_{FDI}\Delta FDI_{t-1} + \beta_{INST}\Delta INST_{t-1} + \beta_{GDP}\Delta GDP_{t-1} + \mu_t + \Delta\epsilon_{it},$$

where $\Delta X_t = X_t - X_{t-1}$.

However, this results in correlation between the first difference of the lagged dependent variable (i.e., $\Delta FDI_{t-1} = FDI_{t-1} - FDI_{t-2}$) and the difference of the error term (i.e., $\Delta\epsilon_{it} = \epsilon_{it} - \epsilon_{i,t-1}$). The AB difference estimator overcomes this problem by using further lagged values of the dependent variable as instruments since these are correlated with the lagged value of the difference of the dependent variable (in levels, not differences) and because these are uncorrelated with the differenced error term.[2] This second condition—that is, the lack of correlation between more distant lagged values of the level of the dependent variable and the error terms—yields moment conditions. Further moment conditions are available due to lack of correlation between the differences of any strictly exogenous regressors and the error terms. Since there are far more instruments available than parameters, a GMM framework is employed. Detailed results for Freedom House's Civil Liberties Index are given in Table 2.3, with results that exclude GDP_{t-1} as a regressor in column 7 and those which include GDP_{t-1} in column 8.

A potential problem of weak instruments arises with the AB difference estimator when the regressors are highly persistent and the variance of the unobserved effects is large. This problem is addressed by a similar estimator, the Arellano-Bover/Blundell-Bond system estimator (Arellano and Bover, 1995; Blundell and Bond, 1998), hereafter the ABBB system estimator. The ABBB system estimator supplements the moments using the difference equations with additional moments that use the equations in levels, which is why it is called a system estimator. Summary results for the ABBB system estimator are given in columns 11 and 12 of Table 2.2. Detailed results for Freedom House's Civil Liberties Index are given in Table 2.3, with results that exclude GDP_{t-1} as a regressor in column 9 and those which include GDP_{t-1} in column 10.

2.4 Conclusion

North defines institutions to be "the humanly devised constraints that shape human interaction," and makes the distinction between formal and informal constraints (North, 1990). One of the problems of dealing with institutions in an analytical framework is that there are numerous—not to mention difficult to identify—institutions that may be important. This is further complicated by the impulse to measure any institution that one may

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[2]Griliches and Hausman (1986) (among others, e.g., Durlauf, Johnson, and Temple (2005)) warn against the possibility of measurement error bias in fixed effects models as well as in regressions with (first) differences. Arellano (2003) suggests comparing results from regressions in first differences to those using orthogonal deviations and testing for differences between the estimates. Significant differences suggest that measurement error may be a problem. For the AB and ABBB regressions that include the Civil Liberties Index (CIV), this test failed to reject the hypothesis that the estimates were the same.

identify. However, this is not merely a problem of measurement error or omitted variable bias, but rather it is a problem that is vastly complicated by the interdependence and interaction of institutions, both formal and informal. Moreover, the operationalization of any definition of institutions (not to mention measurement) into a formal economic model is complicated by the intrinsically fuzzy notion of institutions. It is difficult to imagine that a summary measure of institutions will yield at one and the same time a meaningful measure of a well-defined concept (e.g., ideal types) and an informative description of an inherently complex phenomenon.[3] As such, attempts at analysis tend to "give[s] us an inadequate and frequently misleading notion about the relationship between formal constraints and performance" (North, 1990).

These problems are already appreciable and they seem to be further exacerbated by another of North's observations. North writes, "We cannot see, feel, touch or even measure institutions; they are constructs of the human mind" (North, 1990). While this is certainly true, most any economic model is itself a construct of the human mind (e.g., demand and supply). As such, we can find reassurance that incorporating institutions into our analyses can be a fruitful exercise. However, this paper suggests that the previous findings of a positive association—not to mention implications of causation—between institutions and FDI may be fraught with the very inadequacies and errors of which North warned. The long history of the study of institutions suggests that it should not be surprising that incorporating institutions into typical formal economic models will be a substantial challenge (see Footnote 1).

The idea that institutions are an important determinant of FDI is appealing on its face, but many of the empirical findings that support this view are not robust to changes in specification. Simply applying an unobserved effects model to the data changes many statistically significant results to insignificant. Furthermore, including per capita GDP, a common determinant of FDI that is nearly universally found to be significant, reduces to insignificant many of the otherwise significant results. Finally, applying dynamic models suggests that (1) the significance of GDP remains strong, even in the presence of institutional variables and (2) that institutional measures are not a significant determinant of FDI. While one might be interested in finding a link between institutions and FDI, the phenomenon to be explained is, ultimately, FDI. As Friedman suggests, the goal is to find a model that explains a lot with a little (Friedman, 1953), and it seems that institutions do not contribute much to an explanation of FDI in transition economies.

Whereas the findings of this paper suggest that the previous empirical findings of a positive relationship between institutions and FDI are suspect, they should not be taken as a falsification of this notion; that is, the conclusion is not that institutions are unimportant, much less that poor institutions attract FDI. Rather, the findings of this paper suggest that the relationship between institutions and FDI deserves more careful examination.

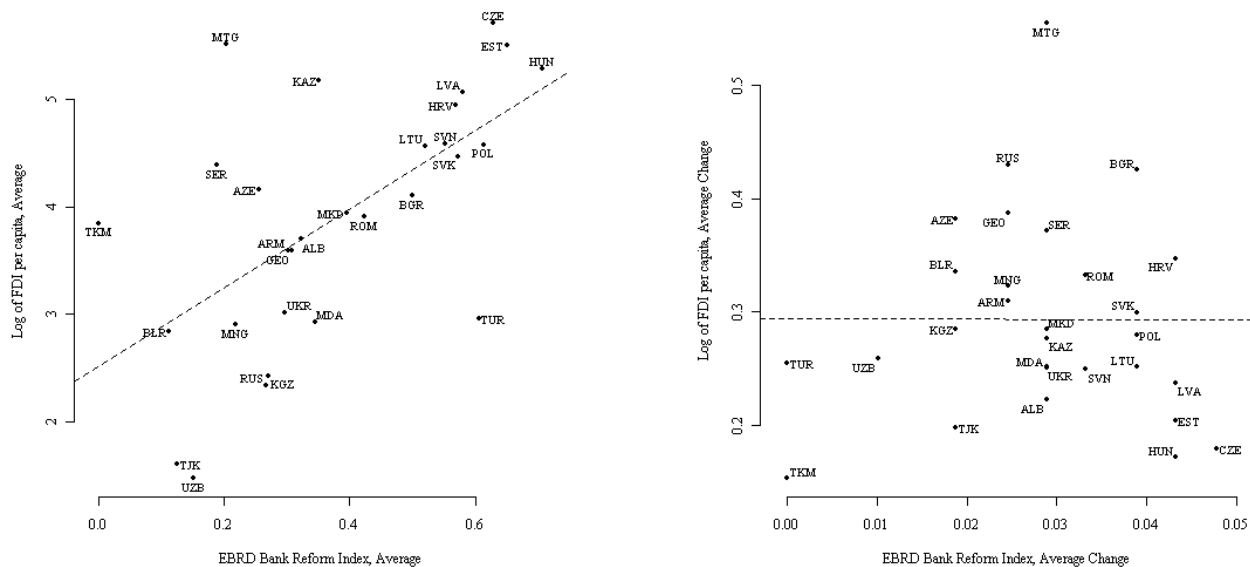[3]See Jellema and Roland (2009) for other criticisms.

2.A   Figures

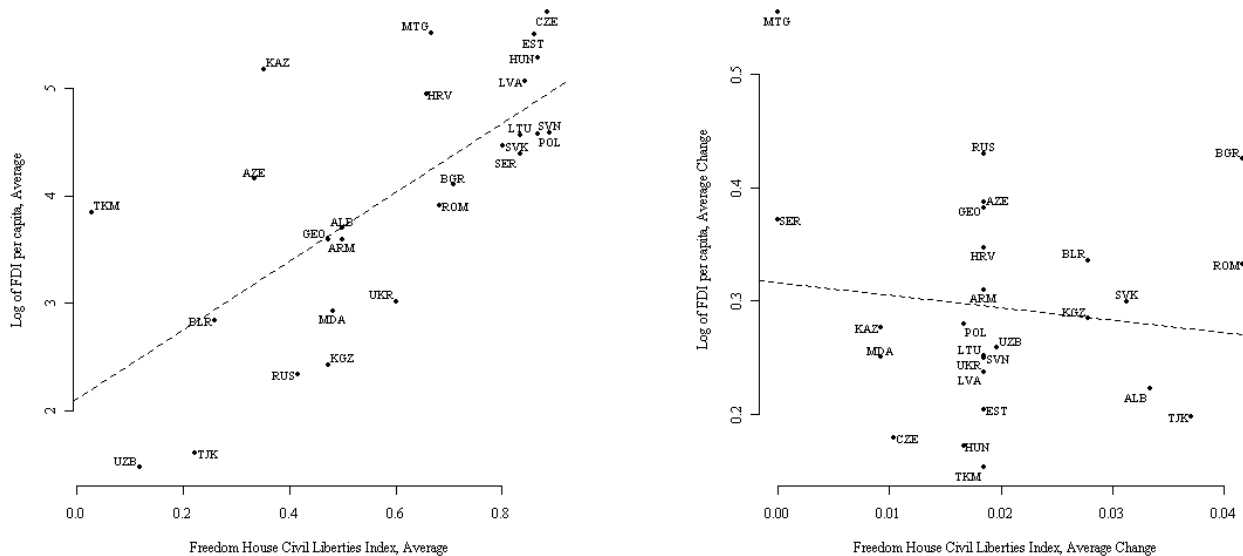Figure 2.1: EBRD Bank Reform Index and FDI

Figure 2.2: Freedom House Civil Liberties Index and FDI
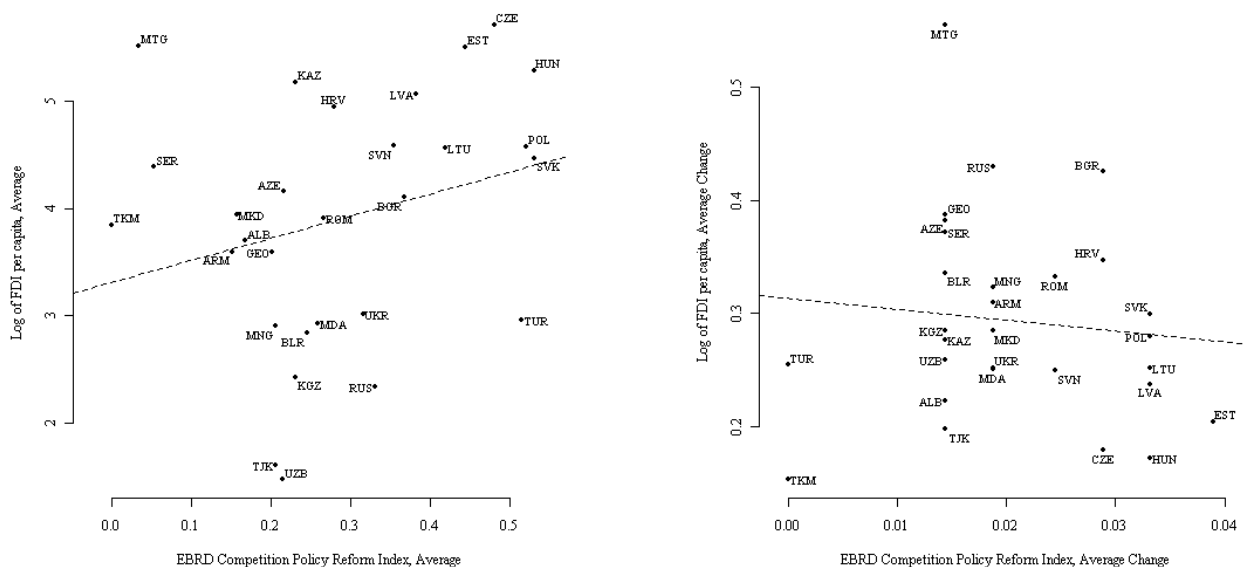

Figure 2.3: EBRD Competition Policy Index and FDI

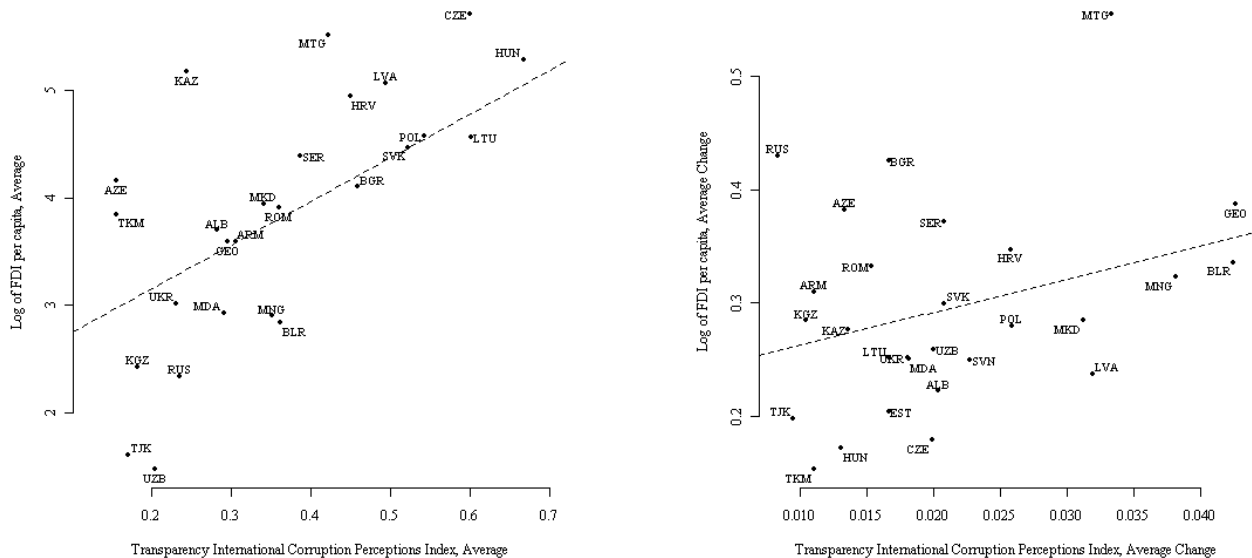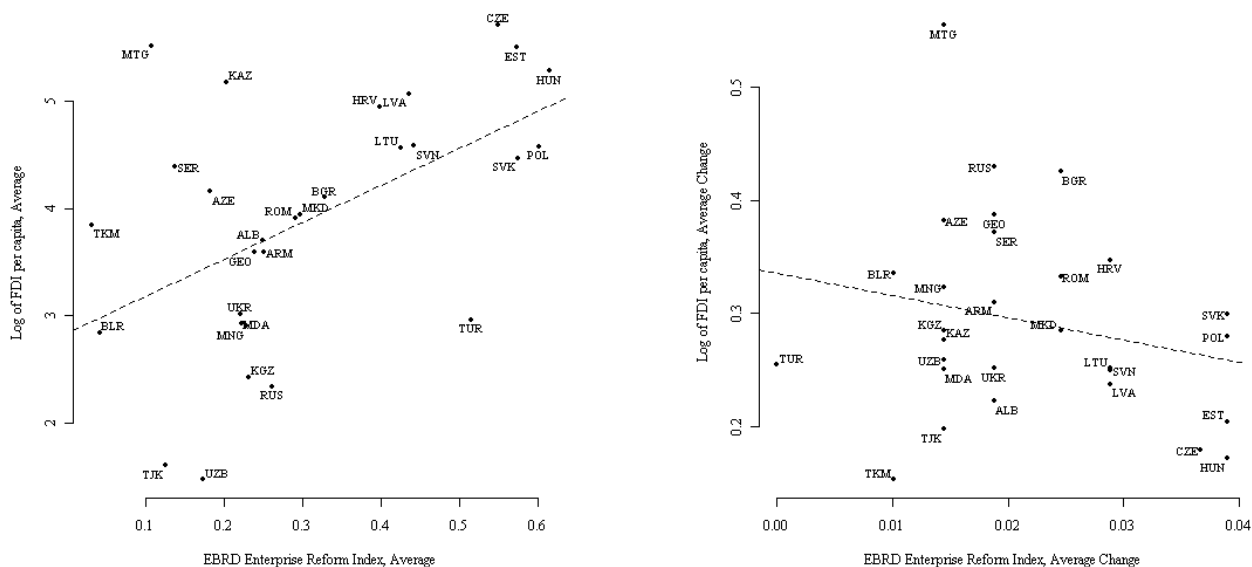Figure 2.4: Transparency International Corruption Perceptions Index and FDI

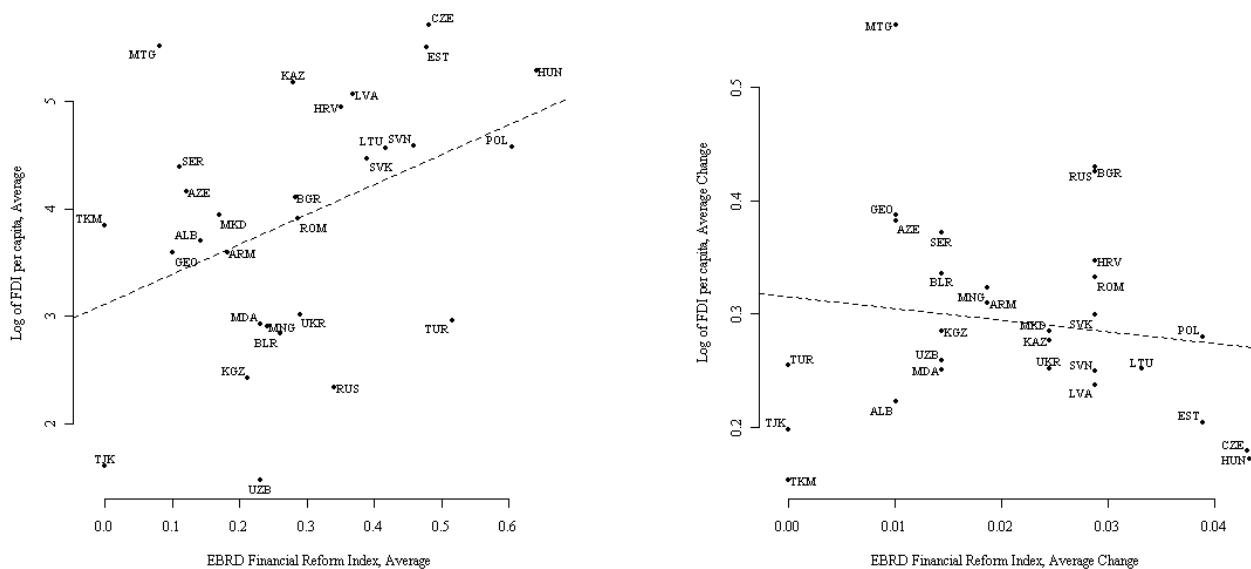Figure 2.5: EBRD Enterprise Reform Index and FDI
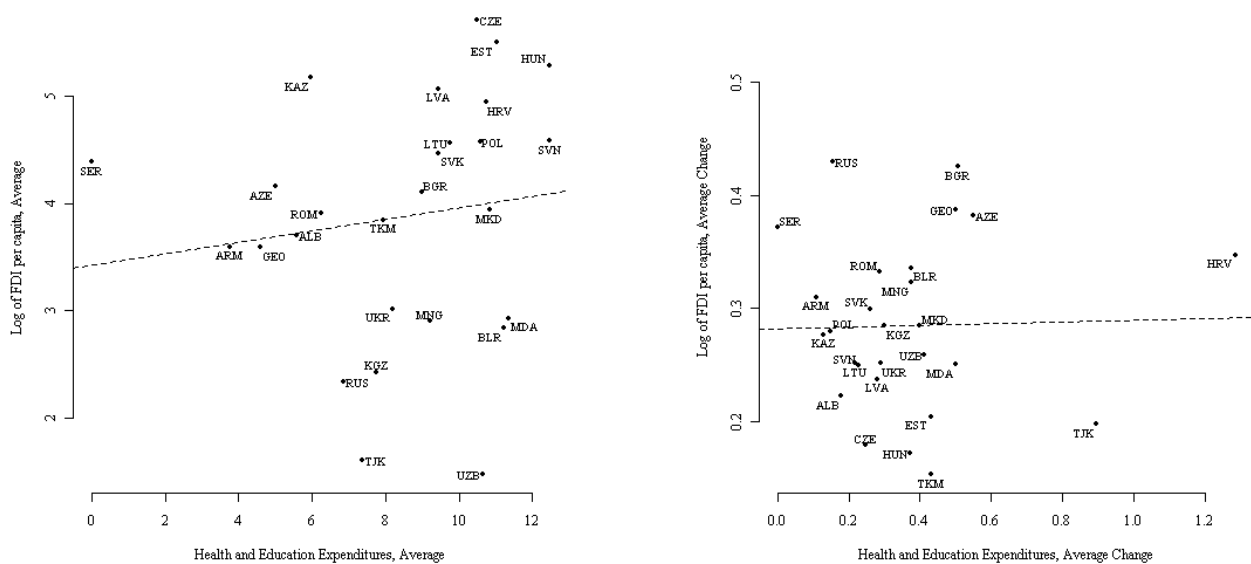
Figure 2.6: EBRD Financial Reform Index and FDI

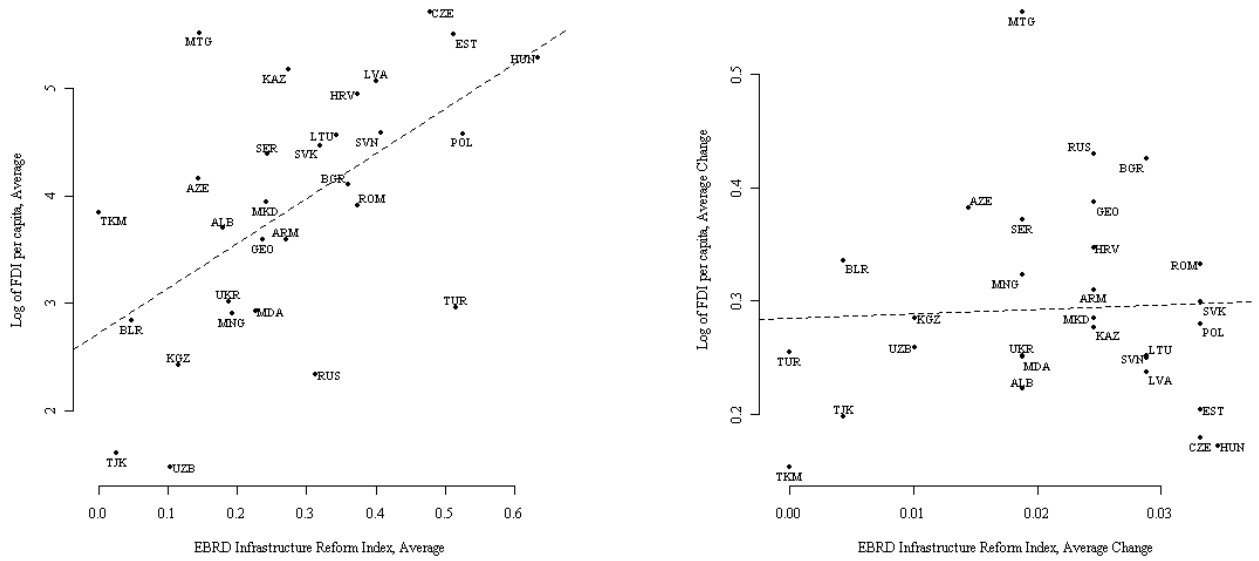Figure 2.7: Health and Education Expenditures and FDI

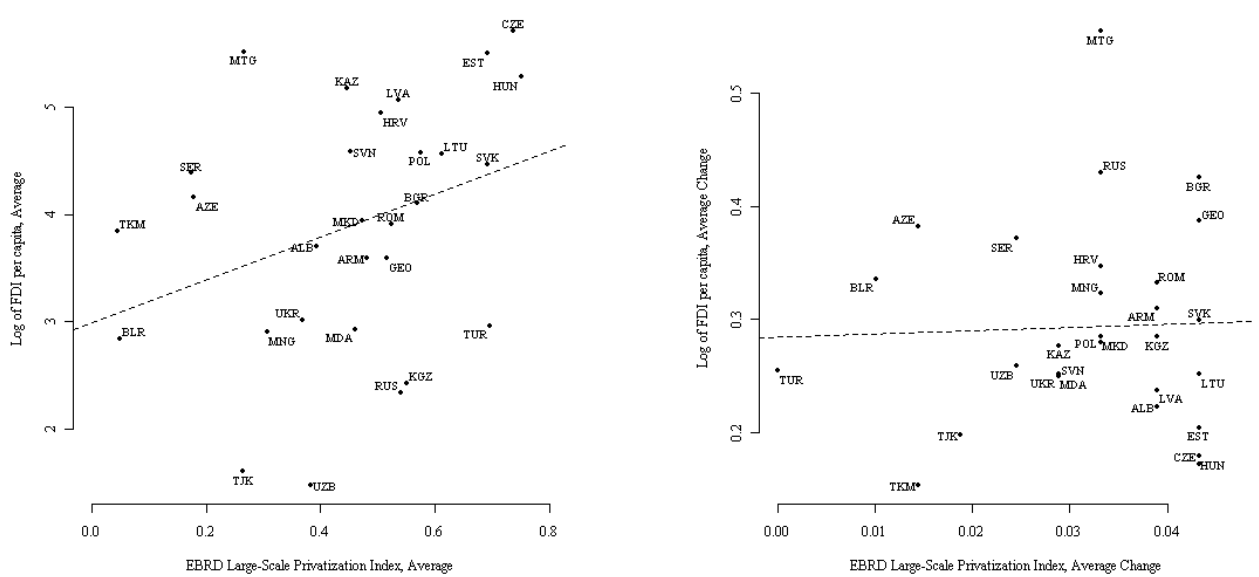Figure 2.8: EBRD Infrastructure Index and FDI

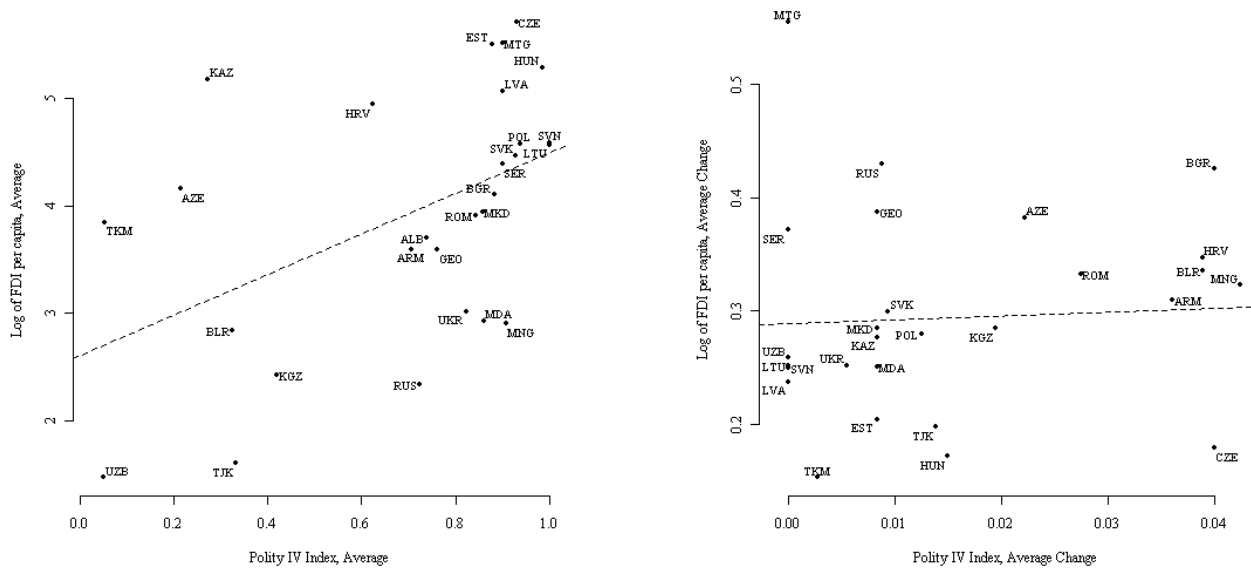Figure 2.9: EBRD Large-Scale Privatization Index and FDI
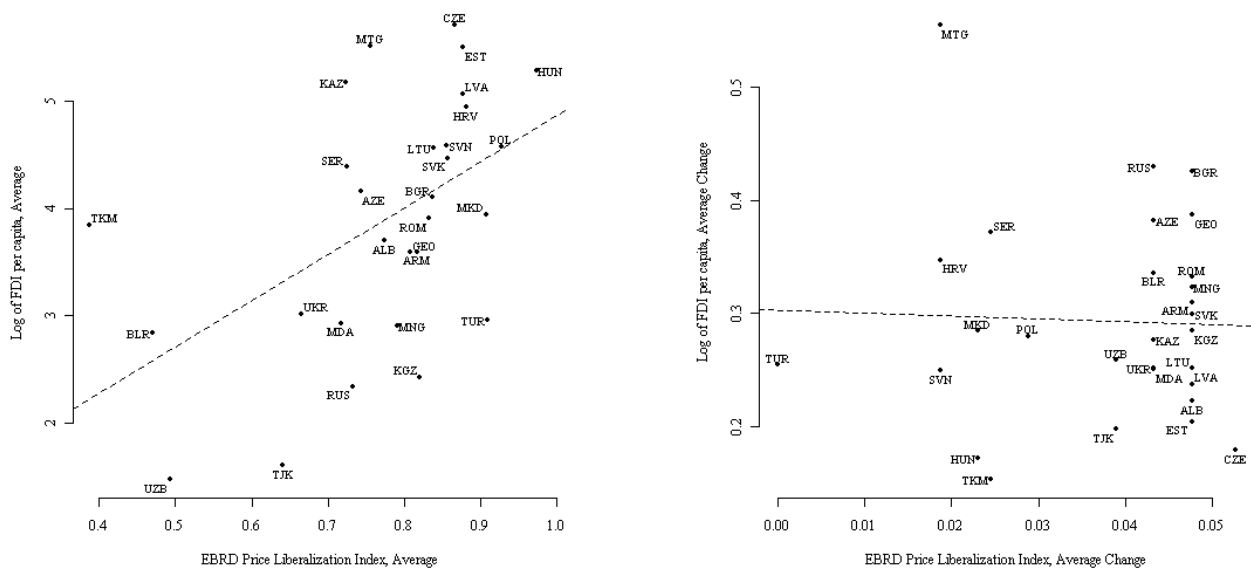
Figure 2.10: Polity IV Index and FDI

Figure 2.11: EBRD Price Liberalization Index and FDI

Measure	OLS[a] Measure[d]		FE-OLS[b] Measure[d]		OLS[a] Measure and GDP[e]		FE-OLS[b] Measure and GDP[e]		ABBB System Estimator[c] Measure[d]		ABBB System Estimator[c] Measure and GDP[e]	
	Ann. Data[f] (1)	Quad. Data[g] (2)	Ann. Data[f] (3)	Quad. Data[g] (4)	Ann. Data[f] (5)	Quad. Data[g] (6)	Ann. Data[f] (7)	Quad. Data[g] (8)	Ann. Data[f] (9)	Quad. Data[g] (10)	Ann. Data[f] (11)	Quad. Data[g] (12)
Banking Reform[h]	✓	✓			✓				✓			✓
Civil Liberties[i]	✓	✓										
Competition Policy[h]						✓				✓		
Corruption Perceptions[j]	✓	✓					✓(-)					
Enterprise Reform[h]	✓											
Non-Bank Fin. Reform[h]	✓											
Health and Education[h]						✓						
Freedom Index[k]	✓	✓										
Infrastructure Reform[h]	✓											
Large-Scale Priv.[h]	✓	✓		✓				✓		✓	✓	✓
Price Liberalization[h]	✓	✓	✓			✓	✓					
Polity Score[l]	✓	✓				✓						
Small-Scale Priv.[h]	✓											✓

✓ indicates that the institutional measure was statistically significant in the given regression, with $p < 0.05$.

[a] Pooled ordinary least squares regression, including time dummies.

[b] Fixed-effects regression, including time dummies.

[c] Arellano-Bover/Blundell-Bond system GMM regression, including time dummies.

[d] Regression with lagged measure, lagged FDI, and time dummies.

[e] Regression with lagged measure, lagged FDI, lagged GDP per capita, and time dummies.

[f] Full sample with annual data.

[g] Full sample with quadrennial data (i.e., at four-year intervals); e.g., if $t = 1995$, then $t - 1 = 1991$.

[h] Data are from the European Bank for Reconstruction and Development (EBRD).

[i] Data are from Freedom House.

[j] Data are from Transparency International.

[k] Data are from the Heritage Foundation.

[l] Data are from the Polity IV Project.

Table 2.2: Summary of Regressions

	Pooled OLS[a]			Fixed Effects[b]			AB difference estimator[c]		ABBB system estimator[d]	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
FDI[e]		0.762***	0.696***		0.415***	0.410***	0.496**	0.473**	0.496**	0.477***
		(0.039)	(0.046)		(0.066)	(0.068)	(0.164)	(0.168)	(0.175)	(0.117)
CIV[f]	3.209***	0.629*	0.297	1.247	0.283	0.296	-0.769	-0.522	-0.224	-0.084
	(0.729)	(0.231)	(0.248)	(0.672)	(0.521)	(0.524)	(2.535)	(8.513)	(4.87)	(0.612)
GDP[g]			0.191**			0.045		0.029		0.368***
			(0.055)			(0.072)		(0.526)		(0.094)
m_2[h]							[0.598]	[0.402]	[0.292]	[0.401]
Sargan[i]							[0.832]	[0.058]	[0.053]	[0.304]
Hansen[j]							[0.974]	[0.052]	[0.176]	[0.901]
N	388	361	360	388	361	360	332	331	361	360

* p<0.05, ** p<0.01, *** p<0.001

Dependent variable is log of FDI per capita. All regressions are on annual data.
[a] Pooled ordinary least squares regression, including time dummies.
[b] Fixed-effects regression, including time dummies.
[c] Arellano-Bond difference GMM regression, including time dummies.
[d] Arellano-Bover/Blundell-Bond system GMM regression, including time dummies.
[e] Lagged value of log of FDI per capita.
[f] Lagged value of Civil Liberties Index.
[g] Lagged value of log of GDP per capita.
[h] Test of second-order autocorrelation; H$_0$: no second-order autocorrelation. p-value is in brackets.
[i] Sargan test of overidentifying restrictions; H$_0$: Restrictions are valid. p-value is in brackets.
[j] Hansen test of overidentifying restrictions; H$_0$: Restrictions are valid. p-value is in brackets.

Table 2.3: Civil Liberties Index (Freedom House), CIV
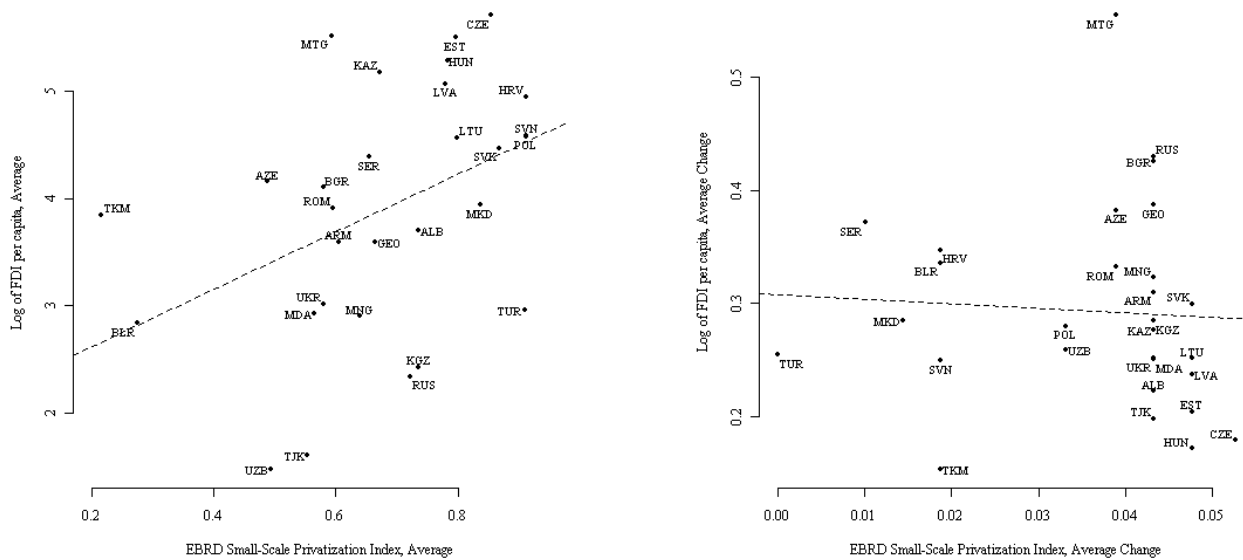
Figure 2.12: EBRD Small-Scale Privatization Index and FDI

Chapter 3

Explaining Violence as an Equilibrium Outcome in Mafia

Abstract

Modeling behavior requires a thorough understanding of the institutional framework that constrains the behavior of the agents in question. The present study of mafia behavior takes the strands of many disciplines' descriptions of mafia organization to develop an institutional analysis of mafia organizations. This institutional analysis is then applied to the construction of a model that describes circumstances under which violence occurs in such organizations. The conclusion is that, rather than being an off-the-equilibrium occurrence, violence is an integral part of mafia behavior.

3.1 Introduction

Studies of organized crime and the mafia have approached the topic from many directions. As mentioned in the introduction to *The Economics of Organised Crime* (Fiorentini and Peltzman, 1995), the primary focus of economists in this area has followed Becker (1968) and "has been targeted on individual agents' allocative choice between legal and illegal activities in the face of different deterrence systems and different opportunity costs." Broadly speaking, the goal of my study is to determine the mechanisms by which organized crime—specifically the Sicilian Mafia—organizes itself. More specifically, I will attempt to develop a model that accurately describes the nature of interactions among Sicilian Mafia families (*cosche*), the mechanisms that give rise to collusive outcomes, and the role of violence in these mechanisms. My interest in the market structure aspect of mafia behavior is inspired in part by Anderson and Bandeira (2005), in whose model the effects of different market structures are compared. Anderson and Bandeira take the market structures as given and hence disregard the manner in which such market structures might be maintained. Since the market structure that arises

is an important determinant of Anderson and Bandeira's analysis, explaining this piece of the puzzle is an important contribution to this literature. Hence, one of my goals is to fill this gap in the literature on organized crime.

This goal may seem to take as a given that mafia groups are organized, or, more precisely, organized solely by intentional design. However, the organizational and structural aspect of the Sicilian Mafia—and other organized crime groups as well—is disputed. As a first step towards examining the very organization of the Sicilian Mafia, I will explore competing views on the structure of the Sicilian Mafia. Naturally, the descriptions of the Sicilian Mafia advanced by various writers are often a reflection of the disciplinary approach and goals of the writers' research. In examining these various views I will attempt to discern the characteristics of each view that will inform my attempt to model behavior among mafia groups. Essentially, this step of the research comprises developing a taxonomy of viewpoints that is focused on the institutional framework within which mafia groups operate, notably the Sicilian Mafia.

A second step that follows from developing this taxonomy is applying the taxonomy to develop an appropriate model for the study of behavior of mafia groups. A goal of such a model is to incorporate the most fundamental institutional characteristics of mafia behavior, rather than to reflect a particular disciplinary bias. A natural subsequent step is to apply these models in predicting behavior as well as to examine the implications that arise from a comparative statics analysis. One issue of interest is the circumstances under which mafia wars—or violence in general—occur.

Regardless of one's assumption about the structure of mafia groups, one runs into difficulties when faced with evidence suggesting that one's view of mafia groups is not always accurate. Common ways out of this conundrum often involve describing activities that do not agree with one's focus of study as something other than mafia activities, even though the same activities and actors are cited as evidence in support of conflicting views. Instead of developing a strict definition of mafia phenomena, I will present common views of mafia phenomena, structure, development, etc. In doing so, I will draw attention to attributes that suggest that a common mechanism underlies mafia relations, broadly defined, as well as a common institutional environment.

The predominant views offered to explain the structure that mafia groups assume can be described as hierarchical, network, clan, and economic explanations. Each of these paradigms, by its nature, suggests its own particular manner of managing relations among members and subgroups. Also, each of these has its use in various analyses, but no study that I have encountered has addressed how mafia groups interact with one another in a rigorous and analytical manner that traverses the boundary of the assumed mafia structure. Clearly a chief goal of such characterizations is the analysis of phenomena that are of particular interest to the social scientist proposing the characterization, rather than how that characterization relates to other disciplines and other questions. Rather than challenging a given structure or attempting to provide my own definition, I will present some of the major characterizations of mafia organizations and draw attention to common themes that

contribute to an understanding of the institutional environment of mafia groups. Finally, I will bring the common themes and threads together into a model that incorporates the institutional setting and provides an explanation for the now cooperative, then antagonistic manner in which mafia organizations operate.

3.2   Common Views of Mafia Organizations

There remains a debate over the proper view of mafia or organized crime. While this debate is important and can prove informative, I will try to avoid adopting an assumption on mafia structure or a definition of organized crime. Below, I will present a taxonomy consisting of four general approaches to defining organized crime or mafia structure that I have found represents the most prevalent views on this topic. One would expect that a central authority would rule a hierarchical structure, interactions among equals would guide a network, notions of loyalty would motivate clan activities, and some form of competition would govern economic behavior. Regardless of the view of the structure of mafia groups, the notion of separate mafia subgroups exists in all of them to one degree or another.

While evidence for one paradigm is not necessarily evidence rejecting another paradigm, the lack of agreement on the structure of mafia organizations does not make studying the interactions among mafia groups an easy task. Thus, making an account of how those with different viewpoints see these groups interact is important. This is one motivation for presenting what might be seen as conflicting views of mafia groups and organized crime. Another motivation is to point out the similarities in order to maintain that my model is appropriate for the phenomena in question. In other words, it constitutes an institutional analysis informed by an interdisciplinary examination of mafia behavior and organized crime. I claim that the model that I propose to describe the relations among mafia groups fits all views and thus accords with reality, regardless of how one may see it. Moreover, my model will provide a greater understanding of such relations.

While a full accounting of mafia relations is unavailable, there is much evidence offered in various studies on organized crime. Developing a clear definition of mafia phenomena that is consistent across time periods is difficult, if not impossible, due to the very nature of what is often labeled as mafia phenomena. Perpetrators actively seek to conceal what are often illegal activities from law enforcement authorities or any other group that may want to document such activities. Moreover, due to law enforcement's targeting of many of the activities in question, the manner in which these activities are carried out, as well as the activities themselves, are constantly in flux. I will not attempt to narrowly define mafia phenomena or organized crime, but I will present some of the more prevalent views of such phenomena. The evidence is meant to present a common theme of calculated cooperation, tolerance of deviations from cooperation, and punishment that will be apparent in all mafia accounts. Moreover, while the evidence marshaled to support this model will focus on Italian mafia groups, and even more so on the Sicilian Mafia, I will argue that this mode of explaining

relations will extend to other settings, including those outside of the criminal realm. As an example to motivate the applicability of this model in situations unlike the Sicilian Mafia, I will attempt to make comparisons between the Sicilian Mafia and Russian organized crime.

Finally, having substantiated my model in the light of rival views on organized crime, I will return to these various views, examined through the prism of my model. Specifically, I will seek to answer how changes in the assumed structure affect the mechanisms at work in my model. For example, given a hierarchical view of mafia, what are the effects in a shift of power? In a network framework, what happens when a less important node gains importance? Viewed as phenomena of clans, what are the consequences of deteriorating social norms? Finally, in the context of markets, what are the likely outcomes when a certain activity is decriminalized? In short, given a particular context, how might external factors affect the relations among organized crime groups?

3.2.1   Organized Crime Groups as Clans

Gambetta, in constructing his definition of mafia phenomena, refers to the comparison between mafia organizations and the state that has been offered by scholars including McGuire and Olson (1996), Grossman (1995), Skaperdas and Syropoulos (1995), among others and, in doing so, suggests that the comparison does not withstand scrutiny (Gambetta, 1996). This literature focuses on the choices that the state and its challenger will make with respect to the provision of public goods and the similarities that arise between common representations of a state and, in the words of Olson (2000), a stationary bandit. This is much like the description that North offers for the "predatory or exploitation theory of the state" in which the state's function is income extraction on behalf of an interest group or class (North, 1981).[1] When examining mafia phenomena in this light, it is frequently observed that mafia groups have often been formed in the aftermath of social change, with two prominent examples being that of the retreat of foreign rulers in Italy (and the subsequent formation of the modern Italian state) in the middle of the nineteenth century and the fall of the Soviet Union, precipitating the decline of the authorities' ability to maintain control.

A key element in these historical examples is the sudden change to a system in which owning private property was allowed in a more universal sense. This change brings about social unrest and uncertainty, accompanied by—or perhaps caused by—the inability of the authorities to protect private property. Feudalism was formally ended in Sicily in 1812, though land reforms continued through the nineteenth century. The sudden and widespread introduction of private property rights, accompanied by the expropriation of church lands following the unification of Italy in 1861, resulted in a large increase in the number of landowners as well as the amount of land under private ownership. In addition to this expansion in private property ownership, the Italian state was unable to effectively protect

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[1]This description of the state is an echo of Marxian political economy. See, for example, *The State and Revolution* by V.I. Lenin (1932 [1917]).

private property, especially in remote areas such as Sicily.

Similarly, in the Soviet Union during *perestroika*, private enterprise was somewhat tolerated, but it was not given adequate protection. Furthermore, laws governing private property were practically non-existent. The fall of the Soviet Union brought about a great expansion in the ownership of private property, but it lacked significant and meaningful changes in the laws governing private property or the institutions that should have provided the protection of private property. In the language of Gambetta, a demand for private protection arises, but, as Gambetta argues, just because the demand is present does not guarantee that it will be met (either by the state or a mafia organization).

While perhaps accepting the notion that the lack of a strong state may serve as a condition for the formation of mafia groups, Gambetta's criticism of comparisons between the state and mafia organizations runs deeper. One motivation for Gambetta's rejection of this view is simply the implications that it has for the legitimacy of the Italian state. However, striking more at the essence of the comparison and its analytical value, Gambetta points out key differences between the state and mafia organizations that diminish the theory's value in terms of analysis of mafia organizations.

Frequently cited factors that serve to state more precisely the conditions under which mafia phenomena arise include the presence of specific social norms. In both Sicily and Russia it has been observed that citizens harbor distrust for the government and, more specifically, for law enforcement authorities. In Sicily this lack of trust developed due to the frequent changing of the rulers that governed Sicily. It was further reinforced by the neglect and contempt that the rulers often had for Sicily. In Russia this distrust was fostered, oddly enough, by the power that law enforcement authorities had during the Soviet period and the subsequent collapse of order. Russian law enforcement was perceived to have gone from overly repressive to incompetent and corrupt. This lack of trust, in light of comparisons of the state with mafia organizations, serves to give mafia organizations a competitive advantage over the otherwise legitimate state. In short, mafia groups, whether seen as having a positive role or as merely the lesser of two evils, are given legitimacy by popular sentiment. At the very least, mafia groups are perceived to be the more effective of the two.

Another social norm that is held in common in both Sicily and Russia is the depth of social networks founded on a client-patron basis. In Sicily this is said to have arisen in part due to the distance that separated Sicily from the various centers of power. Over time, local authorities, often unofficial, served to maintain public order. It was these local authorities that played the role of patron to the clients in the immediate locality. Such authorities would often be called on to intervene in local affairs, being seen to possess not only the ability to enforce a settlement, but also the standing to arrive at a settlement that would be perceived as fair. In Russia, the patron-client system was present before the revolution and was reinforced by the Soviet economic system. The commonly referred to practice of *blat* is an expression of this patron-client system. In the Sicilian patron-client system, the client, having been served in some way by the patron, became indebted to that patron and would invariably be called upon to reciprocate. By contrast, in the Soviet system, the exchange of

favors was part of a huge network that provided the grease on which the entire Soviet system depended. Favors were not, necessarily—and not frequently—directly reciprocated.

Another frequently cited social feature of both Sicily and Russia is the existence of a criminal underclass. It is argued that certain elements of this underclass in each society were more organized and formed the basis of what would subsequently develop into mafia groups. In Russia, the *vory-v-zakone*[2] are said to have developed the close-knit social networks in which these *vory-v-zakone* and other mafia figures are said to currently operate. Unlike common criminals, *vory-v-zakone* professed a very strict code, as suggested by their very name. This code served to create a very cohesive group. The mechanism by which this cohesion was maintained was that adherence or noncompliance with the code was readily verified. Moreover, the *vory-v-zakone* quickly determined and meted out punishments for violators of the code. The lightest punishment—depending on one's point of view—was mere expulsion from the group. However, the most commonly cited punishment was death. *Vory-v-zakone* were unwittingly nurtured by the repressive Soviet prison system.[3]

Omertà, or a code of silence, serves many uses in the Sicilian Mafia groups, from simply maintaining secrecy and operational security to ensuring that witnesses will not offer information to law enforcement agencies. This social norm thus works both within the group, effectively creating a distribution of information that can often be effectively manipulated by the leader, and outside of the group, by co-opting a pre-existing social norm to limit the threat that outsiders would otherwise pose to the group.

One of the most coherent attempts to understand the organization among mafiosi is offered by Paoli (1995). While neither limiting herself nor ignoring hierarchical, market, and network explanations, the view emerges that mafiosi are, like firms in an oligopoly, cognizant of one another's existence and behave in a strategic manner vis-à-vis their fellow mafiosi. Furthermore, borrowing from the anthropological literature, Paoli deems mafiosi to be a "segmentary society."

> Since the times of Sir Henry Maine, anthropologists have also had to deal with a large number of primitive societies lacking centralized ruling bodies. Initially defined as 'stateless' or 'acephalous societies,' they were subsequently fully recognized as unitary social, cultural, and political entities, despite their lack of central political organs. The unifying feature here is the overt recognition by all the groups of other similar and associated groups; in this sense societal boundaries coincide with the maximum range of structurally homologous units recognized by others. These federations are called 'segmentary societies,' clearly an appropriate term for describing the two mafia associations examined here. (Paoli, 1995)

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[2] *Vor-v-zakone*, literally thief-in-law, is variously translated as thief-within-the-code, thief-professing-the-code, and most commonly, by its literal translation. *Vory-v-zakone* is simply the plural of *vor-v-zakone*.

[3] The Soviet prison camp administration often employed and relied upon the *vory-v-zakone* to maintain order in the camps (Applebaum, 2003).

In this anthropological sense, the defining feature of mafiosi that Paoli describes is clan behavior that, while at times exhibiting features of the other views, is indeed quite distinct from the other views.

3.2.2 Viewpoint of Organized Crime Being Hierarchical

Another view of mafia organization is that of a hierarchy with a well-specified structure connecting all families in a network that one can, thus, call *The* Mafia. This view is supported in part by evidence gathered over more than a century, including the nomenclature and ranks given to members within mafia families. Further strengthening this evidence is the fact that much of this terminology is consistent across time and space. Cressey, in a study of organized crime in the United States, maintains that, "[W]hile we are confident that American organized crime is not merely the Sicilian Mafia transplanted, the similarities between the two organizations are direct and too great to be ignored" (Cressey, 1969). Cressey describes an account given by Cutrera (1900) of an Italian mafia group of the late nineteenth century which had an organization similar to that of American "families" as conveyed by members of Cosa Nostra (Cressey, 1969). The organization includes a *capo*, who heads the entire organization, with each territory assigned to a *sottocapo*, along with his assistant, or *consiglio direttivo*. Again drawing on Cutrera, Cressey describes the code of conduct that Cutrera reports to govern the Sicilian Mafia and asserts, although with minimal evidence, that the American Cosa Nostra has a similar code of conduct.[4] Interestingly, Hess reports that "Cutrera was the first to call the idea of the mafia being a closed organization a 'gravissimo errore'" (Hess, 1973). Hess offers criticism of other scholars who have espoused the view of mafia as a well-structured organization that arose by conscious design, including Reid (1964), Lewis (1963), Candida (1960), and Longo (1957). Hess, referring to a letter quoted by Alongi (1890) describing the poor conditions in the state schools, offers a suggestion as to how such conclusions may be reached:

> An outraged schoolmaster who describes an act of corruption by a term otherwise reserved for violent crime. A factual author who briefly records the fact. A third author, reading Alongi only cursorily, may then present the matter as follows: The camorra[5] takes over the schools and textbook production. Just as it has been said: The Mafia takes over the flower markets. (Hess, 1973)

Regardless of the true state of affairs among mafia families, in such an environment, one would expect a somewhat precarious and fragile situation, which, in the absence of

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[4]The core ingredients of the code of conduct are loyalty to the group, honesty with members of the group, secrecy regarding the group, and honorable behavior (Cressey, 1969).

[5]The *Camorra* is the name given to an organized crime group that is centered in Campania's capital, Naples. Another commonly cited organized crime group in Italy is the *'Ndrangheta*, operating in Calabria. *The* Mafia, or, sometimes, the Sicilian Mafia, is the organized crime group originating in Sicily.

organization, would be marked by significant instability and turmoil. If one accepts the ideal type of a well-organized hierarchy, one question that arises is, why is there consistent competition among mafia families, not to mention cases of mafia wars? More specifically, if mafiosi are so well-organized, what institutions govern "the" mafia? Assuming that a mafia organization could arrive at an agreement, in an environment that, by definition, cannot resort to formal legal institutions, how would such a mafia organization enforce its rulings? If one accepts the view that mafia families do not belong to a central organization, a question that arises is, how do the mafia families avoid a state of constant bloodshed? With violence as the ultimate determinant of success, how do such fierce groups manage to avoid constant conflict? Why is it the case that one mafia family does not come out unequivocally on top, much less as a sole survivor? Such a question regarding the boundaries of the firm, as it were, might be explained by informational considerations (Hayek, 1945). Another consideration might be diseconomies of scale. Regardless of one's view of mafia organization (or lack thereof), there exists, at the very least, evidence that certain mafia families have entered into cooperative relationships. But how is cooperation maintained, even cooperation that might be better described as the mere avoidance of conflict?

3.2.3   Perspective of Organized Crime as a Loose Network

I include under the view of organized crime as a loose network the concept of small and similar—but independent—groups co-existing and at times cooperating as well as a more current view inspired by transnational crime. This view of mafia is one of an unorganized (or, at least, not consciously organized) group of, at best, similar gangs, operating independently of one another. Hess is among those adopting this view, proposing an alternative definition of mafia, quite similar to Gambetta's, albeit less narrow. Hess's description of mafia, or mafioso behavior, involves recurring interactions in which the mafioso's reputation (based on violence) for solving problems (in harmony with social norms) develops and is maintained in a manner that involves reciprocal relationships with members of the community, including those in state service. Furthermore, this mafia phenomena arises as a consequence of the breakdown of the feudal order. "In this situation the role of the mafioso is that of a self-help institution" (Hess, 1973). This view is supported by evidence of those turned state's evidence claiming to not be aware of *the*, or even *a*, mafia, as such. Violence among groups is also considered to be further evidence of the lack of cooperation and organization among mafia families, if not the existence of outright antagonistic relations among mafia families. Arlacchi states it quite unequivocally, even denying well-documented evidence gathered over the course of the last two centuries: "The *cosca mafiosa* is a simple organism, but a solid one, without formalization or bureaucracy. Within it there are neither statutory ordinances, initiation rites nor courts of judgment" (Arlacchi, 1986). Although this description of the cosca mafiosa does not necessarily preclude the cooperation among such "solid" organisms, Arlacchi does not suggest that this cooperation exists. Part of Arlacchi's view of mafia phenomena is undoubtedly in accordance with that of its antithesis; specifically, his description of the

cosca as consisting of far-reaching ties and relations that extend far beyond that of blood relations. His view, however, rebukes the notion of anything approaching a well-defined hierarchy or otherwise formalized organization.

3.2.4 Economic Descriptions of Organized Crime

Economic analyses of mafia phenomena have attempted to explain, among other things, the size and geographic distribution of mafia families (Polo, 1995) and the role that mafia groups play in enforcing cartels.[6] Examining such phenomena often implies a very specific assumption about the structure of the mafia group in question. Schelling eschewed the organizational aspect and focused on the nature of typical economic activities in which individuals classified as members of organized crime groups participate, typically so-called victimless crimes, in which there exists demand for a good or service deemed illegal by the state (Schelling, 1984). Schelling takes the analysis a bit further by discussing the ability of the organized crime group to monitor activities and enforce an effective monopoly. As mentioned above, one might ascribe the boundaries of the firm to be limited by informational concerns. In quite an opposite direction, Gambetta attempts to divorce mafia organizations from the illegal nature of activities in which it may be involved, nearly missing—if not dismissing—the obvious fact that mafia methods of providing private protection are, in fact, illegal (Gambetta, 1996). Ignoring the illegality of mafia activity, Gambetta narrowly defines mafia as a phenomenon characterized strictly by the provision of private protection. More specifically, Gambetta describes mafia organizations as a group of oligopolistic firms engaging in the provision of private property protection. The firms, in fact, are unified only to the extent that they share a brand name—*The Mafia*—while they act as a cartel only occasionally. While this narrow definition is useful in preventing one from casting too wide a net in describing various activities as "mafia" activities, it sets aside the question that arises in the light of—among other areas—the literature on conflict, institutions, and industrial organization: if mafia groups are merely in the business of providing protection much like a state—where the state is either unwilling or unable to do so—then how do these small "states" interact with one another (Gambetta actually argues that "the mafia is not even 'minimal state' as defined by Nozick [Nozick, 1977]")? That is, if *The Mafia* is such an effective oligopoly, what are the mechanisms through which it maintains its effectiveness?

In narrowly defining the mafia as a phenomenon of groups providing private protection, Gambetta was likely inspired by Schelling, who escapes suppositions on the structure of mafia by defining organized crime as an issue of monopoly rather than mere organization (Schelling, 1984). This approach is not only analytically convenient and appropriate for his purpose, but it is also necessary owing to the lack of reliable evidence available on mafia activity, however one may define it. Schelling characterizes organized crime in terms of its

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[6]"Mafia methods, with their power to intimidate, actually erect what amounts to a tariff barrier." (Arlacchi, 1986)

victims, using ideas familiar to students of industrial organization. Schelling argues that the true victims of organized crime are nominally criminals themselves, who are but simply unable to effectively protect themselves (e.g. prostitutes and bookkeepers), unable to conceal themselves (prostitutes and bookkeepers must be seen in order to attract customers), and easily monitored. Schelling makes an analogy between the criminal organization and those from whom it extorts money and a franchiser and its franchisees. Schelling asserts that the bookkeeper is not harmed by the extortion and may in fact benefit from the extortion via reduced competition. To a certain extent this is consistent with the notion of mafias acting within the social norms of their environment, with the social norms as revealed by the latent demand for the products mafia organizations offer or the suppliers of which they protect. A minor error in this analysis is that Schelling presupposes that the extorted bookkeeper can pass on the entire "tax" to the consumer with no effect on his volume of business. While this fairly well defined view of organized crime proves useful for certain analyses, it does not offer an explanation as to the relationships that exist among various mafia groups. The relations are not simply analogous to those in an environment of local monopolies.

The salient quasi-public good when examining mafia phenomena is that of the protection of private property. The public choice literature compares, among other things, the incentives for protecting private property or, more broadly, providing public goods, in various institutional settings. The common metaphor is that the state is simply a robber, or in Olson's words, a stationary bandit, and it is in this manner that mafia groups are often compared to a state. Gambetta challenges this comparison when applied to mafia organizations, claiming that the differences are too substantial to consider mafia groups as a state. One claim, mentioned earlier, is that mafia groups are not centralized organizations. Another characteristic of mafia groups which warrants criticism of the theory's application to mafia phenomena is that mafia organizations do not, like an ideal state, have a monopoly on the use of force in its territory. More precisely, the state is one of many rivals for the use of force in its territory. A question that naturally arises is, How do these mafia groups, which Gambetta asserts are neither state-like entities nor centrally organized, interact with one another?

To complement the notion that mafia groups may form in the presence of a demand for private protection, Blok (1974), Gambetta (1996), and Hess (1973) suggest that the supply of protectors was readily provided by the *gabellotti* and *campieri*—the guards hired by former feudal landowners to protect their estates. That this was the case in Sicily is confirmed by many studies of the period. The owners of these estates frequently resided far from these estates in Palermo or Naples. This allowed a great amount of freedom for the *gabellotti*, not only with respect to their treatment of small sharecroppers farming the land, but also with respect to their relations with the landowners themselves. More important, the *gabellotti* and *campieri* had, by their profession, developed the skills of violence that were well-suited to mafia activities. Naturally, this accords well with Gambetta's definition of mafia as providers of private protection. In a similar manner, the fall of the Soviet Union saw the release from employment of thousands of soldiers—notably special operations troops—and

law enforcement officers, in addition to highly trained athletes, due to the inability of the state to continue to bankroll such expansive payrolls. These men, similar to the *gabellotti* and *campieri*, also had already developed the skills that could find immediate employment in the business of private protection. Thus in both post-feudal Sicily and post-Soviet Russia the supply of those willing to provide private protection was present.

While these historical examples describe the state of affairs in numerous countries across many time periods, they also fail to explain why mafia phenomena did not occur in many more places. To further bolster the argument and to restrict more narrowly the scope of societies in which the conditions for mafia may have occurred, other contributing factors are cited. More important, the methods by which mafia groups achieve and maintain collusive outcomes, especially in Sicily, is given little attention in such studies that focus on the market for protection.

3.3   Common Threads in Disparate Views

I will focus on descriptions of mafia as a hierarchical organization and critiques of such views. In doing so I will attempt to highlight the core characteristics of such an organization in order to properly summarize its features and the institutional framework in a simple model. Mention of the critiques of this view will serve to further highlight such common characteristics. Among the many proponents of the hierarchical view of mafia is Dickie (2004), who has written a history of the Sicilian Mafia. Illustrative of this view is a quote Dickie draws from Franchetti.

> [in the violence industry] the mafia boss...acts as capitalist, impresario and manager. He unifies the management of the crimes committed...he regulates the way labor and duties are divided out, and controls the discipline amongst the workers. (Discipline is indispensable in this as in any other industry if abundant and constant profits are to be obtained.) It is the mafia boss's job to judge from circumstances whether the acts of violence should be suspended for a while, or multiplied and made fiercer. He has to adapt to market conditions to choose which operations to carry out, which people to exploit, which form of violence to use. (Dickie, 2004)

It should be noted that this observation is with respect to relations between a boss and those Families, or *cosche*, over which he is the boss. Also, the mechanism through which a boss is able to coordinate activities and enforce discipline among several independent groups, each with their own membership, is absent. It is simply stated, as though such mechanisms were self-evident. Moreover, Dickie directly disputes the viewpoint that the Sicilian Mafia is not hierarchical. For instance, in reference to Alongi, one of the proponents of the view that the mafia groups were not hierarchical, Dickie writes:

> Alongi did not believe that such people could create a large criminal association that had fixed rules. The mafia, he maintained, was nothing more than a label for a disparate, self-contained cosche in individual neighborhoods and villages. He saw the Favara Brotherhood as an example. Alongi may have been right to discount the theory that the mafia was a centralized conspiracy. But he was almost certainly wrong to discount the possibility that many local cosche were part of a bigger network. (Dickie, 2004)

Dickie substantiates this view of mafia by drawing on sources spanning over a century. The Sangiorgi report, written at the beginning of the twentieth century and drawing on events from the late nineteenth century, gives a very extensive schematic of mafia organization, detailing the *cosche* of villages near Palermo, with information covering such topics as profiles of over 200 made members or men of honor, including the names of each *cosca*'s boss and underboss, initiation rites, codes of behavior, business practices, and the administration of the interactions among the various *cosche*, including territorial boundaries. Dickie notes that the detailed description is "impressive enough," but, more important, that "it chimes almost precisely with what Tommaso Buscetta sat down to reveal to Judge Falcone decades later" (Dickie, 2004). This notion of the stability of the central elements of mafia organization over time is reiterated by Paoli, who argues that such evidence should be taken into account with reasonable assurance of its accuracy for a number of reasons, including: the consistency of such evidence over the span of one-and-a-half centuries; the "multiplicity and dissimilarity of informants"; the "high number of law enforcement officials and independent observers who have gathered their confessions, as well as the diversity of historical points during which similar accounts have been put forward," and; the confirmation by "wiretappings and conversations among mafiosi themselves." (Paoli, 1995)

What arises in the various descriptions of mafia organization and the governance of relationships among *cosche* are a number of characteristics that are of interest for my model. First, although a code of conduct exists and meetings of the minds clearly take place to govern behavior among *cosche*, the decisions are not rigidly obeyed. "Indeed, the noble principles of brotherhood and solidarity are frequently recalled publicly by the very adherents willing to betray them, in order to promote their own *particulare* [interests]" (Paoli, 1995). Traditionally, punishment for violations is carried out under the aegis of the top leaders of the *cosche*. In recent times, this procedure has been somewhat formalized by the formation of a Commission. The Commission is a meeting of the most dominant members of the most powerful *cosche*. It is a more organized and clearly defined version of informal meetings among similarly influential members of *cosche* that took place in earlier times. The Commission, in its current and more rigid arrangement, was introduced by American mafia members after World War II. Catanzaro, drawing on the testimony of various *pentiti* describes the organization from top to bottom (Catanzaro, 1992). (See Appendix 3.3 for diagram)

- The *cosca* is the basic unit, controlling a specific quarter or an entire inhabited center.

- Each *cosca* is made up of "soldiers," men of honor coordinated in groups of ten by a *capodecina* (head of ten), who elect a *capo* (family head). The *capo* is assisted by a *consigliere* (counselor).

- Three or more territorially contiguous *cosche* make up a *mandamento* (district) and nominate a district chief.

- The district chiefs comprise the *cupola* (Commission), which has a provincial sphere of action and the task of insuring respect for the rules of Cosa Nostra and of settling disputes between the families.

- The Commission is presided over by one of the district chiefs who is called "secretary" or "chief."

- Finally there exists a superior liaison organism called "interprovincial," which has largely unknown features.

Paoli writes, "Since the institution of the provincial commission, Cosa Nostra prohibits its members from taking revenge for offences committed by other mafia members on their own. The provincial and regional commissions claim the right to examine all cases of conflicts among mafia brothers and, eventually, to impose the most appropriate sanctions. Since 1957, violence against another member of Cosa Nostra has been authorized only under conditions of immediate threat" (Paoli, 1995). While this may seem to contrast with previous, less formal arrangements, it differs only in manner of degree of formalization from the arrangement that pre-dated the formation of the Commission. Again, while this description is consistent across many sources, it suggests a greater level of organization that exists and disguises the critical consensus that must underlie any decision that is expected to be enforced. Essentially, the Commission is at the mercy of the *cosche* to enforce its rulings.

Another characteristic is the nature and source of mafia profits. Gambetta argues that the unifying—if not sole—characteristic of mafia is the provision of private protection (Gambetta, 1996). Paoli agrees that such a description focuses on one of the most important functions historically played by mafia groups, but argues that such a focus neglects other important aspects (Paoli, 1995).[7] Thus, Gambetta's classification places too great of a constraint on the actual economic activities in which mafia groups have been involved. Paoli asserts that the great extent of variation across mafia activities belies the application of such a stringent model to mafia activities. More to the point at hand, activities are directed at a number of levels, including single men of honor, the heads of individual *cosche*, with the cooperation of multiple *cosche*, and even at the level of the "superordinate bodies of coordination." It is also important to note that enterprises are often short-lived, constituting what

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[7]Specifically, Paoli writes, "Gambetta's assessment is linked to a functionalistic approach, according to which the evolution and organization of a social phenomenon can be deduced from the functions it plays" (Paoli, 1995).

Schneider and Schneider refer to as "action sets," the partnerships made up of men of honor from one or multiple *cosche* and even non-members (Schneider and Schneider, 2003).

Thus, in accordance with Gambetta, business activities—licit and illicit—that enrich the participants are not to be taken as the primary goal of mafia activity. Mafia members, including *capomafia*, do not derive their influence from wealth. More important, increased involvement in business activities should not be taken as evidence of respect for the customs of modern capitalism (i.e., competition without resort to violence) or as being characteristic of mafia groups; viability as a mafia member is ultimately backed by violence. Furthermore, mafia members employ and depend upon violence regardless of the specific activity in which they may be involved. However, resorting to or refraining from violence is a calculated measure for mafiosi, whether in a business enterprise or in the pursuit of power and influence. Quoting Weber, Paoli writes,

> Like the seafarers of antiquity and the Middle Ages, mafia entrepreneurs are pleased to take whatever they can get by force and fraud and have recourse to peaceful bickering only where they are confronted with a power equal to their own or where they regard it as shrewd to do so for the sake of future exchange opportunities. (Paoli, 1995)

More important, this aspect of mafia activity characterizes the relations that exist among mafia members and *cosche* themselves.

3.4 Literature Review

3.4.1 Connection to (the New) Institutional Economics

As mentioned earlier, one common approach to the study of organized crime is informed by the institutional economics literature such as McGuire and Olson (1996) and Olson (1993; 2000).[8] The focus of this literature with respect to organized crime is the typical role that organized crime groups play as the protectors of private property and how, in this capacity, organized crime groups can be compared to governments. In the language of Olson, a mafia organization is a "stationary bandit" whose "encompassing interest" induces it to provide protection to the target from whom it exacts tribute. Compared with living under threat of "roving bandits," those who are protected by the stationary bandit retain greater incentives for investment and production.

The focus of McGuire and Olson is examining the incentives that drive the stationary bandit to limit the amount of tribute exacted from his subjects and even to take costly actions that benefit his subjects, vis-à-vis a roving bandit. In doing so, McGuire and Olson

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[8]North writes, "If we wish to explore...the Mafia...our models must not only take into account literature that has recently evolved on the firm and the polity, but also integrate into the analysis the way institutional constraints have shaped these organizations and their objectives" (North, 1990).

compare the performance from a welfare standpoint of an autocratic ruler to that of a ruler elected by majority rule. Since a mafia organization cannot rightly be considered one or the other, including a mafia in such a model competing in the market for violence might yield interesting results. This issue, however, is taken up to a large extent by Grossman (1995), as discussed below. Another limit of their model, which McGuire and Olson note, is that it fails to consider the implications arising from the presence of several tribute-exacting bandits. Hence, while the McGuire and Olson framework does much to explain why mafia groups do not exact all wealth from those under its yoke, it fails to consider competing bandits or coexisting bandits in separate, but possibly contested, territories.

The analysis of Hirshleifer (2001) as presented in Dixit (2004) pits two agents with resource constraints against one another. The resources can be allocated to production, defense, and offense. Production in this economy is marked by decreasing marginal returns. Agents devote shares of their allocations to defense and offense, with an agent's offensive expenditures increasing the share of production he seizes from his opponent. Similarly, an agent's defensive expenditures increase the share of his production that he is able to successfully protect from looting by his opponent. A simple symmetric Nash equilibrium is discussed in which each agent spends a positive amount on production, defense, and offense. This is obviously inefficient as compared to the most efficient outcome in which both agents allocate all resources to production. While this analysis describes the general situation in which competing mafia groups allocate resources to violent activities, it does not attempt to describe interactions between these agents. Other questions that such a model might address include whether and how changes in the environment change military expenditures. Addressing this might yield results that would increase our understanding of violence and mafia wars.

A similar analysis is pursued by Grossman (1995), in which a mafia organization competes with the state in the provision of public services, most notably, the protection of private property. The representative producer divides his resources between legal production and extralegal production. Both the state and the mafia organization provide public services and exact tribute, and both state and mafia public services are useful in extralegal production, but the mafia organization's public services are not useful in legal production. Furthermore, state public services are less useful in extralegal production than they are in legal production. A surprising result is that, in a Nash equilibrium of this game, the existence of the mafia organization is beneficial to the producer. This arises because competition from the mafia organization reduces the rent that the state extracts. Grossman tempers this surprising result by extending the model to include a parameter that indicates the extent to which mafia public services are disruptive to the state's public services. Adding this feature gives rise to outcomes in which, for certain parameter values, the state is no longer viable and is replaced by the mafia organization. While some argue that the state in Italy and Russia was or is insufficient in its ability to provide private protection, the state cannot reasonably be considered to have been completely replaced by a mafia organization. Perhaps more interestingly, there is reason to believe that there exists a non-negligible degree of cooperation

between mafia groups and politicians, bureaucrats, and even officers of the law. It has even be said that the mafia and the state are mutually dependent.

Grossman's model explains what often appears to be the complicity of protected owners in protecting mafia activities. Essentially, the competition of a mafia organization vis-á-vis the state compels the state to reduce its rent extraction. It seems reasonable to conclude that the complicity of protected owners contributes to the weakness of the state. This, in turn, exacerbates the situation in which such owners feel compelled to seek—or accept—protection due to an insufficiently strong state. While this model is useful for understanding the coexistence of essentially rival bandits (the state and a mafia organization) it pits the two actors (the state and the mafia organization) in a competition in which the two agents cannot improve upon the outcome. In this sense, it does not provide insight regarding the interaction of multiple non-state bandits. However, merely adding a third agent—a second mafia—to the model to account for interactions among competing mafias is unlikely to contribute to our understanding of those interactions. It seems that focusing on organized crime's competition with the state may not be the route by which our understanding of mafia organizations will be increased.

Dixit (2004) summarizes an earlier version of a model by Anderson and Bandiera (2005) that accounts for predation and private protection with multiple protectors (mafia groups). They examine in detail how the market structure of these protectors affects the distribution of property income. The important point of the analysis is that these interactions induce relative changes in the security of high and low valued property. While Anderson and Bandiera give a thorough discussion of the impact that market structure has on the outcomes of distribution and social efficiency, the manner in which market structure is achieved—specifically collusion—remains unexplained. What my research hopes to provide is an explanation for the manner in which the market structure is achieved and supported. More specifically, I hope to explain the mechanisms through which collusive outcomes are maintained.

An important part of the institutional economics literature is that regarding reputation mechanisms and private contract enforcement. Milgrom, North, and Weingast (1990) use the law merchant as an example of institutions providing a mechanism to make reputations effective and to encourage honest behavior, notably in the absence of a state to provide enforcement. Another example of such a system is the diamond industry, cited by Bernstein (1992). Bernstein describes the institutions—reputation, customs, and arbitration practices—that govern trade in the diamond industry and how they have evolved over time. In contrast to the law merchant, this system functions in spite of the presence of the state. More important, it operates without reference to the effectiveness or ineffectiveness of the state. While reputation is undoubtedly a factor in an individual's becoming a mafioso, a mafioso's reputation for violence is never in question. More to the point of interactions among mafia groups, the ability (reputation) of a group to apply violence is never in question. It is strategic calculations that dictate the application of violence.

Addressing the notion of "spontaneous order" advanced by Hayek (1945; 1960), Williamson (1991) recognizes the importance and subtlety of spontaneous ordering in governance, but

argues that intentional governance has been neglected due to the attention paid to spontaneous order. It seems that both the hierarchical and non-hierarchical views could be better understood by such an analysis. My impression is that mafia behavior is a hybrid of the two, incorporating the flexibility and evolutionary processes of a spontaneous order and the focused effectiveness of hierarchy. It is this structure that has allowed mafia behavior to continue in spite of determined efforts by law enforcement to interdict mafia activities.

3.4.2 Conflict

The literature on conflict naturally has much to offer an analysis of mafia behavior. A most basic element of conflict is determining the outcome of conflict. In this regard, Hirshleifer (1989) and Skaperdas (1996) offer treatments of common forms of contest success functions (CSFs) or so-called technologies of conflict. Hirshleifer (1989) explores the ratio form and the difference form, aptly named to reflect the property that the ratio form represents the probabilities of success as the ratio of inputs, while the difference form represents the probabilities of success as the difference of inputs. Hirshleifer draws on Tullock's basic model that equates the ratio of the contestant's probabilities to the ratio of inputs raised to an exponent, m, called the "mass effect parameter," and analyzes the properties of the ratio form CSF. He then compares the ratio form CSF to the difference form CSF. A key criticism that Hirshleifer levels at the use of the ratio form is that it cannot yield a Cournot equilibrium in which a side unilaterally submits nor in which a bilateral peace emerges. Skaperdas (1996) contributes an axiomatization of these two forms of CSFs.

Polo (1995) incorporates a difference form CSF into an analysis employing contract theory to explore the "relationships between internal contracts and (external) competition among families." The competition among families—the principals offering contracts—revolves around that for the employment of agents. Among the results is that a territorial-spatial separation between families arises. This is highly accurate with respect to the situation in Sicily. However, while territorial stability might be considered a hallmark of the Sicilian Mafia, conflict still occurs. Moreover, such conflict is often over issues that transcend the stable and well-defined territorial divisions. One of the policy implications that Polo draws from the analysis is that a useful goal would be to weaken both "internal cohesion and the external relations among families." The key evidence cited in this regard are the hundreds of *pentiti*, suggesting that lenience—if not a salary and protection for the *pentito* and his family—is an effective method for breaking down this cohesion by increasing the agent's outside opportunity, with respect to the contract. Some difficulties with the relevance of this evidence include: (1) *pentiti* have been coming forward for decades, even before leniency and protection programs were in place, (2) the recruitment for members into the Sicilian Mafia has been far less strict and neglected to cultivate and socialize potential members as thoroughly as had occurred in the past, and (3) the Corleonesi—especially under Riina—undertook heavy-handed and violent action against all those it considered to be a threat. The unprecedented death toll and uncertainty about one's standing contributed to

mafiosi defections. Paoli writes,

> Until the end of the 1970s, the implementation of these manipulative practices was left to the discretion of the chiefs of single families. Each of them was free to choose the combination of force, suspicion, and appeal to traditions through which to enforce and legitimatize his own power and to secure his subordinates' obedience. In Sicily, however, the above-mentioned techniques have been more and more frequently resorted to following the rise of the Corleonesi in the early 1980s. That is to say, their rise to power in Cosa Nostra was achieved by setting members of other families at odds with each other, by creating 'tragedies' and stirring up other families' 'soldiers' against their chiefs. Distrust and suspicion became the norm, leading mafiosi to doubt the good faith of their fellow members, subordinates, and chiefs. (Paoli, 1995)

And although Paoli suggests that distrust and suspicion may have not existed to any degree before the rise of the Corleonesi, the *pentito* Buscetta disabuses us of that when he says, "A mafioso lives in terror of being judged—not by the laws of men, but by the malicious gossip internal to Cosa Nostra. The fear that someone could be speaking ill of him is constant" (Dickie, 2004).

A common thread throughout the literature on conflict is the analysis of the allocation of resources to production and predation. Rather than focusing on, for instance, the competition of private protectors with the state, this part of the conflict literature focuses on the outcome of conflict between agents in conflict. This includes Dixit's (2004) presentation of Hirshleifer (2001). Another analysis in this area is Skaperdas and Syropolous (1995), in which two gangs allocate initial endowments to the production of "guns" and "butter," that is, to coercive means and production of a consumption good, respectively. Although a reasonable interpretation is offered in which the probabilities of success correspond to the share of the consumption good, and the extension to a dynamic setting even yields the possibility of improving upon the single-period Nash equilibrium, there is no mention of means by which such groups might enter a Pareto-dominating equilibrium besides an infinite game setting and sufficiently high discount factors. Furthermore, the coercive allocations are not durable and as such must be replenished in each period. Thus the changes in the balance of power are neglected, while such considerations are likely very important in describing relations among mafia groups.

Examination of factors that contribute to conflict is also a part of the conflict literature. For example, Collier and Hoeffler (2004) consider outbreaks of civil war in Africa and the contribution of poor economic performance to the observation of conflict. Le Billon (2001) examines the role of natural resources in armed conflicts. Le Billon classifies resources along several dimensions, including geographical location (categorized as "proximate" to and "distant" from centers of control), geographical concentration (with "point" and "diffuse" being the two categories considered), scarcity and abundance, and "lootability." The strongest

conclusion is that certain resource characteristics may exacerbate the occurrence of conflict in vulnerable societies, but this result is not analytically satisfactory. The analysis does, however, contribute to the understanding of the relationship between the characteristics of resources and the characteristics of conflict. In a more sweeping examination of factors contributing to conflict, Collier and Hoeffler (2004) examine factors that fall under the broad categories of grievance and opportunity. Collier and Hoeffler exploit a data set of wars that occurred during 1960-1999. They employ an econometric approach, using a logistic model to arrive at marginal probabilities of conflict in a given five-year period. Overall, the authors find opportunity (as proxied by certain variables, notably primary commodity exports, secondary education enrollment, and per capita income) to be a significant factor contributing to conflict, while grievance factors (as proxied by variables such as inequality, political rights, ethnic polarization, and religious fractionalization) failed to provide significant explanatory power. Neglected, however, is the development of an analytical model to explain the role of various factors in the incidence of conflict.

Schelling's (1958) article, *The Strategy of Conflict*, affected both the study of conflict and, probably more significantly, the study of game theory and notions of strategy. Dixit (1987) considers strategic commitment of effort in a game of asymmetric players in a contest over a prize. In a Nash equilibrium with two such players, the player with the advantage will commit greater effort than does the weaker player. However, for more than two players, such a contest without a favored player results in overcommitment by some player. Another example of the influence that Schelling's ideas have had regarding strategy is Garfinkel's (1990) paper describing the strategic components of threats and punishments and their affect on peaceful outcomes. Significantly, within the framework of allocating resources to peaceful and military production, the allocation of resources to military production is endogenized and shown to be dependent on changes in aggregate economic activity. Furthermore, the presence of cooperative or opportunistic behavior among states is demonstrated to be associated with the relationship between aggregate economic activity and military expenditure.

3.4.3 Industrial Organization

While not addressing organized crime, *per se*, industrial organization naturally offers many tools with which one could study organized crime. For example, reputation models form an important part of the industrial organization literature with respect to predation. Selten (1978) applied game theoretic tools to analyze the notion that a chain store would be able to build reputation by fighting entry, even though accommodation would be preferred to fighting by the chain store in a one-shot game. Selten's so-called chain-store paradox, in which the chain store accommodates in every stage, in spite of preferring to remain a monopolist in each market, resulted from the unraveling that occurs in such finite-horizon settings. This finite-horizon setting removes the possibility that behavior in one stage of the game can affect behavior in subsequent stages; essentially, there is no possibility of building a reputation in such a setting.

Milgrom and Roberts (1982) picked up the chain-store paradox and offered a solution through the introduction of incomplete information. First, they formally demonstrate that in an infinite-horizon setting, the chain store does have the opportunity to develop reputation, notably in the presence of complete information. More interestingly, they show that—in a finite-horizon game—introducing incomplete information regarding the payoffs of the incumbent, the incumbent—who in spite of otherwise preferring accommodation—can develop a reputation for aggressive behavior. Kreps and Wilson (1982a) also address Selten's chain-store paradox by introducing imperfect information. Specifically, the potential entrants facing the monopolist are unsure about the type of monopolist that they are facing. Similar to Milgrom and Roberts, they find that the weak monopolist (the monopolist who prefers accommodation in the one-shot game) can develop a reputation for aggressive behavior. Both of the above solutions to the chain-store paradox employ the sequential equilibrium solution concept, formalized by Kreps and Wilson (1982b). As mentioned earlier, the reputation of mafiosi employing violence is unquestioned, so reputation, *per se*, does not likely enter into the relations among mafia groups. However, the sequential nature of the game does seem appealing. It is this model that inspired the model that I will describe later.

The scope for and factors facilitating collusion are other important aspects of the industrial organization literature. A standard textbook model is Bertrand competition in an infinite-horizon repeated game, focusing on factors such as concentration, symmetry, the size and regularity of orders, and changes in demand. While such factors may doubtlessly be important, in most cases, a richer description is necessary for developing an understanding of the mechanisms at work in sustaining collusive behavior.

An example of a richer model that describes instances in which collusive behavior may arise is Bernheim and Whinston's (1990) model, which develops conditions under which multimarket contact in a repeated-game setting can facilitate collusive behavior. The pooling of incentive compatibility constraints across markets gives rise to a case in which asymmetry in markets can ease the constraints, hence facilitating collusion, relative to the case in which markets are considered in isolation. On the other hand, in the case of symmetry across markets, such multimarket contact does not increase the likelihood of collusion. Because mafia groups meet in a wide variety of situations, such an analysis may be useful in understanding mafia behavior.

Another useful model describing collusive behavior is that of Green and Porter (1984). Notable in this analysis is the occurrence of price wars. Green and Porter model Cournot competition in an infinitely-repeated setting. Firms do not directly observe outputs of their rivals, but rather observe market price. Market price is determined by aggregate output—as usual—along with a stochastic shock. Green and Porter find that the Cournot outcome can be improved by employing trigger strategies, which focus on a trigger price. Firms remain in the collusive phase until the market price falls below the trigger price, at which point, firms enter a punishment phase, lasting T periods, during which firms produce their one-shot Cournot outputs. There are at least a couple of interesting characteristics of this equilibrium that are relevant to modeling mafia behavior. First, in order to improve upon

the Cournot outcome in the collusive phase, the trigger price must be sufficiently high that, given the distribution of the stochastic shock, the punishment phase is triggered with positive probability, even in the absence of cheating. Second, firms respond in the punishment phase with the Cournot equilibrium not to punish a possibly cheating rival, but rather because the self-enforcing characteristic of the collusive mechanism would break down if low prices were to fail to occasion punishment phases.

Another model that yields price wars in equilibrium is Rotemberg and Saloner (1986). Rotemberg and Saloner also employ an infinitely-repeated setting, but in this case, there is no uncertainty about output. Moreover, the shock to demand is observed prior to firms choosing their outputs. Rather than a low price triggering a price war, as in Green and Porter, a sufficiently high state of demand can compel otherwise colluding firms to increase output in an attempt to garner a greater share of currently high demand. With respect to mafia wars, Rotemberg and Saloner's price wars with observed shocks seem to offer a possible explanation for violence and mafia wars. What remains to be explained is the manner in which the status quo is arrived at.

Consideration of the boundaries of the firm forms another important part of the industrial organization literature relevant to the task at hand. Baker, Gibbons, and Murphy (2002) formalize part of what Williamson (1985) covers with respect to opportunism and the governance of contractual relations. The analysis employs a principal-agent framework to compare outcomes in different governance-ownership regimes. As noted before, examples of relational contracts include those that govern the diamond industry (Bernstein, 1992) and the law merchant (Milgrom et al., 1990). One possible drawback to such an approach is that the outside opportunity for the mafioso is, for the most part, death. Falcone (1992) stated that the Sicilian Mafia is like the priesthood in that one never retires.

3.5   The Model

3.5.1   A Sequential Game Inspired by the Chain-Store Paradox

I will explore the interactions between a mafia Boss and a Family, or *cosca*. Of basic interest are the mechanisms that govern the collusive aspects of mafia behavior. Stated more bluntly, the state of affairs to be considered is the decision of a *cosca* to challenge or obey the Boss's demands. Naturally, one would like to consider cases that are not quite as stark as such polar extremes. To this end, after demonstrating the various equilibria that arise in this game, I will consider how these different equilibria reflect a wider host of scenarios than just the challenge or obey paradigm.

The model I propose is a game in which a mafia family (Family or *cosca*) chooses whether or not to challenge the Boss. The Family has uncertainty about the type of Boss that it faces. As I will show below, alternative interpretations of the uncertainty surrounding the Boss's type include uncertainty regarding the Boss's reaction to a possibly non-challenging

action on the part of the Family. The Boss may view a given action as a transgression that requires severe punishment, as it may threaten either the Boss's standing, the Boss's own enterprises, or the stability of the collusive arrangement in effect. On the other hand, the Boss may view a given action as either legitimate (within the framework of the current collusive arrangement), nonthreatening—or possibly beneficial—to the Boss's standing, or simply not worth punishing. In essence, the uncertainty lies not with whether the Boss is tough or weak, but whether the Boss will consider the Family's action deserving of a tough reaction or a weak reaction.

The model that I present here is closely related to the solution to the classic chain-store paradox. In the chain-store game, potential entrants consider entry into a market in which the chain store enjoys a monopoly. If the potential entrant chooses to enter, then the chain store can choose whether or not to fight this entry. Here, families stand as potential challengers to the mafia boss. If a family disobeys the mafia boss, then the boss can choose whether or not to fight this challenge. Also, similar to the typical approach to the chain-store paradox, the shorthand that I will use to represent the uncertainty surrounding the Boss's type is that the Boss could be tough (T) or weak (W). The prior probability that the Boss is the Tough type is given by x. Again, interpretations of this uncertainty will give rise to various scenarios. For example, rather than considering the Boss to be of a fixed type, the Family's challenge may represent an action for which there exists an uncertainty of punishment. In the chain-store literature, when the chain store chooses to fight entry, its success is assured. In contrast to the typical approach to the chain store paradox, imagine that, if the Boss chooses to fight a challenger, its success is not assured; that is, there is a positive probability (p_T for the tough Boss and p_W for the weak Boss) that the Boss will be successful in foreclosing challengers. The probabilities of emerging victorious in any given face-off may depend on a number of factors, including the strength and regard of the Boss, and the strength and regard of the Family. Hence, these probabilities of success are taken as given and are not determined endogenously. Again, for the sake of simplicity, this model will take the punishment that the Boss can mete out to be fixed and known, as well as the cost of fighting. Moreover, in the event of the Boss's victory, the Boss can inflict a punishment on the defeated challenger, Π_0. Finally, the payoffs of both the Boss and the Family are hence well-known, and here, for the sake of simplicity, fixed. This is similar to the chain-store literature, in which the payoffs of each type of chain store are known, with the uncertainty being focused on the type of chain store that the potential entrant faces. Payoffs for the Boss and the Family are as follows:

For the sake of simplicity, I will consider a case in which these parameters are taken as given. Also, I consider only a twice-repeated game. The motivation for this is in contrast to the chain-store literature, which seeks a mechanism for developing reputation. Notably, I am concerned with the occurrence of violence and changes in the structure of the game that contribute to the occurrence of violence. Not to put too fine a point on this, but the reputation of the Boss is not in question. The uncertainty arises from the informal nature of the institutions governing mafia relationships, e.g., what is to be punished and what will

Action	Boss's Payoff		Family's Payoff	
(Challenge, Acquiesce)	$\Pi^B - \Pi_C$		Π_C	
(Obey, Acquiesce)	Π^B		0	
(Challenge, Fight)	Win	Lose	Win	Lose
	$\Pi^B - \Pi_C$	$-C$	Π_C	- Π_0

Table 3.1: Matrix of Payoffs

not be punished.

There are three types of equilibria that arise in such a game, which depend on the parameters: separating, pooling, and semi-separating. I will consider each in turn.
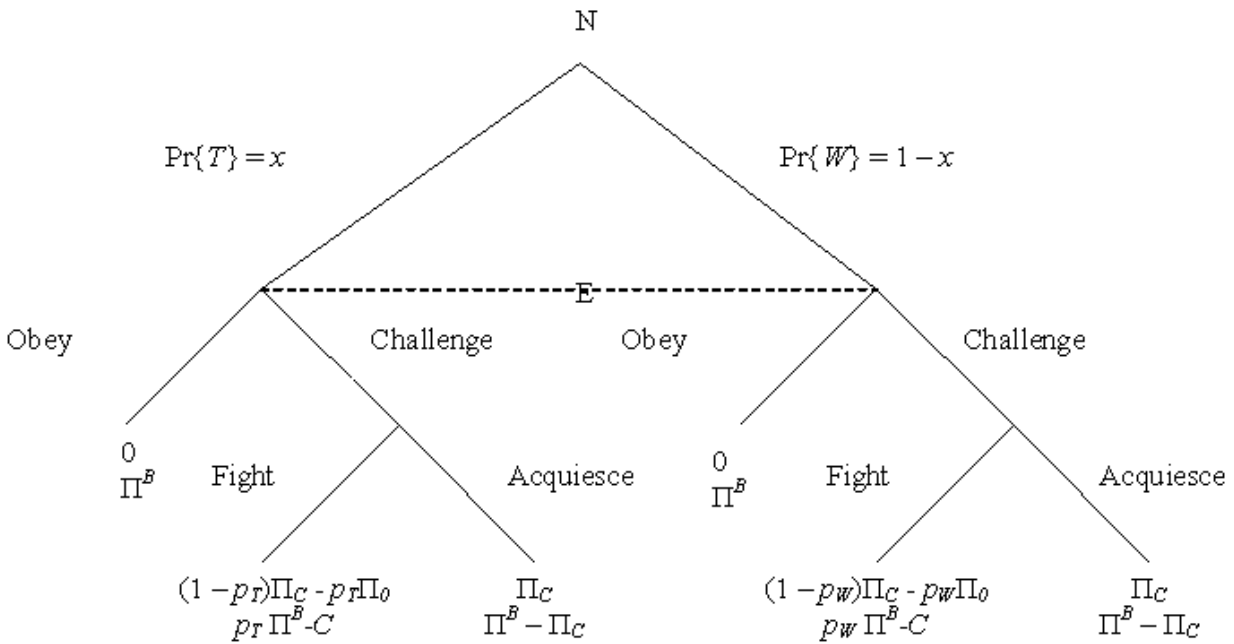

Figure 3.1: Game Tree

Intuition

In the first period, a Family faces the choice of obeying the Boss or challenging the Boss. As noted previously, rather than considering the prior probability, x, that the Family assigns to the Boss being a Tough or Weak Boss, one might consider this uncertainty to concern the Boss's response to the challenge under consideration. In this sense, it is as if the Family is unsure about whether the action being taken will be considered a threat by the Boss, and thus fought, or whether it will be considered of minor import, and thus met

with acquiescence. Thus this probability may reflect the degree to which social norms are entrenched regarding a given action. As noted previously, while social norms—e.g., codes of honor—are important, mafia bosses exercise various rationalizations to strictly interpret such codes when justifying punishments or to overlook violations when convenient. Again, the decision regarding the application of violence is largely strategic.

The second Family to consider challenging the Boss, then, in such a framework, must be considering a similar action as the first Family. The second Family will revise the probability it assigns to the response that such an action provokes from the Boss using Bayes' rule to revise its prior probability, x, given the action that the Boss takes against the first Family.

One can imagine that actions which provoke clear cut responses will give rise to a separating equilibrium. A minor action, for example, a Family engaging in a new enterprise that does not threaten the Boss, will most likely be met with acquiescence, or in the framework of this model, will evoke a greater probability that the Boss is Weak. The nature of this action and the response it provokes from the Boss are reflected in the payoffs that the action provides for the Boss and the Family.

A pooling equilibrium might be found in cases in which, while the action may or may not be minor, the perceived threat to the Boss is quite uncertain. In this sense, even some minor action, which the Family would otherwise consider to be of no consequence to the Boss, may evoke strategic concerns for the Boss.

A semi-separating equilibrium may arise when the Boss is concerned with doubts on the Boss's side about the nature of a challenge. After having fought the first Family due to perceiving the action as a threat, the Boss who subsequently chooses to acquiesce in future instances of such actions concludes that such actions are not threatening, while the Boss who chooses to fight such actions concludes that such actions are, in fact, threatening. This might describe the evolution of social norms.

Separating

In the first period, the first Family challenges the Boss. Because this is a separating equilibrium, the tough Boss fights and the weak Boss acquiesces. In order for this to be the case, for the weak Boss, it must be that

$$\frac{\Pi^B - \Pi_C + C}{\Pi^B} \geq p_W \tag{3.1}$$

This condition can clearly be met under some conditions. The second period potential challenger Family will challenge if it observes Fight because it will have complete information about the type of Boss that it faces. His updated beliefs will be $Pr\{W|A\} = 1$ and $Pr\{T|F\} = 1$.

Pooling

In a pooling equilibrium, both the tough Boss and the weak Boss fight challenges. In order for this equilibrium to arise, it must be that the second-period challenger Family will not challenge after observing the first Family being fought. Because this is a pooling equilibrium, the second-period Family's posterior beliefs remain unchanged from his prior beliefs; that is, $Pr\{T|F\} = x$. The resulting condition taken from the second-period Family's expected payoffs follows.

$$\frac{\Pi_C}{\Pi_C + \Pi_0} \leq x p_T \tag{3.2}$$

Semi-Separating

Now consider the case when neither (3.1) nor (3.2) hold. That is, consider the case when

$$\frac{Pi^B - \Pi_C + C}{\Pi^B} < p_W \tag{3.3}$$

and

$$\frac{\Pi_C}{\Pi_C + \Pi_0} > x p_T \tag{3.4}$$

The following can be shown to be an equilibrium:

1. The first Family chooses to challenge.

2. (a) The second Family challenges if the first challenging Family was met with acquiescence.

   (b) The second Family challenges with probability $\frac{(1-\delta)\Pi_C - (1-p_W)\Pi^B - C}{\delta \Pi_C}$ if the first challenging Family was fought.

3. The tough Boss fights in both periods.

4. The weak Boss fights in the first period with probability less than one.

5. The weak Boss acquiesces in the second period, if a challenge occurs.

Parameter	Description
x	Probability that Boss is Tough
p_T	Probability that Tough Boss wins confrontation
p_W	Probability that Weak Boss wins confrontation
Π^B	Boss's payoff from being obeyed or from winning
C	Boss's cost of fighting a challenging Family
Π_C	Family's payoff from challenging and winning or being met with acquiescence
Π_0	Punishment inflicted by successful Boss
δ	Discount factor

Table 3.2: Parameters
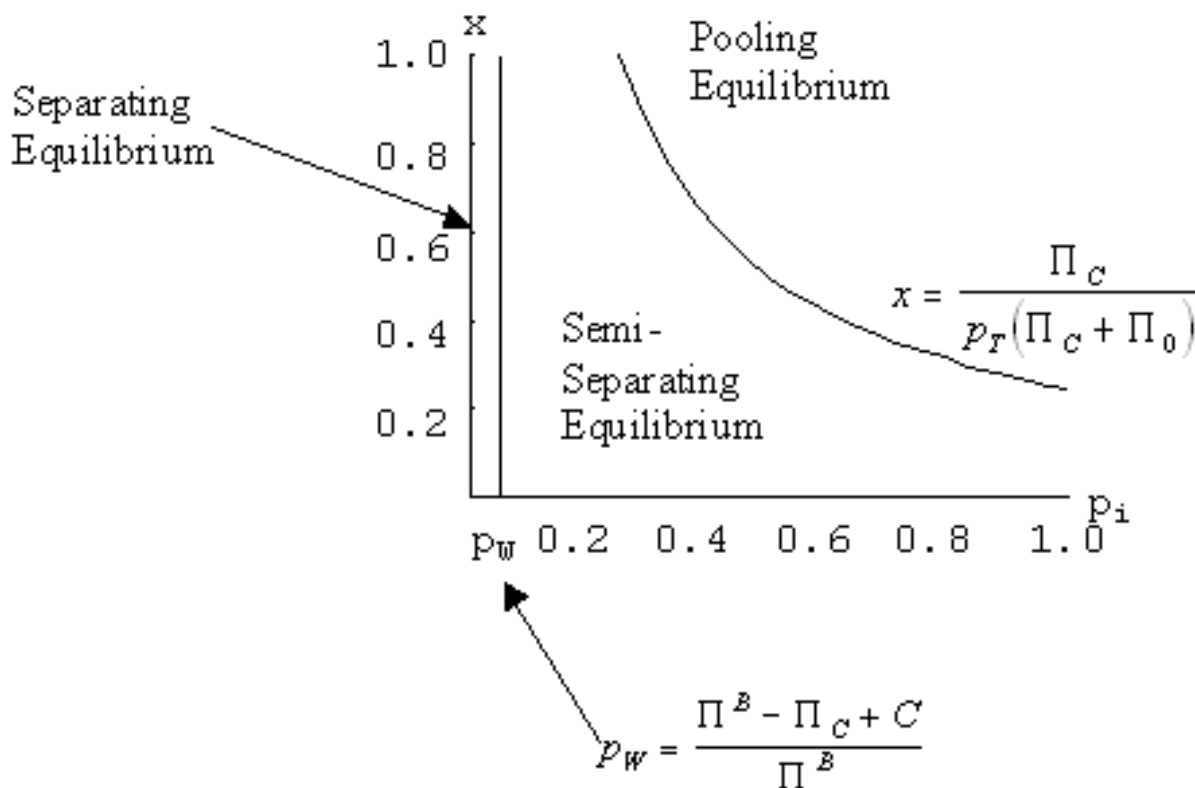
Figure 3.2: Equilibria in p_i, x space

Comparative Statics

$$p_W \leq \frac{\Pi^B - \Pi_C + C}{\Pi^B} \quad \text{denotes the upper bound of the probability of success} \quad (3.5)$$

for the Weak type for which a separating equilibrium occurs.

$$\frac{\partial p_W^{sep}}{\partial \Pi_C} < 0 \tag{3.6}$$

$$\frac{\partial p_W^{sep}}{\partial C} > 0 \tag{3.7}$$

$$\frac{\partial p_W^{sep}}{\partial \Pi_B} \begin{cases} < 0 & \text{if } \Pi_C < C \\ > 0 & \text{if } \Pi_C > C \end{cases} \tag{3.8}$$

$$\frac{\partial^2 p_W^{sep}}{\partial \Pi_C^2} = 0 \tag{3.9}$$

$$\frac{\partial^2 p_W^{sep}}{\partial (\Pi_B)^2} \begin{cases} < 0 & \text{if } \Pi_C > C \\ > 0 & \text{if } \Pi_C < C \end{cases} \tag{3.10}$$

$$\frac{\partial^2 p_W^{sep}}{\partial C^2} = 0 \tag{3.11}$$

$$\frac{\partial^2 p_W^{sep}}{\partial \Pi_C \partial \Pi^B} > 0 \tag{3.12}$$

$$\frac{\partial^2 p_W^{sep}}{\partial \Pi_C \partial C} = 0 \tag{3.13}$$

$$\frac{\partial^2 p_W^{sep}}{\partial \Pi^B \partial C} < 0 \tag{3.14}$$

$$x_p \geq \frac{\Pi_C}{p_T \left(\Pi_C + \Pi_0 \right)} \qquad \text{denotes the lower bound of the prior probability} \qquad (3.15)$$

that the Tough type for which a pooling equilibrium exists.

$$\frac{\partial x_p}{\partial \Pi_C} > 0 \tag{3.16}$$

$$\frac{\partial x_p}{\partial \Pi_0} < 0 \tag{3.17}$$

$$\frac{\partial^2 x_p}{\partial \Pi_C^2} < 0 \tag{3.18}$$

$$\frac{\partial^2 x_p}{\partial \Pi_0^2} > 0 \tag{3.19}$$

$$\frac{\partial^2 x_p}{\partial \Pi_0 \partial \Pi_C} = \frac{2\Pi_C - 1}{p_T \left(\Pi_C + \Pi_0 \right)^3} \tag{3.20}$$

$$Pr\{C|F\} = \frac{(1-\delta)\Pi_C - (1-p_W)\Pi^B - C}{\delta\Pi_C} \quad \text{denotes the probability that the} \quad (3.21)$$

second Family challenges the Boss after having observed the first

Family being fought, which arises in the semi-separating equilibrium.

$$\frac{\partial Pr\{C|F\}}{\partial \Pi_C} > 0 \tag{3.22}$$

$$\frac{\partial Pr\{C|F\}}{\partial \Pi^B} < 0 \tag{3.23}$$

$$\frac{\partial Pr\{C|F\}}{\partial C} < 0 \tag{3.24}$$

$$\frac{\partial^2 Pr\{C|F\}}{\partial \Pi_C^2} < 0 \tag{3.25}$$

$$\frac{\partial^2 Pr\{C|F\}}{\partial \left(\Pi_B\right)^2} = 0 \tag{3.26}$$

$$\frac{\partial^2 Pr\{C|F\}}{\partial C^2} = 0 \tag{3.27}$$

$$\frac{\partial^2 Pr\{C|F\}}{\partial \Pi_C \partial \Pi^B} > 0 \tag{3.28}$$

$$\frac{\partial^2 Pr\{C|F\}}{\partial \Pi_C \partial C} > 0 \tag{3.29}$$

$$\frac{\partial^2 Pr\{C|F\}}{\partial \Pi^B \partial C} = 0 \tag{3.30}$$

$$\frac{\partial^2 Pr\{C|F\}}{\partial \delta} \begin{cases} < 0 & \text{if } p_W\Pi^B - C > \Pi^B - \Pi_C \\ > 0 & \text{if } p_W\Pi^B - C < \Pi^B - \Pi_C \end{cases} \tag{3.31}$$

$$\tag{3.32}$$

Discussion

The structure of the stage-game within this repeated game is similar to that of the Stackelberg game. In this case, the Family is the first-mover, but, being subject to punishment, may not derive what might be considered a first-mover advantage, with respect to the follower, the Boss. The Family takes its action with consideration of the two reactions that its action may provoke, represented by the types of Boss that it might face, and the corresponding probabilities of facing such reactions (or types of Boss). Where the typical first-mover advantage may blunt or deter action of one's opponent, here the first-mover must consider what type of reaction his action is likely to provoke. It is the Boss's ability to fight and inflict punishment that mitigates what otherwise might be the Family's first-mover advantage.

Probability of Success for the Weak Type

Inequalities in (3.6)-(3.8) are discussed here. Increasing the Family's payoff reduces the upper bound on the probability of success for the Weak type that gives rise to a separating equilibrium. As such, a separating equilibrium becomes less likely with increases in the Family's payoff from challenging. This makes sense because, all else equal, a higher payoff for the Family will induce it to challenge regardless of whether the action is a direct threat to the Boss. Another way of thinking about this is that a greater payoff to the Family corresponds directly to an increase in the likelihood that the Boss will consider a given action to be a threat.

On the other hand, increasing the Boss's cost to fighting will increase the upper bound on the probability of success for the Weak type that gives rise to a separating equilibrium. Thus, a separating equilibrium becomes more likely as the Boss's cost of fighting increases because the significance of the actual threat value of the action becomes important in deciding whether or not to fight.

The conditions in (3.8) that determine how the Boss's payoff affects the likelihood of a separating equilibrium are understandably relevant. If the cost of fighting is greater than the loss from acquiescence, then increasing the Boss's payoff makes a separating equilibrium more likely, as in (3.6).

Upper Bound of Prior Probability that Boss is Tough for Which a Pooling Equilibrium Arises

Inequalities in (3.16)-(3.17) are discussed here. An increase in the Family's payoffs increases the likelihood of a semi-separating equilibrium by increasing the lower bound on the prior probability required for a pooling equilibrium. This can be interpreted as a case in which, all else equal, an increase in the payoff to the Family reflects an increase in the doubt surrounding the likely reaction of the Boss to the action in question.

A greater punishment decreases the lower bound on the prior probability required for a pooling equilibrium. All else equal, an increase in the severity of the punishment decreases the expected value of the Family's payoff, making the pooling equilibrium more likely. This can be interpreted as a case in which, all else equal, the Boss has a greater scope for punishing the action in question, which causes some actions for the Family to become less attractive.

Probability that Second Family Challenges after Having Observed Fight

Inequalities in (3.22)-(3.24) and (3.31) are discussed here. An increase in the payoff available to the Family from challenging increases the probability of the second Family of challenging the Boss after having observed the first Family being fought. This is fairly straight-

forward, in the sense that a greater expected payoff for a given action, all else equal, would tend to increase the likelihood of that action being taken.

An increase in the Boss's payoff decreases the probability of the second Family challenging the Boss after having observed the first Family being fought. This can be understood as an increase in the stakes for the Boss, which makes fighting any entry more worthwhile.

An increase to the Boss in the cost of fighting causes the probability of the second Family challenging the Boss after having observed the first Family being fought to decrease. This cost of fighting for the Boss can be taken to reflect the value the Boss assigns to not being met by challenges from Families. This result is somewhat surprising because on first thought, it seems that an increase in the cost of fighting to the Boss would be equivalent to a decrease in the payoff that the Boss enjoys.

3.6   Conclusion

An obvious way to make the above model richer is to include continuous action sets for the agents. In addition to merely adding continuous action sets, the payoffs, costs, and even the prior probabilities assigned to the Weak and Tough types could be made to be functions of the continuous actions. More specifically, modeling the probabilities using contest success functions, with actions entering as variables, might prove useful. A further step in this regard would be to more fully specify preferences. For example, payoffs could be characterized by single-peaked preferences (bliss points) or preferences that satisfy the single-crossing property. The payoffs of the Boss and Family could then more precisely specify the role of pursuing purely profit-making enterprises, which may not be perceived as challenges, as opposed to purely ego-rent enterprises, which may be perceived as challenges. A fuller description of the preferences of the actors would be more likely to yield greater insights into the behavior that arises and, ideally, into the mechanisms by which mafia groups achieve collusive outcomes.

One of my motivations for studying mafia behavior was the very turbulent setting of mafia groups in post-Soviet Russia. At first pass, it may seem that these groups are feeling themselves toward an equilibrium that may eventually come to look like the outcome in Sicily or the United States. That is, that the instability—relative to the Sicilian Mafia—is a transition issue that will sort itself out, so to speak. A question that arises is whether and how shocks such as the fall of the state (e.g., post-Soviet Russia, post-World War II Italy), new opportunities (e.g., heroin trafficking, arms trafficking), or new environments (e.g., the establishment of the Sicilian Mafia in the United States) affect such groups. My model suggests that new opportunities—increased payoffs—may lead to instability, but does not reasonably say much about the other examples.

Given that one of my interpretations is that part of the uncertainty surrounds the likely reaction of the Boss to an action that the Family takes, a subsequent step might be to consider the evolution of social norms in mafia organizations. Referring to heroin trafficking,

such activities were proscribed by the Sicilian Mafia, but the social norms surrounding this clearly evolved after greater involvement in this arena.

The same issues that I address with my model would likely be amenable to a principal-agent framework. In addition to addressing issues such as collusive outcomes and the role of violence in maintaining collusive outcomes, a principal-agent framework might be extended to consider the role of corruption in mafia activities. This approach could itself be taken in a number of directions. Of direct relevance to relations among mafia groups is focusing on the composition and procedures of the Commission. Are there several principals and several agents? Or can the Commission be rightly considered as a single principal? Another direction for the principal-agent framework is the relations among mafia groups and politicians. But who in this case is the principal and who is the agent? It has been argued that the Sicilian Mafia has traditionally placed itself in the position of being a power broker. For example, in 19th century Sicily the *gabelloti* ostensibly served the absentee landowners, but were able to manipulate their positions to exert pressure on such landowners, due to the landowners' dependence on such figures. At that point in time, it was precisely the landowners who, outside of the Sicilian Mafia, exerted the greatest influence in Sicily. Similarly, after the consolidation of the Italian state, the Sicilian Mafia was profoundly involved with politics, though never really seeking to place Sicilian Mafia members in political power. The Sicilian Mafia has had a remarkable ability to place itself at the service of the holders of power while indebting those very people to the Sicilian Mafia. As such, the Sicilian Mafia has been able to adapt quite readily to changes in political, economic, and other institutions (North, 1990); the adaptability of other mafia organizations is similarly successful.

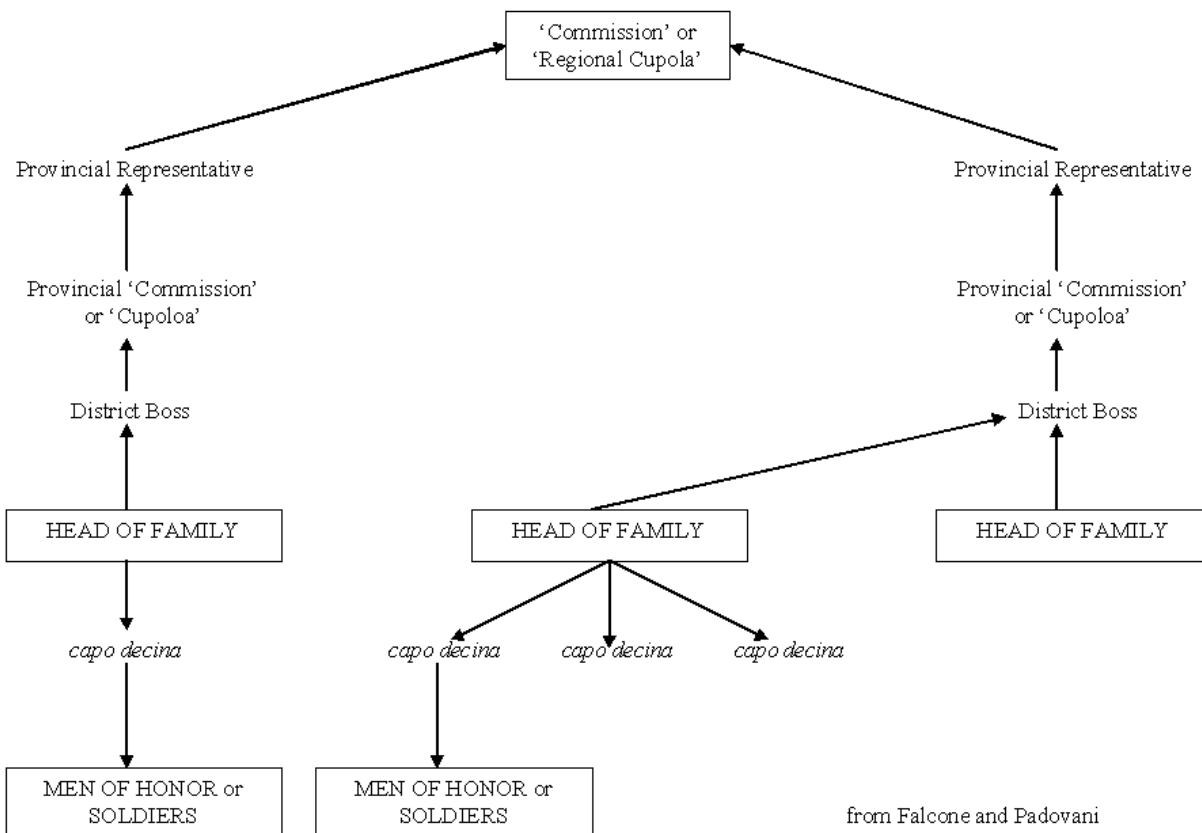# 3.A   Structure of the Sicilian Mafia

Figure 3.3: Structure of the Mafia

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