UC Irvine

UC Irvine Electronic Theses and Dissertations

Title
Essays in Coerced Labor

Permalink
https://escholarship.org/uc/item/4vw195c7

Author
Finn, Ian

Publication Date
2016

Peer reviewed|Thesis/dissertation

UNIVERSITY OF CALIFORNIA,
IRVINE

Essays in Coerced Labor

DISSERTATION

submitted in partial satisfaction of the requirements
for the degree of

DOCTOR OF PHILOSOPHY

in Economics

by

Ian Finn

Dissertation Committee:
Professor Stergios Skaperdas, Chair
Associate Professor Dan Bogart
Professor Michael McBride

2016

DEDICATION

To my parents for their unwavering support, and YinMonMon Aung for her unwavering love.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ACKNOWLEDGMENTS

I would like to express the deepest appreciation to my committee chair, Stergios Skaperdas, whose guidance and persistent help made this dissertation possible.

I would like to thank my committee members, Professor Dan Bogart and Professor Michael McBride for their constant support.

In addition, I thank the Center for Citizen Peacebuilding at the University of California, Irvine and the Institute on Global Conflict and Cooperation at the University of California, San Diego for their generous support.

CURRICULUM VITAE

Ian Finn

Education

Ph.D., Economics, University of California, Irvine (June, 2016).

M.A., Economics, University of California, Irvine (May, 2016)

B.A., Economics, Minor in International Studies, Boston College (2008).
-Membership: Golden Key International Honours Society, Omicron Delta Epsilon: Gamma Chapter, Deans List High Honors (4 semesters).

University College Dublin, Study Abroad Program (one semester, 2007).

Research Interests

Economic History; Development Economics; Public Economics; Economic Demography; Applied Microeconomics; Labor Economics.

Articles Under Review

Finn, I. 2015. "Ties That Bind: The Political Economy of Coerced Labor." (submitted).

Articles in Progress

Finn, I. 2015. "Coerced Labor, Insurrection and Urbanization: Theory and Evidence from the Antebellum South." (preparing for submission).

Finn, I. 2015. "Coerced Labor, Insurrection and Agricultural Productivity: Theory and Evidence from the Antebellum South." (preparing for submission).

Finn, I., Brian Asquith, and Nanneh Chehras. 2015. "A Theory of Love and War: The Vietnam Draft, Assortive Mating, and Crime in the 1980's." (data analysis in progress).

Research and Travel Grants

Herbert F. York Global Security Dissertation Fellowship, University of California Institute on Global Conflict and Cooperation, 10/15-10/16, $18,000

Economics Summer Research Fellowship, University of California, Irvine, 2013, 2014, 2015, $6,000

All-University of California Group in Economic History Research Fellowship, University of California, 2014, $1,500

Travel Grant, "Institutions in Context: The Free Market" Conference, University of Tampere, 2013, $1,100

Kugelman Research Fellowship, Center for Citizen Peacebuilding, 2014, $1,000

Travel Grant, Associated Graduate Students, University of California, Irvine, 2014, $40

Conference, Seminar, and Poster Presentations

Institutions in Context: The Free Market Conference, University of Tampere, Finland, June 2013

Institute for Mathematical Behavior Sciences Seminar, University of California, Irvine, March 2013

Graduate Student Poster Session, Department of Economics, University of California, Irvine, 2013, 2014 and 2015 (Runner-Up, Art DeVany Prize for Best Presentation)

Graduate Economic History Seminar, Department of Economics, University of California, Irvine, 2014

Teaching Fellowships

Instructor, The Global Economy, University of California, Irvine, Summer 2015

Teaching Assistant, University of California, Irvine (since 2011)
- Probability and Statistics for the Social Sciences I-III (Fall 2011, Winter 2012, Spring 2012)
- Introduction to Microeconomics (Fall 2012, Summer 2013, Fall 2013)
- Introduction to Macroeconomics (Summer 2012, Summer 2014)
- Applied Econometrics (Summer 2013)
- Social Science Analysis (Winter 2013)
- Intermediate Microeconomics (Winter 2014)
- Advanced Macroeconomics (Spring 2014)

Research and Relevant Work Experience

Research Intern, Beacon Hill Institute at Suffolk University, 2007-2008
-Economic analysis and modelling for policy research regarding Medicaid spending, gasoline taxation and state competitiveness (*Metro Area and State Competitiveness Report, 2007*).

Financial Representative, Northwestern Mutual Financial Network, 2007-2008
-Developed and administered personal network of clients to implement financial strategies targeting risk management, wealth accumulation and tax-efficient distribution

University Service

Graduate mentorship: Debapriya Chakraborty (2012-2013)

Graduate student panelist, University of California, Irvine, *Prospective Student Visiting Day* (2013)

GRE tutor, University of California, Irvine, Extension Program (2012)

Other

Quantitative Data Analysis: MATLAB, STATA, SAS, R, Python, ArcGIS

Affiliation: American Economic Association

Foreign Language: Russian (beginner)

ABSTRACT OF THE DISSERTATION

Essays in Coerced Labor

By

Ian Finn

Doctor of Philosophy in Economics

University of California, Irvine, 2016

Professor Stergios Skaperdas, Chair

My dissertation examines various facets of coerced labor. Chapter 1 develops a theoretical model of coerced labor and draws predictions regarding the intensity of serfdom in feudal Europe. These predictions are then utilized to explain why Western Europe abrogated serfdom centuries before Eastern Europe. Chapter 2 studies the factors affecting the prevalence of slave unrest in the antebellum Southern United States. I find that areas which were endowed with geographic and climatic conditions best suited for cotton production were more likely to experience revolts and discovered conspiracies. I also find that years in which cotton prices were higher led to more revolts. Chapter 3 investigates a hypothesis which attributes the backwardness of industry in the antebellum South to an inherent incompatibility between urbanization and slavery. In direct contradiction to this hypothesis, I find that county-level urbanization is uncorrelated with the incidence of revolts, discovered conspiracies or panics.

Chapter 1

Ties That Bind: A Theory of Coerced Labor

Abstract

This paper develops a game theoretic model of coerced labor, with particular
applications to serfdom in Late Medieval Europe and slavery in the antebellum United
States. Two of the more prominent explanations for the abrogation of this institution in
Western Europe are critically examined. The model predicts that reductions in
population are generally associated with less coercion, in accordance with the
population-based Malthusian theory. More profitable outside opportunities for laborers
and price inflation, in some cases, decrease coercion as well, which is interpreted as
evidence in favor of the market-based commercialization theory. The theory also
provides explanations for why these same factors did not bring about the demise of
serfdom in Eastern Europe, a puzzle posed in the famous Brenner debate. Because
greater coercion increases output per laborer, the model also accords with the Fogel and
Engerman (1974) finding that slave labor was productive in the antebellum United
States.

Introduction

A fundamental assumption implicit throughout traditional economic theory is that of perfect and costless enforcement of property rights. Yet the foundational insights garnered from the Arrow-Debreu model of competitive general equilibrium, for example, remain salient only if one assumes that agents can bargain over scarce resources free from coercion, forceful appropriation or the threat thereof. A review of recorded human history illustrates that the majority of labor market transactions across the globe exhibited precisely these characteristics. Forced labor was common practice in labor markets in several ancient civilizations including Egypt, Greece, Rome and Japan (see Melzter (1993), for example). In the feudal era, restrictions on labor mobility and the various customary labor services serfs were obliged to provide landlords, for example the *Gutswirtschaft* in Germany, were a defining feature of the "ties of dependence"[1] that characterized European serfdom.[2] During the European colonial era, slavery was an integral component of plantation economies formed in the Caribbean, parts of Brazil and Colombia[3] and, of course, in the United States.[4] Coercion was also an important factor in the organization of labor in mining operations, encomiendas, as well as the later hacienda system that persisted throughout much of Latin America well into the post-colonial era.[5]

More strikingly, the United Nations' International Labor Organization estimates that there are roughly 21 million forced laborers worldwide today, the vast majority residing in the developing world.[6] In Pakistan, for example, underdeveloped capital markets preclude easy access to credit, forcing sharecroppers dependent on short-term liquidity to seek it from opportunistic landowners.[7] In newly industrialized Brazil, lucrative opportunities

---

[1] Bloch (1964).

[2] See Hagen (1985) for discussion of these labor dues in the case of 16th century Brandenburg.

[3] Curtin (1990).

[4] Fogel and Engerman (1974), Ransom and Sutch (2001).

[5] Lockhart and Schwartz (1983).

[6] "Forced Labour, Human Trafficking and Slavery," *United Nations International Labour Organization*, accessed September 2014, http://www.ilo.org/global/topics/forced-labour/lang–en/index.htm.

[7] "Bonded labor in Pakistan and India almost certainly accounts for the largest number of forced

afforded by black market economies create a demand for labor, often satiated by duplicitous means, while negating traditional avenues for legal recourse. For instance, windfall profits from illegal logging in the Brazilian Amazon incentivize the activity of *gatos,* who entrap laborers in debt bondage by promising jobs and then demanding repayment for transportation, meals and tools.[8] Moreover, globalization, and the attendant labor market displacements that occur as a result of weakening barriers to capital mobility, have led to a massive increase in the supply of migrant workers. The UNILO estimates that there are currently 175 million such laborers across the globe, and it is well documented that many of these transients toil under dubious conditions.[9]

This paper develops a game theoretic model to investigate the underlying incentives behind coerced labor, with a particular emphasis on feudalism in Late Medieval Europe and slavery in the antebellum Southern United States. The model is used to rigorously evaluate two of the more prominent theories for the eventual disappearance of serfdom in Western Europe: a demographic theory which posits the radical reduction in European populations as a result of famine and the Black Death, and a commercialization theory which posits greater market integration due to reduced transportation costs. In general the theory accords with the demographic theory, in that a smaller laboring population will lead to less coercion. However, under an alternative specification of the model in which communal institutions are taken into account, such as the village commune which prevailed throughout much of Eastern Europe and Russia, coercion increases as the population shrinks. Moreover, the model illustrates that the success of the commercialization theory hinges critically on whether the landowner's demands for labor are curtailed by the ability of laborers to flee the manor for more profitable opportunities. When such

laborers in the world today" Khan (2009, p. 51).

[8]Sakamoto (2009, p. 27).

[9]In large part this results from the fact that visa status is almost exclusively determined by employment status, creating a relationship between employer and employed characterized by what James Taylor (1977) terms "contrived dependence"; the former, by virtue of their ability to restrict the outside opportunities afforded to the latter, is able to impose more deleterious working conditions, perhaps by coercively extracting greater effort. See Subramanian and Hedge (1997), Lim (2003).

non-manorial opportunities are limited, coercion increases as the price of agricultural output increases. Conversely, when outside opportunities for laborers are more profitable, the ability of landlord's to appropriate their labor is restricted and therefore coercion will decrease. Lastly, the model predicts that, when non-manorial opportunities are limited, coercion will increase as the institutional environment becomes more biased in favor of landowners.

The theory contributes to the existing literature by evaluating the relative strengths and weaknesses of these competing theories, while explicitly accounting for the resistance efforts put forth by laborers in these contexts. Such an exercise may be viewed as a logical extension of the famous Brenner Debate, in which Robert Brenner forcefully criticized the aforementioned theories because they did not account for the inherently coercive nature of property relations predominating in Late Medieval Europe.[10] This paper explicitly formalizes these relationships through the use of a contest-success function, and is the first to model "labor extraction" as a contest.[11] In addition, the model offers formal explanations to an important, unresolved puzzle put forth by Brenner in his critique: why did serfdom persist into the 19th century in Eastern Europe (its abolishment in Russia, for example, did not occur until 1861), while in Western Europe it was all but eradicated by the turn of the 16th century, though both regions experienced greater market

---

[10]Brenner (1976, p. 31) argues that "...such attempts at economic model-building are necessarily doomed from the start precisely because, most crudely stated, it is the structure of class relations, of class power, which will determine the manner and degree to which particular demographic and commercial changes will affect long-run trends in the distribution of income and economic growth and not *vice versa*."

[11]It is often recognized that the work of Haavelmo (1954) was the first to investigate the basic tradeoff between production and appropriation inherent in the use of these functions. Later contributions include Tullock (1980), Hirshleifer (1988) and Skaperdas (1992). Skaperdas (1996) and Jia (2008) provide derivations of variants of the functional form employed in this paper, the former via an axiomization approach and the latter using stochastic methods, in which the determination of a "winner" in the contest is noisy. Bowles (1985) and Bowles and Boyer (1988) apply a "labor extraction function", complete with supervision costs, to determine labor effort in an industrial organization setting, but the form of this function is not specified and the primary means through which employers guarantee higher worker exertion is through the threat of unemployment. In this sense the work of Bowles and Boyer is closely linked to the seminal contribution of Shapiro and Stiglitz (1984), in which involuntary unemployment is shown to be an equilibrium outcome. An important commonality between each of these papers and my own is the importance of outside opportunities, captured by workers' reservation utilities, in specifying worker exertion.

integration and reduced populations in the Late Medieval period? The analysis suggests that the prevalence of communal institutions in Eastern Europe, as well as relatively smaller urbanization rates and therefore less profitable non-manorial opportunities for laborers, are potential explanations for these disparate responses.[12]

The theory also predicts that greater coercion necessarily leads to increased output per laborer, and in this vein adds to the extensive scholarship on the viability of American slavery on the eve of the Civil War. Fogel and Engerman (1974), Genovese (1972, 1989), Ransom and Sutch (2001), David and Temin (1979) and several others, with varying degrees of acrimony, have weighed in on this important issue. If in the language of Fenoaltea (1989, p. 304), this debate may be termed a "Great War", then a crucial battlefield is the issue of slave-labor productivity. Some historians have argued that slave labor was of such poor quality and given so reluctantly that the plantation system was too inefficient to be viable (see, for example, Genovese (1972, 1989) and Cairnes (1863)), while Fogel and Engerman (1971a) argue that plantations employing slave-labor were more productive than free farms in the North. The model implies that coerced labor can indeed be productive, and thus offers a potential explanation for the findings of Fogel and Engerman (1971a, 1974).

Despite the prevalence of coercive labor markets throughout historical time and space, scholarship on this topic remains limited. Seminal works include Domar (1970), Fogel and Engerman (1974) and Ransom and Sutch (1977). More recently, Naidu and Yuchtman (2013) highlight the inherently coercive nature of labor relations in a time and place normally considered to be at the genesis of modern labor relations: nineteenth century industrial Britain. Master and Servant laws which existed in Britain until 1875 made it a criminal offense for employees to breach contracts entered into with their employers, and the resultant restriction on labor mobility had the ambiguous effect of decreasing wages,

---

[12]See Acemoglu et al. (2005) and Anderson (1996) for a discussion of the dearth of cities in Eastern Europe, and Carsten (1954) and Blum (1957) for how this manifested itself in the conflicts between peasants and landlords.

but also lessening their volatility.[13]

That said, the contribution of Acemoglu and Wolitzky (2011), which is in turn heavily inspired by Chwe (1990), is most directly similar to my own. In their paper the authors develop a principal-agent model of coerced labor and derive general equilibrium implications regarding the intensity of labor extraction and scarcity that seem to confirm the influential theory of Domar (1970). Yet an important distinction remains, as Acemoglu and Wolitzky do not employ a labor appropriation function as in this paper, and instead model coercion as a reduction in the reservation utility of laborers. Although the ability of landowner's to force laborers into accepting unfavorable labor terms is certainly a feature of coerced labor, the *direct* mechanisms by which coercion manifested themselves in both the feudal and slavery settings cannot be overlooked. It is this distinction in my paper that leads to the varying predictions regarding Eastern and Western Europe. In addition, accounting for the myriad forms of resistance put forth by serfs and slaves appears important, especially given the cost imposed by investments in quelling unrest and outright rebellion, as well as guaranteeing effort.[14] Indeed such costs were often a feature of the debates over the viability of American slavery described above.[15]

---

[13]This contribution broadens a strand of literature which has typically focused on "labor tying", and the ability of landlords to force peasants into unfavorable contracts, in a purely agricultural context. For example, Genicot (2002) develops a theoretical model in which agrarian peasants benefit from a legal ban on bonded labor agreements because this creates incentives for the development of alternative credit institutions. Similarly, Conning (2004) provides further rigor to Domar's (1970) agrarian model and generates implications regarding landlords' ologopolistic market power in the context of a standard general equilibrium trade model.

[14]The historiography of peasant and slave resistance is quite rich. In the case of serfdom, see Hilton (1990), Freedman and Bourin (2005), Kosminsky (1956), Bloch (1962), Postan (1937, 1972) and Kolchin (1987). In the case of slavery, see Aptheker (1963), Kilson (1964), Morgan (1975, 1998), and Genovese (1972, 1989).

[15]In particular, see Genovese (1989, p. 43). "The economic backwardness that condemned the slaveholding South to defeat in 1861-1865 had at its root the low productivity of labor, which expressed itself in several ways. Most significant was the carelessness and wastefulness of the slaves. Bondage forced the Negro to give his labor grudgingly and badly, and his poor work habits retarded those social and economic advances that could have raised the general level of productivity."

Commercialization and Demographic Theories

Forceful extraction of labor from direct producers by a landed nobility which specialized, either directly or through contractual ties of dependence, in the use of violence was the hallmark of European serfdom. Nevertheless, it is widely recognized that a necessary condition for the economic development witnessed by early modern Western Europe was the abrogation of this coercive institution. The creation of a free-flowing labor force dependent on the market for subsistence and the proliferation of a tenant wage-earner labor structure via commutation, precipitated an era of manorial production characterized by large-scale land ownership, the elimination of principal-agent issues associated with effort in landlord-serf "contracts", incentives for fixed investment and enhanced agricultural productivity.[16] Moreover, labor mobility allowed for intra-regional specialization and interdependence, further stimulating competitiveness and efficiency (e.g., Brenner (1982, 2001)). Yet despite a broad consensus on the importance of the eradication of serfdom in unfurling Europe's economic potential, there is far less agreement as to why this important transition took place. The debate is as old as it is contentious, but this paper will focus on two popular theories which attribute the supplantation of the manorial system to factors such as demographic contraction and commercialization. Due to their importance in interpreting the results of our model, each will be briefly delineated.

The demographic model finds its inspiration in the theory of Thomas Malthus (1798), and although first espoused by such eminent historians as M.M. Postan (1960) and Emmanuel Le Roy Ladurie (1966) more than half a century ago, continues to garner broad consensus today.[17] In its simplest rendering the theory argues that the rampant demo-

---

[16]See, for example, North and Thomas (1995, 1981) and Brenner (1982, 2001). On the stunting impact of labor obligations on peasant investment in England, see Postan (1960) and Fussell (1968). For principal-agent issues associated with serfdom see Fenoaltea (1975). Relatedly, Ogilvie and Dennsion (2007) discuss the tendency for social capital formation to be hindered by vertical hierarchies such as serfdom.

[17]For example, primitives of the Malthusian model are assumed in the theory of Voigtländer and Voth (2012), which attempts to explain Europe's escape from the "Iron Law of Wages".

graphic downturn, a form of Malthusian "phase B", which plagued much of the European continent during the 14th century dramatically altered relative factor scarcities and, consequently, the distribution of income between landlords and peasants. Faced with falling agricultural prices and rents, as well as a drastically reduced labor supply,[18] landlords were compelled to compete for productive tenants. This competition resulted in the reduction of peasant-borne levies, such as *tallage*, *merchet* and *heriot*[19]*,* and culminated in the abolition of serfdom in large, contiguous areas in England, France and much of Western Europe.

A second popular explanation for the abrogation of serfdom in late medieval Europe posits the rise of trade, in conjunction with the integration of competitive markets, as the underlying causal factor. This "commercialization" theory was perhaps first popularized by Marc Bloch (1962), and has recently been reinvigorated by the contribution of Acemoglu, Johnson and Robinson (2005a), but its economic and philosophical underpinnings are clearly evident in the work of Adam Smith (1776).[20] Its foundational premise is that markets induce producers to maximize profits through specialization, cost-cutting and productivity-enhancing investments *inter alia*, and, through a Coase-like mechanism, bring about the demise of institutions which are at odds with these incentives.[21] Viewed through this lens the eradication of serfdom in Europe was a result of the precipitous rise in intra-European trade in the wake of reduced transportation costs and frequency of war concomitant with the late medieval period; in particular, between the grain-producing East and states which possessed nascent, urban manufacturing sectors, as in the Italian city-states and Flanders.

---

[18] Tilly (1992) estimates that in some areas rural populations declined by over 40%.

[19] See Schofield (2003, p.15) for a description of the various customary dues borne by peasants.

[20] See Shiue and Keller (2007) for an empirical examination of this market-based theory, and its ability to explain the comparative economic history of Western Europe and China in the period leading up to the Industrial Revolution. Kelly (1997) formalizes the proposition that specialization brought on by trade and market integration can yield a take-off in growth.

[21] This is an example of the "efficient institutions view" described by Acemoglu et al. (2005).

Model

The model parsimoniously depicts two distinct but inter-related contexts: the archetypal European feudal manor, and the slave plantation endemic to the antebellum Southern United States. On the former, cultivable land was divided between the *demesne* and tracts with customary tenure subdivided between peasant families. Landlords held exclusive property rights over the *demesne*, including the right to appropriate all agricultural output accumulated therein, which was almost exclusively produced through coerced labor.[22] Peasants populated the latter, and the agricultural production from these plots, or "strips", satisfied subsistence requirements, with any remaining surpluses sold in fairs or the local town for private revenue.[23] Identical productive and appropriative relations obtained on Southern slave plantations, with slaves toiling roughly 5 days per week in the service of their owners, the remainder of which could be put toward production on family garden plots.[24]

The foregoing structure of productive activities is presented as a sequential game in which all players are, by assumption, endowed with perfect recall and common knowledge, so that they may costlessly observe the history of play in choosing an optimal strategy.[25] The set of players is discrete, and consists of a single landowner and a set J of identical laborers, each of whom supply a given quantity of labor in homogenous quality. For

---

[22]Andersen (1996) and Duby (1978, p. 224-6) note that common practice was for peasants to work 2-3 days each week (unpaid) on the lord's *demesne.*

[23]Although there is of course variation in the organization of production exhibited by feudal manors throughout time and space in Medieval Europe, Postan (1972, p. 89-94) notes that "this bilateral composition of the manor and of its revenues was the true hallmark of the typical manor."

[24]See, for example, Ransom and Sutch (2001, p. 83), Fogel and Engerman (1974, p. 127), Covey and Eisnach (2009, p. 73-5) and Morgan (1998, p. 186). Fogel and Engerman (1977, p. 286) estimate slaves toiled between 270 and 293 days out of the year on average. "By permitting families to have *de facto* ownership of houses, furniture, clothing, garden plots, and small livestock, planters created an economic stake for slaves in the system. Moreover, the size of the stakes was variable. It was possible for some families to achieve substantially higher levels of income and of *de facto* wealth ownership than others. The size and quality of houses and the allotments of clothes as well as the size of the garden plots differed from family to family" (Fogel and Engerman 1974, p. 127).

[25]There is often subtle differences in the manner in which these terms are employed in the game theory literature. The terminology employed in this paper is that of Fudenberg and Tirole (1991).

simplicity it shall be assumed that the set of laborers has a cardinality of J (i.e., $|J| = J$), and that $J > 2$. The strategy set M of the landowner is compact, bounded by zero from below and an arbitrarily large, but finite, Δ from above so that his strategy consists of some $m \in [0, \Delta]$.[26] This choice, along with the resistance effort put forth by peasants, determines the quantity of labor the landowner is able to forcibly extract from the direct producers residing on his land. This variable may be imbued with a variety of concrete interpretations, but in each it represents a direct expression of force made possible by the absence of an interceding centralized political or legal authority, and thus a lack of inviolable, unalterable and sufficiently well-specified property rights in labor.[27] As such, m may represent the purchase of weapons, maintaining of mercenary forces or various supervisory efforts, such as the employment of overseers tasked with monitoring labor productivity.

The strategy space of laborer $j \in J$ consists of the unit interval, representing all possible choices of resistance effort, as well as the decision to *Flee* and earn a reservation utility or *Stay* and remain on the landowner's plot.[28] Thus, a complete strategy profile is a tuple from the cartesian product $[0, 1] \times [Flee, Stay]$. Each laborer $j \in J$ is endowed with one unit of a resource, say time or work-effort, the proportions of which, given the decision to *Stay,* are distributed between private production (λ_j), coerced labor conducted in the

---

[26]In fact, given the structure of the landowner's utility function explained below, it can be shown that the optimal choice of m will always be finite, and thus the assumption of an arbitrary upper bound Δ is somewhat superfluous in ensuring the their strategy set is compact. This results from the assumptions of diminishing marginal product of labor and a constant, finite marginal cost of coercion, denoted μ below.

[27]Marc Bloch (1962) argues that hierarchical "ties of dependence" between those with varying degrees of political, military and economic clout arose as a mechanism by which social order and security could be maintained after the fall of the (western) Roman and Carolingian Empires. Fogel and Engerman (1974, p. 128) argue that plantation owners in the Southern United States enjoyed similar latitude in the interpretation and application of state law regarding the treatment of slaves. "Within fairly wide limits the state, in effect, turned the definition of the codes of legal behavior of slaves, and of the punishment for infractions of these codes, over to planters. Such duality of the legal structure was not unique to the antebellum South. It existed in medieval Europe in the duality between the law of the manor and of the crown..."

[28]This reservation utility may be interpreted as the Von Neumann-Morgenstern expected utility from stealing away to the city and earning a wage, for example.

service of the landowner (β), and resistance to forced labor obligations ($r_j \in [0, 1]$).[29] Condition (1) expresses this distribution of the peasants' resource:

$$\lambda_j + r_j + \beta(m, R) = 1. \tag{1}$$

Where $R \equiv \sum_{j \in J_s} r_j$ to represent the communal nature of resistance efforts and J_s is the set of laborers who choose *Stay*.

The choice variable r may also be given a number of historical interpretations. In the context of Late Medieval Europe, for example, it may represent the accumulation of military strength through the purchase of crude weapons, as well as the organization and training of a local militia; in such cases the credible threat of violence may have been sufficient to reduce customary dues to forward-looking lords.[30] At times a more effective alternative, r may represent costs, monetary or otherwise, associated with persuading religious and legal authorities to protect them from arbitrary exaction. For example, throughout this era religious "peace associations" were formed by prelates as a method to impose codes of conduct and morality, on peasants and nobility alike, in an era in which the Catholic church increasingly filled the void left by rampant political fragmentation. Such organizations relied on contributions from all segments of society, known as the *pezade* in France, and sometimes protected peasants from the abuses of "robber nobles."[31] In addition, it was not unheard of for non-manorial courts to rule in favor of the peasantry, as

---

[29]Two remarks are warranted here. First, it should be noted that an alternative interpretation of λ_j is the proportion of laborers' time that may be devoted to leisure. Second, from the perspective of the peasant, direct appropriation of their resource through β and a contestable lump-sum tax on the private production elicited from λ_j would be identical. As a result, in terms of its effect on peasant decision-making, m may also be interpreted as costs associated with the collection of tallages, entry fines and death dues that were also a continuing source of contention in the late Medieval period (see, for example, Anderson (1996), Duby (1978)).

[30]The threat was indeed credible, over-zealous appropriation on the part of landlords was at the heart of bloody confrontations in Catalonia in 1486, culminating in the Sentence of Guadalupe, as well as the French *Grande Jacquerie* of 1358 and peasant revolts in Germany in 1525, England in 1381, Flanders in the 1320's and the convulsions of the Calabrian peasantry from 1469-75; and "these were only the major episodes of a continent-wide phenomenon, which stretched from Denmark to Majorca" [Andersen (1996, p. 203)].

[31]Bloch (1961, p. 412-420)

was the case in the altercations between the bondsmen of East Sussex and lord Harengod.[32]

The collective nature of these forms of resistance, evident in the contest-success function detailed below, was catalyzed by the fact that much of the land not expressly designated to landlords was shared among peasant communities, as was the case with scattered allods, pastures, meadows and forests.[33] As Robert Brenner notes,

> "...the peasant wars in both west and east Germany were largely a failure, as were most of the really large-scale peasant revolts of the later medieval period in Europe. What was successful, however, not only in Eastern Germany, but throughout most of Western Europe, was the less spectacular but ultimately more significant process of stubborn resistance, village by village, through which the peasantry developed its solidarity and village institutions."[34]

In terms of the antebellum slave plantation, r may represent what Peter Kolchin (1987) refers to as "silent sabotage", such as the maiming of draft animals or destruction of lands, tools and facilities, in which effort was expended to reduce the burden of difficult labor in the field.[35] Moreover, strikes and revolts were also a common form of resistance employed by slaves.[36]

Thus the model formalizes an inherent conflict over the distribution of slaves' time between forced labor obligations, and a residual which could be applied to gainful pursuits,

---

[32] As Searle (1973, p. 165) notes, "a jury once again recalled the history of their tenure, emphasizing that the tenants had never tallaged or paid merchet and that their services were certain. The court ordered the instigators, the prior Ralph Harengod, to gaol until they should repay and satisfy the me men they had attacked."

[33] Andersen (1996, p. 148).

[34] Brenner (1976, p. 59).

[35] Daniel Dennett (1849), editor of the *Planter's Banner* in Louisiana, spoke about his slaves as such: "On a plantation they can neither hoe, nor ditch, chop wood, nor perform any kind of labor with a white man's skill. They break and destroy more farming utensils, ruin more carts, break more gates, spoil more cattle and horses, and commit more waste than five times the number of white laborers do." Moreover, an anonymous contributor to the *South-Carolina Gazette* reported, "Mr. James Gray who work'd his negroes late in his Barn at Night, and the next Morning before Day, hurried them out again, and when they came to it, found it burnt down to the Ground, and all that was in it" (quoted in Morgan 1998, p. 154-5).

[36] Aptheker (1963, p.142).

the prosecution of which had important implications for the efficiency of American slavery. Its outcome was not a foregone conclusion, as concerted efforts by slaves could prove effective in curtailing infringements on norms governing what was considered a "fair day's work." As one South Carolina planter noted, emphasizing the aforementioned lack of clearly defined property rights,

> "The daily task does not vary according to the arbitrary will and caprice of their owners, and although it is not fixed by law, it is so well settled by long usage, that upon every plantation it is the same. Should any owner increase the work beyond what is customary, he subjects himself to the reproach of his neighbors, and to such discontent amongst his slaves as to make them of but little use to him."[37]

The effectiveness of slave resistance, as well as its communal character to be formalized below, is also echoed in the detailed accounts of Eugene Genovese.

> "Thus, the slaves struggled to influence their own working conditions. Their actions did not challenge slavery *per se*, nor were they often meant to, any more than striking workers often mean to challenge the capitalist system. Yet, in an important sense the slowdowns and resistance to overwork contributed more to the slaves' struggle for survival than did many bolder individual acts that may have reflected a willingness to attack slavery itself. The slaves did make gains in their everyday living conditions...the collective form of this kind of resistance imparted a sense of community strength and taught the rudiments of organization..."[38]

If resistance proved futile attempted flight could be undertaken in the last resort, perhaps

---

[37] Quoted in Morgan (1998, p. 184). Commenting on the planter's observation, Morgan states "the requirements of the task system were hammered out just as much in conflicts with the workforce as in the supposedly inevitable march of technological progress" (Ibid, p. 184).

[38] Genovese (1972, p. 621).

to pose as a self-hired slave in the nearest town or city.[39]

The timing of the game is as follows:[40]

Stage 1: The landowner chooses $m \in M$.

Stage 2: Each laborer $j \in J$ chooses *Flee* or *Stay.* Let J_s refer to the subset of laborers who choose *Stay* in this subgame. If the laborers flee, they receive a reservation utility $\pi \in (0, 1)$, and the landowner receives $-\mu m$, where μ represents the constant marginal cost of coercion.

Stage 3: If previously laborer $j \in J$ chose *Stay,* they then choose $r_j \in [0, 1]$. Letting $L(\beta)$ represent coerced labor, T land[41], P the price of agricultural output, A a Hicks-neutral productivity parameter and $F : \Re \times \Re_+ \to \Re$ a twice-differentiable production technology, the payoff functions, if Stage 3 is reached, may be written as:

$$U_{j \in J_s}(r_j, m) = \lambda_j = 1 - r_j - \beta(m, R),$$

$$U_L(r_j, m) = PAF(L(\beta)), T) - \mu m.$$

Where $U_{j \in J}$ and U_L refer to the payoffs of laborers and the landowner, respectively. The extensive form representation of the game for a single laborer $j \in J$ is shown in Figure 2.1 above. Therefore a laborer in stage 2, having observed the choice of the landowner $m \in [0, \Delta]$, will only choose *Stay* if $\lambda_j(R, m) \geq \pi$.[42]

---

[39]"It was a unusual planter who could boast that none of his slaves had absconded during a given year. In fact, the vast majority admitted just the opposite, and some complained about 'habitual' runaways, or those who ran off two, three, and four times each year. Traveling through the southern states during the 1850s, Frederick Law Olmsted noted that at virtually every plantation he visited masters complained about runaways" Schweninger (1999, p. 267).

[40]In the current setup the landowner is the first-mover. It should be noted that comparative statics results regarding the equilibrium choice of coercion are qualitatively robust to deviations in this formulation. That is, equilibrium coercion responds similarly to deviations in P, A, T, J and μ irrespective of whether the landowner or laborers move first.

[41]It is assumed that the quantity of land endowed to the landowner is determined exogenously and utilized costlessly.

[42]It is assumed that laborer $j \in J$ chooses *Stay* if $\lambda_j(m, r_j) = \pi$.

Thus the utility laborer $j \in J_s$ receives in stage 3 is equal to the proportion of their resource which can be devoted to their private production or leisure. The payoff the landowner receives in stage three is equal to the revenue garnered from agricultural production, which takes as inputs labor $L(\beta)$ and land (T), less the costs associated with coercion. F is assumed to be a prototypical neo-classical production function, satisfying positive marginal products, strict concavity in its arguments, positive cross partial derivatives, smooth dependence on its parameters and constant returns to scale. That is:

$$\frac{\partial F}{\partial L} > 0, \quad \frac{\partial F}{\partial T} > 0, \quad \frac{\partial^2 F}{\partial L^2} < 0, \quad \frac{\partial^2 F}{\partial L^2} < 0, \quad \frac{\partial^2 F}{\partial L \partial T} = \frac{\partial^2 F}{\partial T \partial L} > 0$$

$$F(0, T) = F(L, 0) = 0 \quad \forall L, T, \quad \text{and}$$

$$F(\rho L, \rho T) = \rho F(L, T) \quad \forall \rho \geq 0.$$

Lastly, the total quantity of labor the landowner is able to forcibly extract from all $j \in J_s$ depends on the contest-success function $\beta(m, R)$, which is borrowed from the economic literature on conflict:

$$L(\beta) = \beta(m, R)J_s = \frac{cm}{cm + (1 - c) \sum_{j \in J_s} r_j} J_s) \qquad \text{for } m + R > 0 \text{ and } c \in (0, 1). \quad (2)$$

Landowner

m

Laborer j

Flee — Stay

$(-m\mu,\pi)$

Laborer j

r_j

$(PA\mathrm{F}(L(\beta),T)\text{-}m\mu,\lambda_j)$
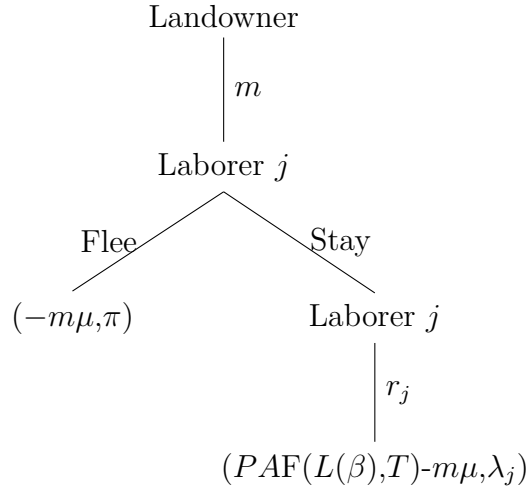
Figure 1.1: Extensive Form Representation

As the functional form for $\beta(m, R)$ plays a critical role in the following analysis, it is worth a brief discussion. It states that the proportion of labor appropriated by the landowner from laborer $j \in J_s$ is a function of his individual contribution to coercion (m), the combined level of resistance on the part of laborers $(\sum r_j)$ and the parameter c which, perhaps via norms, laws and tradition, determines the relative efficacy of repression versus resistance.[43] $\beta(m, R)$ may be considered a conflict technology, markedly distinct from those generally encountered in economic theory in that its inputs are combined *adversarially* in the "production" process, so that if both total resistance and monitoring efforts are doubled, the "output" remains constant. The fact that $(\sum r_j)$ is an argument of β is meant to reflect the communal nature of resistance discussed above, in which solidarity among the peasant and slave communities was crucial in countering the fluctuating demands of landlords.

Lastly, the parameter c is critically important in determining the relative power between the landowner and laborers. For example, note that when $m = \sum_{j \in J} r_j > 0$, $\beta = c$; and

---

[43]More specifically, it is the *ratio* of coercion to combined resistance that determines β. This can be mostly clearly seen by assuming $c = \frac{1}{2}$, which yields $\beta = \frac{m}{m+\sum r_j}$. Also, it will be assumed that $\beta(m, R) = \beta(0, 0) = c$.

thus the conflict becomes increasingly unbalanced in the landlord's favor as c approaches 1. As mentioned above, c may represent the influence of norms regarding the definition of a "fair" day's work on Southern plantations. Or c may signify a bias on the part of legal and religious authorities adjudicating disputes between lord and peasant.[44] Finally, less invasive mechanisms of slave control in cities *vis-a-vis* plantations, often posited as an important factor in the decline of urban slavery in the antebellum may be represented by a smaller c.[45] Lastly, in order to ensure the existence of best-response functions, it shall be assumed that $\beta(0,0) = 0$; in other words, if the landowner chooses not to attempt to appropriate labor and, conversely, laborers decide not to resist such efforts, then no labor is extracted.

Equilibria

The solution concept employed throughout this paper is that of subgame perfect Nash equilibrium (SPNE). Such a solution will require a Nash equilibrium to be played in each subgame, and thus will give a strong prediction to the course of play. Given the primitives of the game a pure-strategy SPNE is guaranteed, but to first narrow down the candidate strategy profiles, an immediate result is useful.

LEMMA 1: *Suppose their exists an $m \in [0, \Delta]$ that induces the decision "Stay" by laborers. This m endows the landowner with a strictly higher payoff than an $m' \in [0, \Delta]$ which induces the decision "Flea" by laborers.*

PROOF: Consider a strategy $m_f \in (0, \Delta]$ that induces laborers to choose *Flee*, and a strategy $m_s \in (0, \Delta]$ that leads to the choice *Stay*. Suppose by contradiction that the payoff to the landowner from m_f is greater than the payoff from m_s :

---

[44]Bogart (2013) gives a similar interpretation of this parameter in discussing the success of river navigation improvements in the British Parliament following the Glorious Revolution.

[45]For a detailed discussions see Wade (1964) and Goldin (1976).

$$\mu(m_s - m_f) > F(\beta(m_s, R), T) \geq 0.$$

But because $\lambda_j(m, r_j)$ is decreasing in $m \: \forall \: r_j > 0$, it must be the case that $m_f > m_s$, and thus the above statement is a contradiction because the left hand side is negative.

Given this equilibrium condition, the left-hand side of the tree diagram in Figure 1 may be disregarded, and an SPNE will be derived by employing the method of backward induction, beginning with optimal choice r_j, given that *Stay* was played in the previous proper subgame. The optimality problem of the laborer in stage 3, having observed this history of play, is :

$$\underset{r_j \in [0,1]}{\text{Max}} \: \lambda_j(m, r_j), \tag{3}$$

$$s.t. \: \beta = \frac{cm}{cm + (1 - c) \sum\limits_{j \in J_s} r_j}.$$

There are a multiplicity of equilibrium resistance efforts, $r(m)$, which satisfy the first-order condition to this problem, as only the *total* level of resistance by laborers is important in β. As a result, the symmetric strategy profile in which each laborer devotes an equal proportion of their resources to resistance shall be chosen. That is, it will be assumed:

$$\sum_{j \in J_s} r(m) = J_s r(m). \tag{4}$$

Note that equation (3) is a linear combination of concave functions, and is thus itself concave; this combined with the fact that $m > 0$ in equilibrium ensures that the solution $r(m)$ is a unique, global maximizer. Utilizing the laborer best-response function yields an immediate result that will be used throughout the text:

LEMMA 2: *If $m < m_f$, as m increases the proportion of laborers' time devoted to the landlord (β) increases.*

PROOF: Follows directly from substituting the laborer best-response function into $\beta(m, R)$.

Lemma 2 implies that greater coercion necessarily increases the time or work-effort devoted by laborers to the landlord, and therefore output per laborer, regardless of the resistance effort put forth. This result is in accordance with the argument of Fogel and Engerman (1974) that the productivity of slave labor in the antebellum United States was actually quite high relative to wage labor in the North. This topic has been the subject of intense, and often acrimonious, debate, and figured prominently in the "ongoing Great War between the Central Empires of Fogel and Engerman and the Allied Powers of near everybody else"[46]

Having obtained $r(m)$, and established that any candidate strategy profile must induce the decision *Stay* by peasants, backward induction proceeds by next solving for the optimal landowner strategy m^*. In order for peasants to be incentivized to remain on the manor, or for slaves to remain on the plantation, any equilibrium strategy m must satisfy:

$$\lambda_j(m, r(m)) \geq \pi. \tag{5}$$

As one would expect, condition (5) places an upper bound on m in equilibrium, which will henceforth be referred to as γ in the text. The optimality problem of the landowner can thus be summarized as:

$$\underset{m \geq 0}{\text{Max}} \, (PA) \cdot F(L(m, r(m)), T) - \mu m, \tag{6}$$

$$\text{s.t. } m \leq \gamma \quad \text{and}$$

---

[46]Fenoaltea (1989, p. 182).

$$\text{s.t. } L(m, r(m)) = \beta(m, r(m)) \cdot J_s.$$

Differentiation yields the Kuhn-Tucker conditions:[47]

$$PA(\frac{\partial F}{\partial L})(\frac{\partial L}{\partial m}) = \frac{J}{2} PA(\frac{\partial F}{\partial L}) \left[\frac{c}{m(1-c)} \right]^{\frac{1}{2}} = \mu + \phi \tag{7}$$

$$\phi(m - \gamma) = 0 \tag{8}$$

$$\phi \geq 0 \tag{9}$$

$$m \leq \gamma \tag{10}$$

Cursory examination of these conditions reveals the possibility of two distinct cases, each to be discussed in turn: an equilibrium in which constraint (5) binds and one in which it does not.

Binding Equilibrium

Simply put, a binding equilibrium is one in which the returns to the landowner from extracting coerced labor are high enough that they will employ coercion up until the point where laborers are indifferent between fleeing and staying on the manor. Thus, $m^* = \gamma$ and the Lagrange multiplier ϕ, which may be interpreted as the shadow price of coercion, is positive, as the landowner would be willing to pay a nonzero sum in order to accrue the benefits from a slackening of constraint (5). Re-arranging equation (7) lends insight into the conditions under which this equilibrium may arise:

---

[47]Note that because the restriction is linear in m, the constraint qualification associated with the Kuhn-Tucker formulation is automatically satisfied.

$$\phi = PA(\frac{\partial F}{\partial L})(\frac{\partial L}{\partial m}) - \mu > 0. \tag{11}$$

Landowners may wish to increase m, and intensify villein or slave labor to the point where laborers are indifferent between fleeing and remaining on the manor, if the marginal cost of m is sufficiently low, or if the price they receive for their output and the productivity of their production technology is sufficiently high. If one interprets m as an armament expenditure, a possible explanation for a low marginal cost (μ) is the technological and organizational advances in utilizing weaponry that were a by-product of the incessant warfare characteristic of medieval Europe.[48] Indeed such technological advancements may have also created spillover effects which enhanced the efficiency of productive technologies, an effect captured by a larger A. In each of these scenarios the marginal revenue garnered from increasing m would surpass its marginal cost. Thus a candidate SPNE of the game in which (5) binds is the strategy profile:

$$\left\{ m^* = \gamma, \left(Stay \text{ if } \lambda_j(m^*, r(m)) \geq \pi, Flee \text{ otherwise}; r(m) = \text{Max} \left\{ \frac{2\theta^{\frac{1}{2}} - \theta}{4J}, 0 \right\} \text{ if } Stay \right) \right\}$$

$$where \quad \theta \equiv 2(J-1)\left[J - 1 - \left[(J-1)^2 + 4J(1-\pi)\right]^{\frac{1}{2}}\right] + 4J(1-\pi).$$

Non-binding Equilibrium

As a converse to that described in the previous section, a non-binding equilibrium obtains if the returns to the landowner from employing coerced labor are sufficiently low. Such a situation may arise if the marginal cost of m is sufficiently high, or if the price of agricultural output and the Hicks-neutral productivity of the production technology

---

[48]See Hoffman (2013).

is sufficiently low. Such conditions may have been characteristic of Medieval Europe before the economic and demographic expansions of the 12th and 13th centuries, in which efficiency improving techniques such as advanced husbandry and the 3 field system had yet to be adopted, and intra-regional trade had yet to have an inflationary effect on agricultural output. In regards to the antebellum South, μ may have been relatively higher before the advent of organizational improvements in the extraction of labor, such as the gang and task systems, which took advantage of scale economies in supervision. From the complementary slackness condition this implies that $\phi = 0$, and from equation (7) an implicitly defined reaction function for the landowner may be derived:

$$PA(\frac{\partial F}{\partial L})(\frac{\partial L}{\partial m}) = \frac{PAJ}{2}(\frac{\partial F}{\partial L})\left[\frac{c}{m(1-c)}\right]^{\frac{1}{2}} = \mu. \tag{12}$$

This yields the familiar condition that, in equilibrium, the landowner will calibrate his strategy so that the marginal benefit accrued from coercion is equal to its marginal cost.

Thus, an SPNE in the case where constraint (5) does not bind is given by:

$$\{m^* \text{ defined by } (12), (Stay \text{ if } \lambda_j(m^*, r(m)) \geq \pi, Flee \text{ otherwise}; r(m) = \text{Max}\{\eta, 0\} \text{ if } Stay)\}$$

$$where \quad \eta \equiv \frac{cm^*\left[\left(\frac{1-c}{cm^*}\right)^{\frac{1}{2}} - 1\right]}{(1-c)J}.$$

Comparative Statics

The properties of these equilibria, specifically how the laborers' and landlord's equilibrium strategies respond to marginal changes in parameter values, will be discussed presently. To simplify the following exposition m_b^* and m_n^* shall refer to the equilibrium choice of

coercion in the binding and non-binding equilibria, respectively, where $m_b^* \equiv \gamma$. The analysis is somewhat complicated by the fact that, in contrast to simultaneous games, fluctuations in parameters that do not enter directly into the peasant utility function may, as a result of a deviation in the landlord's strategy, nevertheless induce an altered laborer best response. This section is organized according to the main theories discussed in the Introduction.

Commercialization Theory Comparative Statics

Recall that this theory poses the entrenchment and expansion of markets, for example those associated with grain, woolens and viticulture, as the fundamental causal factor in explaining the decline of serfdom and, ultimately, the adoption of more efficient means of agricultural production. The potential gains from trade realized through specialization and the division of labor, as well as economies of scale and agglomeration, necessitated a freely mobile labor force and thus an abandonment of the feudal organization of production. Two parameters within the model most directly capture the growing commercialization that was characteristic of Medieval Western and Southern Europe in the 12th and 13th centuries: P and π.

In regards to P, a number of historians have highlighted the inflationary impact of market integration on agricultural output, as reductions in transport costs and specialization stimulated urban demand, both home and abroad. As Robert Brenner notes, "Ultimately the growing shift of population into industrial employments, supplemented by a powerful demographic upturn, determined a long-term increase in the demand for agricultural products, leading to a rise in food prices" Brenner (1982, p. 87). Moreover, Slicher van Blath writes

> "The changes which took place in the second half of the twelfth century and
> during the thirteenth century are well illustrated by the tremendous rise in

cereal prices. Although information about prices in this period is scarce, the movements of English wheat prices between 1160 and and 1339 are symptomatic of the economic development of all western Europe. In about one hundred years the price of wheat increased almost threefold, an increase comparable to that of the price revolution of the sixteenth century."[49]

Thus, between the 12th and 14th centuries increases in the price of agricultural output were symptomatic of deepening trade and commerce, an effect captured by a larger P in the model.

In regards to π, recall that this parameter represents the non-manorial opportunities afforded to laborers. Suppose π represents the Von Neumann-Morgenstern expected utility of escaping to the local city and earning a wage in the nascent urban manufacturing center. That is, suppose $\pi = P^e w$, where w refers to such a wage, P^e the probability of attaining employment and it is assumed that peasants are risk-neutral. As has been noted by a number of historians of the era, an important effect of the rise of intra-European trade in medieval Europe was to catalyze urbanization, and thus opportunities for urban employment. As North and Thomas note in their description of the preeminence of the Italian city-states,

> "Improvements in productivity were probably greater in the Italian cities than in Northern Europe. Their ability to support the described population densities suggests an efficiency in economic organization well surpassing that exhibited by Northern Europe...The extension of international specialization and division of labor...allowed those areas to capture the gains from trade. Their ability to reap the benefits from an extensive commerce is the underlying factor in the precocious development of the Italian cities."[50]

---

[49]Slicher van Blath (1963, p. 132-3). North and Thomas (1995, p 48) and Farmer (1988, p. 716-733) similarly note an inflationary effect on agricultural products in England during the economic expansion of the 13th century.

[50]North and Thomas (1995).

More recently, Paul Krugman (1980, 1991) has illustrated that in a context of reduced transportation costs, such as that resulting from the assartation and colonization of new lands in response to population pressure,[51] the ability of manufacturers to take advantage of increasing returns to scale in urban markets may produce a self-reinforcing cycle of urbanization. Essentially in line with the logic of Say (1803), the concentration of production creates its own demand. As a result, a key effect of commercialization in late Medieval Europe was to tighten the individual rationality constraint faced by landlords on the manor. In the model the mechanism through which this effect is manifested is the probability of finding urban employment and, due to the adoption of productivity improving technologies, the wage rate. The sum of these effects is to increase π.

Having established the manner in which commercialization manifests itself in the model, Propositions 1 and 2 below detail the effect of marginal increases in P and π on equilibrium strategies and the quantity of labor extracted by the landowner in the binding and non-binding equilibria.

PROPOSITION 1:

In a binding equilibrium:

1. *An increase in P has no effect on the landlord's coercive effort, the total or individual resistance effort by laborers, or the proportion of laborers' time devoted to the landlord (β).*

2. *An increase in laborers' outside opportunities (π) will decrease coercive effort and β, but will have an ambiguous impact on resistance effort.*

PROOF: statement 1 results directly from Lemma 1 and the laborer best-response function. Part 2 results directly from Lemmas 1, the fact that γ is decreasing in π, and the observation that π only *indirectly* affects $r(m)$ through its impact on m^*.

---

[51]North and Thomas (1981, p. 132) note this phenomenon.

PROPOSITION 2

   In a non-binding equilibrium:

1. *An increase in laborers' outside opportunities (π) has no effect on the landlord's coercive effort, total and individual resistance efforts, or β.*

2. *An increase in the price of output will increase coercive effort and β, but will have an ambiguous impact on resistance effort.*

PROOF: The first statement is straightforward: if m_n^* is the coercive effort that brings the marginal benefits and costs of coerced labor into equality, in the most extreme case an increase in the peasants' outside opportunities will cause constraint (5) to bind, and peasants to now be indifferent between stealing away and remaining on the manor. However, as noted previously, it is assumed that peasants will choose *Stay* under such circumstances, and thus there does not exist a profitable deviation from m_n^* for the landowner. As a result, the laborer best response will also remain unchanged. The second statement follows from total differentiation of the landowner best-response function, Lemma 2 and the observation that P only *indirectly* affects $r(m)$ through its impact on m^*.

   If one interprets m^* and $\beta(m^*, R(m))$, which move in the same direction in response to parameter shifts, as metrics for the severity of serfdom, then clearly the success of the commercialization theory rests on whether a binding or non-binding equilibrium obtains. In a binding equilibrium, changes in the price of agricultural output have no effect on equilibrium strategies and payoffs, but an increase in outside opportunities (π) forces landowners to reduce their employment of coercion, and thus the severity of labor obligations, in order to prevent laborers from fleeing to the city. In the non-binding case an increase in π has no effect, but an increase in P will result in increased coercive efforts by the landowner due to the greater revenue that can be accrued from their output. In a binding equilibrium inflation of agricultural prices will have no effect, but more lucrative

outside opportunities for peasants will force a reduction in m_b^*, and thus a reduction in the coercive efforts associated with serfdom. This prediction accords well with the historical record of Western Europe during this period, in which traditional manifestations of seigneurial power such as forced labor obligations had largely been weakened. As North and Thomas note:

> "By the dawn of the thirteenth century the political and economic structure
> of Western Europe had fundamentally changed from what it had been in the
> tenth century. In summary: population and commerce had expanded together;
> technological changes, if still limited in occurrence, had been widely adopted
> throughout the areas; and the methods of agriculture had been adjusted to
> new conditions. And the net result was both manorialism and feudalism had
> undergone irreversible change" North and Thomas (1995, p.35).[52]

Moreover, the effect of urbanization in undermining the ability of landlords to "squeeze" their peasantry is also noted by Perry Anderson.[53] Referring to the seigneurial reaction to the crisis of the 14th and 15th centuries, in which landlords in the West attempted to resurrect feudal institutions in the face of falling incomes, he writes:

> "The existence of urban municipal independence and power of attraction,
> even in a diminished form, was a manifest obstacle to the coercive imposition
> of a generalized serfdom on the peasantry: it has been seen that it was precisely
> the objective 'interposition' of cities in the overall class structure that blocked
> any final intensification of servile bonds as a response to the crisis in the West"
> Anderson (1996, p. 253).

The effects of urbanization and inflation in a non-binding equilibrium, however, are

---

[52]As a more specific example, the authors also note "Serfdom, where it had existed, had disappeared in most parts of Flanders and Brabant in the course of the twelfth and thirteenth centuries. The rise of the market, typified by Bruges, made vassalage inefficient" North and Thomas (1995, p. 142-3).

[53]Similar arguments are also given in North and Thomas (1995, p. 30)

markedly different, and run contra to the predictions of the commercialization theory. Although an increase in π has no effect on equilibrium strategies and payoffs, inflation in the price of output increases the marginal return to employing coercion, and leads landowners to further entrench serfdom through more burdensome labor dues. These disparate predictions of the binding and non-binding equilibria may be helpful in explaining the divergent reactions to commercialization exhibited by Eastern and Western Europe, and the fact that in the former serfdom was to continue, in certain areas, well into the 19th century. First of all it is noted above that γ is decreasing in π, and therefore a non-binding equilibrium is more likely in a scenario in which vibrant non-manorial opportunities for laborers are not extant. As Anderson notes, this was precisely the case for peasants in Eastern Europe.

> "It was fundamentally this weakness of towns that allowed the nobles to adopt a solution...that was structurally barred to them in the West: a manorial reaction that slowly destroyed all peasant rights and systematically reduced tenants to serfs, working on large seigneurial demesnes" (Andersen 1996, p. 252).

Moreover, fewer cities in Eastern Europe meant less urban demand for agricultural products, and therefore a lower P. Equation (12) implies that this will also make a non-binding equilibrium more likely.

In addition, Hoffman (2013) notes that military technologies progressed at a slower rate in Eastern Europe, in large part because military engagements were often conducted against invading nomads from the Asian steppe, in which traditional cavalry and archer tactics remained effective. As a result, it is likely that, due to the technological and organizational spillovers associated with military advancements, civilian productive technologies in Eastern Europe also progressed at a slower rate. The combined effects of high marginal cost of coercion (μ), lower productivity (A) and lower urbanization rates (π)

would make a non-binding equilibrium more likely in Eastern Europe. The presence of a non-binding equilibrium, coupled with a vibrant grain export market, particularly in Eastern Germany, in the 15th and 16th centuries[54], would have led commercialization to the entrenchment of serfdom in Eastern Europe during this period, colloquially termed the second serfdom.[55]

Demographic Theory Comparative Statics

The merits of the demographic explanation for the eradication of serfdom in Western Europe shall now be assessed in the context of the model, in which population growth is modeled as an increase in the peasant population J.

PROPOSITION 3

In a non-binding equilibrium, under linear and Cobb-Douglas production technologies, as well as Constant Elasticity of Substitution (CES) production with a restriction on the land-labor ratio, if the laboring population (J) increases:

1. *Equilibrium coercion effort (m_n^*) increases.*

2. *The proportion of laborers' time devoted to the landlord (β) increases.*

PROOF: See Appendix 1.1.

PROPOSITION 4

---

[54]see Anderson (1996), footnote 19.

[55]A more expansive interpretation would posit the sign of $\frac{dm_n^*}{dA}$ as contradictory to the commercialization model as well. For as North and Thomas note, "The growth in towns facilitated local and regional exchanges, and the expansion of these markets made it profitable to specialize functions, to introduce new technologies, and to adjust the production processes to altered conditions" (North and Thomas [1995, p. 26]). Thus a more vibrant trade environment led to greater productivity, an effect captured by an increase in A.

In a binding equilibrium, under linear and Cobb-Douglas production technologies, as well as Constant Elasticity of Substitution (CES) production with a restriction on the land-labor ratio, if the laboring population (J) increases:

1. *Equilibrium coercion effort (m_b^*) increases.*

2. *The proportion of laborers' time devoted to the landlord (β) increases.*

PROOF: Part 1 follows from Proposition 3 and the fact that $\gamma(c, J, \pi)$ is increasing in J. Part 2 follows from Part 1 and substitution of the laborer best-response function into $\beta(m, R)$.

If once again one interprets m^* and $\beta(m^*, R(m))$ as metrics for the trenchancy of serfdom, Propositions 3 and 4 align with the predictions of the demographic theory, despite the fact that conflict over property rights in labor are explicitly accounted for as Brenner recommends. Recall this theory portends that a population contraction will induce a ratcheting-down effect on seigneurial appropriation. Such was the case in 14th and 15th century Europe, in which disease, incessant warfare and famine were so deleterious to European populations that landlords were forced to, in the face of falling rents and increased peasant bargaining power, alleviate customary dues in order to attract what remained of a dramatically reduced labor supply. Conversely, in the 12th and 13th centuries, when the introduction of new technologies and more vibrant trade markets allowed for agricultural output to sustain a growing population, peasants were on the receiving end of intensified villein labor.

Moreover, a common effect of demographic pressure was the accumulation of more lands under the lord's *demes*ne, as serfs engaged in the assarting of wastelands and forests or the colonization of frontier lands in an effort to safeguard their livelihood in the face of parcellization. Such efforts may be captured by an increase in T, the effect of which is summarized in Proposition 5.

PROPOSITION 5

In a non-binding equilibrium, if the quantity of arable (T) increases then:

1. *Equilibrium coercion effort (m_n^*) will increase.*

2. *The proportion of laborers' time devoted to the landowner (β) will also increase.*

PROOF: Part 1 follows from total differentiation of the landlord best-response function and the assumption of positive cross partial derivatives in the production technology. Part 2 follows from Part 1 and by substituting the laborer best-response function into $\beta(m, R)$.

Thus the aggregation of lands also increased the profitability of coercive labor extraction by landlords, adding further support to the demographic theory.

Extension: Communal Laborer Utility

Although to this point the model has provided evidence in favor of the demographic theory, the question of why Eastern and Western Europe exhibited radically disparate responses to the bubonic plague and famine remains unresolved. Why was it the case that massive reductions in the population led to the abrogation of serfdom in the West, but a "second serfdom" in the East? A potential answer may lie in the degree to which peasants were able to organize and coordinate their activities in resisting the demands of landowners. Given the recent work of Ogilivie (2005), Dennison (2011) Dennison and Ogilvie (2007), it is clear that the village communes of Eastern Europe, particularly in Bohemia and Russia, played an important role in facilitating collective action among peasants against the opportunism of landowners. Ogilvie (2005, p. 71) writes, "pre-industrial European communes are also believed to exemplify the closely knit and multi-stranded 'social networks' which, according to some modern social scientists, created a 'social capital' of shared norms, information transmission and collective action that benefited society at large and hold lessons for modern less-developed countries." Moreover, and importantly for the model, communes often represented the interests of the entire peasant community in dealings with landowners over the determination of labor obligations.

The current specification of the laborer optimality problem, together with the selection of a symmetric equilibrium, trivially implies that when J_s increases individual contributions to the resistance effort will lessen, a manifestation of the familiar free-rider problem. Given the foregoing discussion, however, it seems reasonable to investigate an alternative formulation of the model in which each laborer $j \in J_s$ maximizes the utility of the *entire* laboring population. Thus, suppose instead that the optimality problem of laborer $j \in J_s$ in Stage 3, having costlessly observed the history of play is:

$$\underset{r_j \in [0,1]}{Max} \sum_{j \in J_s} \lambda_j(m, r_j) = \sum_{j \in J_s} \left\{ 1 - r_j - \beta(m, r_j) \right\}, \tag{13}$$

$$s.t. \ \beta = \frac{cm}{cm + (1-c)\sum_{j \in J_s} r_j}.$$

Comparative statics results regarding the parameters P, A, T, c and π remain precisely the same as those described above. The effect of an increase in J, however, is more interesting. It can be shown that under this alternative setup the total level of resistance will indeed respond positively to an increase in the laboring population, and therefore the proportion of laborers' time devoted to labor dues (β) will decrease. The Proposition below summarizes the effect of a population expansion under this alternative formulation in a non-binding equilibrium.

PROPOSITION 6

In a non-binding equilibrium, under linear and Cobb-Douglas production, as well as CES production with a restriction on the land-labor ratio, if the laboring population (J) increases:

1. *The total level of communal resistance R^{*c} will increase.*

2. *Coercive effort m_n^* will increase.*

3. *The proportion of laborers' time devoted to coerced labor (β) will decrease.*

PROOF: Part 1 results directly from the peasant best-response function. It can be shown by total differentiation that the necessary and sufficient condition for Part 2 to hold is identical to that required in Proposition 3, described in Appendix 1.1. Part 3 follows from differentiation of $\beta(m_n^*, R^*)$.

Thus, this alternative formulation yields markedly different predictions regarding the effect of population growth on the severity of labor obligations. While the equilibrium coercive effort of the landowner still increases as the peasant population swells, the fact that total peasant resistance also increases ensures that the net effect is a reduction in forced labor obligations. This offers a potential explanation for why Eastern Europe, where a non-binding equilibrium was more likely, witnessed a general increase in peasant labor obligations in the wake of extreme population reduction brought on by famine and the Black Death.

The Role of Institutions in the Seigneurial Reaction

Investigating the role of institutions which arbitrated the conflictual relationship between laborers and landowners offers another potential explanation for the disparate responses to the massive demographic contraction witnessed by Eastern and Western Europe in the Late Medieval period. As a number of authors have noted, landowners throughout Europe met falling rents and agricultural prices with a "seigneurial reaction" in which more onerous labor dues were placed on peasants in order to maintain profits.[56] These measures were typically codified into law, as was the case with the English Statute of Labourers of 1351, legislation passed by the Catalonian *Corts* in the early 14th century, and the various measures employed by the Junkers throughout much of Prussia.[57] As mentioned above, the parameter *c* may be interpreted as an institutional parameter which

---

[56]See Brenner (1982), Jones (2000), Hilton (1990), Blum (1957).
[57]See Melton (1994) and Hagen (1985).

determines the relative efficacy of coercion versus resistance, and as such, represent aspects of the legal code pertaining to labor disputes between landowners and serfs. Therefore, the seigneurial reaction manifests itself in the model as an increase in c. Propositions 7 and 8 summarize the effect of such a parameter deviation on the equilibrium level of coercion.

PROPOSITION 7

In a non-binding equilibrium, under linear and Cobb-Douglas production, as well as CES production with a restriction on the land-labor ratio, if institutions become more biased in favor of the landowner, that is, as c increases, equilibrium coercion (m_n^*) and the proportion of laborers' time devoted to the landowner (β) increase.

PROOF: this follows from total differentiation of the landowner best-response function and by substituting the laborer best-response function into the contest-success function (β).

PROPOSITION 8

In a binding equilibrium, if institutions become more biased in favor of the landowner, that is, as c increases, equilibrium coercion (m_b^*) decreases.

PROOF: This follows directly from Lemma 1 and the fact that $\gamma(c, J, \pi)$ is decreasing in c. The logic here is intuitive. In a binding equilibrium, *ceteris paribus,* an increase in c will enhance the effectiveness of the landowner's attempts at extracting labor, and consequently must be accompanied by a drop in m_b^* in order to prevent the laborers from profitably deviating to *Flee.*

Thus, as is the case with many of the parameters previously discussed, the effect of greater institutional bias in favor of landowners hinges on whether a binding or non-binding equilibrium obtains. It has been previously discussed that a non-binding equilibrium was more likely in Eastern Europe, and as a result Proposition 7 is most appropriate.

Aided by a legal system favorable to their interests, landlord's in Eastern Europe could increase their coercive efforts and extract more labor from a peasantry which did not possess viable opportunities off the manor. In Western Europe, however, a binding equilibrium was more likely, and therefore landlords could not wantonly increase labor dues for fear that this would lead to a mass exodus of their labor supply.[58]

Numerical Examples

This section details the results of numerical simulations aimed at illustrating the welfare effects of various parameter deviations, as well as the propensity for constraint (5) to bind in equilibrium. With regard to the latter, an important result that is immediately garnered from these simulations is that extreme parameter values are required for (5) *not* to bind. As is evident from the discussion above, lower and higher values for c and μ, respectively, decrease the returns to the landowner from applying coercive efforts, and thus should make such an eventuality less likely. Nevertheless, considered in isolation, a binding equilibrium obtains even when $c = .13$ (which would imply that only 13% of the laborers' time was spent toiling for the landowner if both chose equal efforts), and $\mu = 10$, that is, if the marginal cost of production was ten times its price. Moreover, the availability of outside opportunities for laborers should diminish the landowners' ability to wantonly extract additional labor dues, but a binding equilibrium results even for values of $\pi < .01$. In the context of Late Medieval Europe, this result seems to accord well with the historical record of Western Europe, as the restraining effect of cities on the coercive efforts of landlords is explicitly corroborated in the scholarship of the period.[59]

---

[58]This observation has been noted by a number of authors. See for example Hatcher and Bailey (2001).

[59]According to North and Thomas (1995, p. 30), "The lord or seigneur was the logical person to settle disputes and in the last resort to enforce local law or customs; thus the provision of justice was added to his role of protector. The lord's power to exploit serfs, however, was not unlimited, but constrained (in the extreme case) by the serf's ability to steal away to seek illegal asylum..." Note that this observation further supports the case for a bias in the valuation of c described in Appendix B.

This insight has salient implications for the comparative statics delineated previously. Recall these results cast doubt on the commercialization theory, as it was shown that under a non-binding equilibrium coercive efforts on the part of the landowner increase in response to inflation in agricultural prices, interpreted as the macroeconomic effect of a rise in demand from burgeoning cities, or perhaps trade. However, simulations in which *both* P and π are incrementally augmented reveal that the expected profitability from escape is an effective deterrent to coercion, and that the efforts of the landlord (m) and the proportion of labor extracted (β) both unambiguously fall under such a scenario. Moreover, if one accepts the view espoused by Douglas North (1981) and M. M. Postan (1937) that the relative income of peasants and landowners was an important factor in determining the course of bargaining over feudal customary dues, it is also important to note that the indirect utility of a single peasant, in both absolute terms and relative to that of the landowner, rises as a result of these parameter deviations. The landowner's indirect utility increases initially as a result of the enhanced profitability of agricultural production, but this effect is eventually swamped by an inability to secure a greater supply of labor in the face of more profitable outside opportunities for peasants. Qualitatively these results are robust to changes in J and T by three orders of magnitude. Figure 1.2 below, which plots $\frac{landowner\ indirect\ utility}{individual\ peasant\ indirect\ utility}$, illustrates that although the income of the landowner was initially just under 20 times that of a peasant, by the end of the simulation this advantage is reduced to less than a factor of 2, and is cut in half when $\pi = .69$ and $P = 1.34$.

Figure 1.2: Relative Income, Landowner vs. Single Peasant
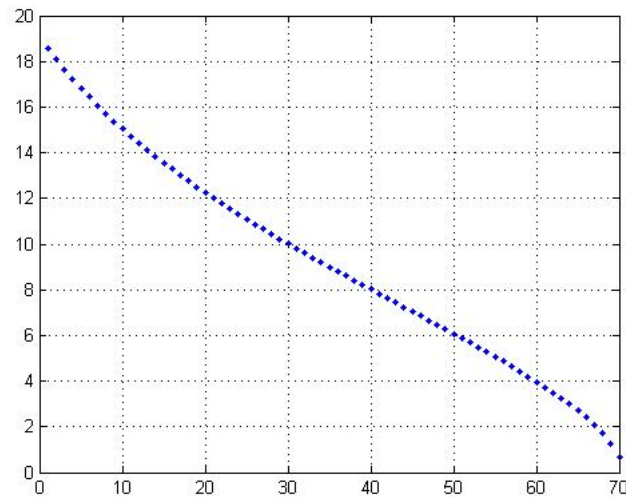
However, it should be noted that when *only P* is increased, the income of the land-lord relative to the entire peasant community *increases.* Thus if commercialization is posited as the underlying causal factor in the decline of serfdom, and bargaining power between landlords and serfs its mechanism, then it must occur in a context of inflation *and* increasing outside opportunities for serfs.

Simulations in which *J* and *P* are simultaneously increased also yield welfare implications which accord with the Malthus-inspired demographic model. As Postan (1937, p. 171) states, "the fluctuation of labour service requires no other explanation than that which is provided by the ordinary interplay of supply and demand - demand for villein services and supply of serf labor." Thus, as the peasant population swelled in Western Europe in the 12th and 13th centuries, and relative factor scarcities increasingly tipped the balance in favor of landowners, their augmented incomes could be leveraged to extract more burdensome labor obligations from the peasantry.[60] Simulations to test this

---

[60]Douglas North also lends weight to the demographic model by arguing its converse, ascribing the eventual abrogation of serfdom in Western Europe to the population contractions of the 14th century. "The plague in 1347 became endemic, returning again and again so that probably population fell for a century...In the agricultural sector there was a return to an era of abundant land and scarce labor...The relative bargaining strength shifted from the lords to the peasants. The opportunity cost of peasants

hypothesis illustrate that as the laboring population increases, and subsistence require-
ments apply upward pressure on agricultural prices, the expected utility of the landowner
indeed rises relative to that of a single peasant, and relative to the peasant community
en masse. Although the indirect utility of an individual peasant is increasing under these
dynamics, that accruing to the landowner increases much more apace; in fact, so much so
that the share of total income enjoyed by the landowner increases despite the expansion
of the peasant population.[61] This insight, in conjunction with the comparative statics,
corroborate the predictions of the demographic model. In the context of Medieval Eu-
rope, one may point to the omission of rental payments made by peasants in return for
use of the land as an important variable missing from the model; however, assuming that
these payments would be a decreasing function of the land/labor ratio, their inclusion
would only strengthen this result. Once again, qualitatively these welfare implications
are immune to changes in the values of J and T by three orders of magnitude. Figure
1.3, which plots $\frac{landowner\ indirect\ utility}{total\ peasant\ indirect\ utility}$, illustrates that while initially the share of total
income accruing to the peasant community collectively is 85%, this figure steadily drops
even as the peasant population (J) expands and the price of output rises, so that by the
conclusion of the simulation ($J = 147$, $P = 1.48$) this number has been reduced to 74%.

improved as escape to towns (which resulted in freedom after a year and a day) offered an alternative
to the oppression of the local lord. Despite repeated efforts to regulate maximum wages, competition
among landlords led to increasingly liberal terms for tenants as well as to rising wages; as a consequence,
the master-servant aspect of serfdom gave way to recognition of copyhold rights and an end to servile
obligations..." North (1981, p.134-5).

[61]This result is altered slightly when *only J* is increased. As is the case when both J and π increase,
both the landowner and laborer utilities are increasing. The landowner's income relative to a single
laborer increases as well, with that of the former being over 30 times that of the latter by the conclusion
of the simulation. However, as the size of the peasant population swells, the relative income of the
landowner versus the entire peasant community decreases, in contrast to Figure 5 above.

Figure 1.3: Relative Income, Landowner vs. Entire Peasant Community
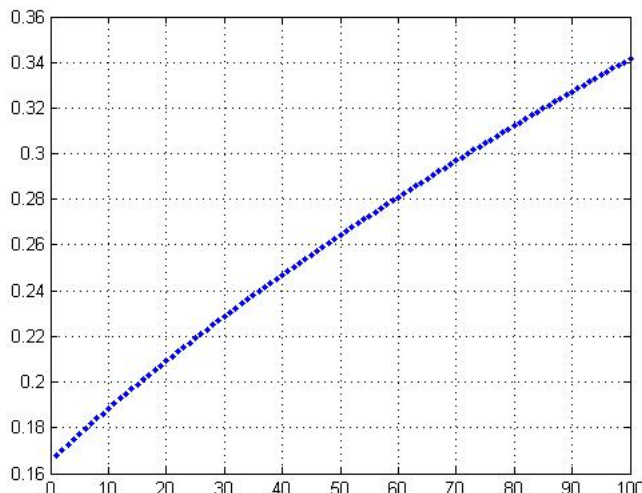
Conclusion

A focus of this paper has been to investigate the relationships of labor extraction extant on slave plantations in the antebellum Southern United States. Numerical optimization methods imply that, given the macroeconomic conditions which prevailed in that period, slave-labor productivity was on the rise. Though these arguments are tentative at best, we hope that further investigation will help inform the longstanding debate over the long-run viability of the peculiar institution. A second focus of this paper has been to illuminate and sharpen some of the more popular explanations for the abrogation of serfdom in Late Medieval Europe. It has been shown that our theory matches the predictions of the demographic model quite well, despite formalizing the character of property relations as prescribed by Brenner (1982, 2001). In the face of population expansion the efforts brought forth by a landowner in extracting the labor of direct producers will be reduced in both a binding and non-binding equilibrium. Moreover, collective resistance from laborers, whether through the petitioning of legal or religious organizations, or through day-to-day acts of "silent sabotage", will also be muted if the institutional framework

is sufficiently biased in favor of landowner interests. Movements in the indirect utilities enjoyed by players also corroborate these findings. Interpretations regarding the commercialization model of European economic development are more mixed, though numerical analysis implies that a binding equilibrium is a likely eventuality. In a binding equilibrium, increases in the price of agricultural output and the laborer reservation utility, each of which may be interpreted as a sign of market integration, will lead to less coercive efforts on the part of the landowner. In a non-binding equilibrium, however, an increase in P, and therefore the marginal revenue amassed from labor, will induce a ramping-up of such efforts, and therefore an entrenchment of the coerced labor associated with serfdom. Once again, the best response of the peasant community in the face of intensified labor obligations will depend on the leanings of the institutional framework adjudicating peasant-landlord disputes.

References

[1] Acemoglu, Daron; Johnson, Simon and Robinson, James A (2005a). "The Rise of Europe: Atlantic Trade, Institutional Change and Economic Growth." *American Economic Review*, vol. 95, no. 3, 546- 579.

[2] Acemoglu, Daron; Johnson, Simon and Robinson, James A (2005b). "Institutions As the Fundamental Cause of Long-Run Economic Growth", in *Handbook of Economic Growth*, eds. Philippe Aghion and Stephen Durlauf. Oxford: North-Holland, 2005.

[3] Acemoglu, Daron and Wolitzky, Alexander (2011). "The Economics of Labor Coercion." *Econometrica*, vol. 79, no. 2, 555-600.

[4] Andrees, B. and Belser, P. (eds.) *Forced Labor: Coercion and Exploitation in the Private Economy.* Boulder: Lynne Rienner Publishers, 2009.

[5] Aptheker, Herbert. *American Negro Slave Revolts.* New York: International Publishers, 1963.

[6] Aston, T.H., and Philpin, C.H.E., eds. *The Brenner Debate: Agrarian Class Structure and Economic Development in Pre-Industrial Europe.* Cambridge: Cambridge University Press, 1985.

[7] Anderson, Perry. *Passages from Antiquity to Feudalism.* London: Verso, 1996.

[8] Bloch, Marc. *La Societe Feodale*, 2 vols. (Paris 1939-40); trans. L. A. Manyon, *Feudal Society*, 2nd edn. London: The University of Chicago Press, 1962.

[9] Blum, Jerome (1957). "The Rise of Serfdom in Eastern Europe." *The American Historical Review,* vol. 62, no. 4, 807-836.

[10] Bogart, Dan (2013). "The Political Economy of Transport Improvements in the Aftermath of the Glorious Revolution." *Working Paper.*

[11] Bowles, Samuel (1985). "The Production Process in a Competitive Economy: Walrasian, Neo-Hobbesian, and Marxian Models." *The American Economic Review,* vol. 75, no. 1, 16-36.

[12] Bowles, Samuel and Boyer, Robert (1988). "Labor Discipline and Aggregate Demand: A Macroeconomic Model." *The American Economic Review*, vol. 78, issue 2, 395-400.

[13] Brenner, Robert (1982). "The Agrarian Roots of European Capitalism." *Past & Present*, no. 97, 16-113.

[14] Brenner, Robert (2001). "The Low Countries in the Transition to Capitalism." *Journal of Agrarian Change*, vol. 1, no. 2, 169-241.

[15] Bulow, J., Geanakoplos, J. and Klemperer, P (1985). "Multimarket Oligopoly: Strategic substitutes and Strategic Complements." *Journal of Political Economy*, no. 93, 488-511.

[16] Cairnes, John E. *The Slave Power*. London: Parker, Son & Co., 1863.

[17] Carsten, F.L. *The Origins of Prussia*. Oxford: Clarendon Press,1954.

[18] Chwe, Michael Suk-Young (1990). "Why Were the Workers Whipped? Pain in a Principal-Agent Model." *The Economic Journal*, no. 100, 1109-1121. Santa Barbara, CA: Greenwood Press, 2009.

[19] Covey, Herbert C. and Eisnach, Dwight. *What the Slaves Ate: Recollections of African American Foods and Foodways from the Slave Narratives*.

[20] Crafts, N.F.R. *British Economic Growth During the Industrial Revolution*. Oxford: Oxford University Press, 1985.

[21] David, P.A. and Temin, P. (1979). "Explaining the Relative Efficiency of Slave Agriculture in the Ante-Bellum South: Comment." *American Economic Review*, vol. 69, 213-218.

[22] Dennett, Daniel (January 11, 1849). *Planters' Banner*, XIV, editorial.

[23] Dennsion, Tracy and Ogilvie, Sheilagh (2007). "Serfdom and Social Capital in Bohemia and Russia." *The Economic History Review*, vol. 60, no. 3, 513-544.

[24] Dennison, Tracy. *The Institutional Framework of Russian Serfdom*. Cambridge: Cambridge University Press, 2011.

[25] Domar, Evsey (1970). "The Causes of Slavery or Serfdom: A Hypothesis." *The Journal of Economic History*, vol. 30, issue 1, The Tasks of Economic History, 18-32.

[26] Duby, Georges. *The Early Growth of the European Economy*: *Warriors and Peasants from the Seventh to the Twelfth Century*. Ithaca: Cornell University Press, 1974.

[27] Farmer, David L. (1988). "Prices and Wages" in *The Agrarian History of England and Wales*, vol. 2, ed. H.E. Hallam (Cambridge: Cambridge University Press, 1988), 716-779.

[28] Fenoaltea, Stefano (1975). "Authority, Efficiency, and Agricultural Organization in Medieval England And Beyond: A Hypothesis." *The Journal of Economic History*, vol. 35, no.4, 693-718.

[29] Fenoaltea, Stefano (1989). "The Slavery Debate: A Note from the Sidelines," in *Articles On American Slavery: Economics, Industrialization, Urbanization, and Slavery*, ed. Paul Finkelman (New York: Garland Publishing, Inc., 1989), 182-187.

[30] Fogel, Robert W. and Engerman, Stanley L. (1971a). "The Relative Efficiency of Slavery: A Comparison of Northern and Southern Agriculture in 1860." *Explorations in Economic History*, vol. 8, 353-367.

[31] Fogel, Robert W. and Engerman, Stanley L. (1971b). "The Economics of Slavery," in *The Reinterpretation of American Economic History*, ed. Robert W. Fogel and Stanley L. Engerman (New York: Harper & Row, 1971), 311-341.

[32] Fogel, Robert W. and Engerman, Stanley L. *Time on the Cross: The Economics of American Negro Slavery.* New York: Little, Brown & Company, 1974.

[33] Fogel, Robert W. and Engerman, Stanely L. (1977). "Explaining the Relative Efficiency of Slave Agriculture in the Antebellum South." *The American Economic Review*, vol. 67, no. 3, 275-296.

[34] "Forced Labour, Human Trafficking and Slavery." *United Nations International Labour Organization.* September 21, 2013. <http://www.ilo.org/global/topics/forced-labour/lang–en/index.htm>.

[35] Foust, James D. and Swan, Dale E. (1970). "Productivity of Ante-Bellum Slave Labor: A Micro Approach." *Agricultural History*, vol. 44, 39-62.

[36] Freedman, Paul (2000). "Rural Society", in Michael Jones ed., *The New Cambridge Medieval History Volume 6, c. 1300-1415.* Cambridge: Cambridge University Press, 2000.

[37] Freedman, Paul and Bourin, Monique, eds. *Forms of Servitude in Northern and Central Europe: Decline, Resistance, and Expansion.* Turnhout: Brepols, 2005.

[38] Fudenberg, Drew and Tirole, Jean. *Game Theory.* Cambridge, MA: The MIT Press, 1991.

[39] Fussell, G.E (1968). "Social Change but Static Technology: Rural England in the Fourteenth Century." *History Studies*, vol. 1.

[40] Genicot, Garance (2001). "Bonded Labor and Serfdom: A Paradox of Voluntary Choice." *Journal of Development Economics*, vol. 821, 1-39.

[41] Genovese, Eugene. *Roll, Jordan, Roll: The World the Slaves Made.* New York: Vintage Books, 1972.

[42] Genovese, Eugene. *The Political Economy of Slavery: Studies in the Economy and Society of the Slave South.* Middletown, CT: Wesleyan University Press, 1989.

[43] Goldin, Claudia D. *Urban Slavery in the American South: 1820-1860.* Chicago: University of Chicago Press, 1976.

[44] Grossman, Herschell (1991). "A General Equilibrium Model of Insurrections." *The American Economic Review*, vol. 81, no. 4, 912-921.

[45] Haavelmo, T. *A Study in the Theory of Economic Evolution.* Amsterdam: North-Holland, 1954.

[46] Hagen, William (1985). "How Mighty the Junkers? Peasant Rents and Seigneurial Profits in Sixteenth-Century Brandenburg." *Past & Present*, no. 108, 80-116.

[47] Hatcher, J. and Bailey, M. *Modelling the Middle Ages: The History and Theory of England's Economic Development.* Oxford: Oxford University Press, 2001.

[48] Hazewinkel, Michiel, ed. *Encyclopedia of Mathematics.* New York: Springer, 2001.

[49] Hilton, R.H. "Rent and Capital Formation in Feudal Society" in *The English Peasantry in the Later Middle Ages.* Oxford: Oxford University Press, 1975.

[50] Hilton, R.H. *Class Conflict and the Crisis of Feudalism.* London: Verso, 1990.

[51] Hirshleifer, Jack (1988). "The Analytics of Continuing Conflict." *Synthese*, vol. 76, no. 2, 201-233.

[52] Hoffman, Philip. *Why Did the West Conquer the World?*, book manuscript, Caltech, June 3, 2013.

[53] Jayadev, Arjun and Bowles, Samuel (2006). "Guard Labor." *Journal of Development Economics*, vol. 79, 328-348.

[54] Jia, Hao (2008). "A Stochastic Derivation of the Ratio Form of Contest Success Functions." *Public Choice*, vol. 135, 125-130.

[55] Kelly, Morgan (1997). "The Dynamics of Smithian Growth." *The Quarterly Journal of Economics*, vol. 112, no. 3, 939-964.

[56] Kelly, Morgan, Cormac, Ograda and Mokyr, Joel (2013). "Precocious Albion: A New Interpretation of the British Industrial Revolution." *UCD Centre for Economic Research Working Paper Series.*

[57] Khan, Ali (2009). "Bonded Labor in Pakistan" in *Forced Labor: Coercion and Exploitation in the Private Economy*, ed. Beate Andrees and Patrick Belser (Boulder, CO: Lynne Rienner Publishers, 2009), 51-71.

[58] Kilson, Marion D. (1964). "Towards Freedom: An Analysis of Slave Revolts in the United States." *Phylon*, vol. 25, no. 2, 175-187.

[59] Kolchin, Peter. *Unfree Labor: American Slavery and Russian Serfdom.* Cambridge: The Belknap Press of Harvard University, 1987.

[60] Kosminksi, E.A. *Studies in the Agrarian History of England in the Thirteenth Century.* Oxford: Blackwell, 1956.

[61] Krugman, Paul (1991). "Increasing Returns and Economic Geography." *Journal of Political Economy*, vol. 99, no. 3, 483-499.

[62] Krugman, Paul (1980). "Scale Economies, Product Differentiation, and the Pattern of Trade." *The American Economic Review*, vol. 70, no. 5, 950-959

[63] Ladurie, E. Le Roy. *Les Paysans de Languedoc*, 2 vols. Paris: S.E.V.P.E.N. edn, 1966.

[64] Lim, Timothy C (2003). "Racing From the Bottom in South Korea? The Nexus Between Civil Society and Transnational Migrfants." *Asian Survey*, vol. 43, no. 3, 423-442.

[65] Malthus, Thomas R. (1798). *An Essay on the Principle of Population.* London: W. Pickering, 1968.

[66] Meltzer, M. *Slavery: A World History.* New York: DeCapo Press, 1993.

[67] Melton, Edgar (1994). "The Decline of Prussian *Gutsherrschaft* and the Rise of the Junker as Rural Patron, 1750-1806." *German History*, vol. 12, no. 3, 334-350.

[68] Metzer, J. (1975). "Rational Management, Modern Business Practices, and Economies of Scale in the Ante-Bellum Southern Plantation." *Explorations in Economic History*, vol. 12, 123-150.

[69] Morgan, Edmund S. *American Slavery American Freedom: The Ordeal of Colonial Virginia.* New York: W.W. Norton & Company, 1975.

[70] Morgan, Philip D. *Slave Counterpoint.* Chapel Hill: University of North Carolina Press, 1998.

[71] North, Douglas. *Structure and Change in Economic History.* New York: W.W. Norton & Company, 1981.

[72] North, Douglas and Thomas, Robert. *The Rise of the Western World: A New Economic History.* Cambridge: Cambridge University Press, 1995.

[73] North, Douglas and Thomas, Robert (1971). "The Rise and Fall of the Manorial System: A Theoretical Model." *The Journal of Economic History*, vol. 31, no. 4, 777-803.

[74] Ogilvie, Sheilagh (2005). "Communities and the 'Second Serfdom' in Early Modern Bohemia." *Past and Present*, no. 187, 69-121.

[75] Phillips, Ulrich Bonnell. *Life and Labor in the Old South.* Boston: Little, Brown & Co.,1929.

[76] Postan, M.M. (1937). "The Chronology of Labour Services." *Transactions of the Royal Historical Society*, vol. 20, 169-193.

[77] Postan, M.M. (1960). "Medieval Agrarian Society in its Prime." *The Cambridge Economic History*, Vol. I, 2nd ed.

[78] Postan, M.M. *The Mediaeval Economy and Society.* London: Littlehampton Book Services Ltd., 1972.

[79] Ramsdell, Charles W. (1929). "The Natural Limits of Slavery Expansion." *The Mississippi Valley Historical Review*, vol. 16, 151-171.

[80] Ransom, Roger L. and Sutch, Richard. *One Kind of Freedom: The Economic Consequences of Emancipation.* Cambridge: Cambridge University Press, 2001.

[81] Ruffin, Edmund (1857). "The Political Economy of Slavery" in *Slavery Defended: The Views of the Old South*, ed. Eric L. McKitrick (Englewood Cliffs, NJ: Prentice hall/Spectrum Books, reprinted 1963).

[82] Russell, R.R. (1966). "Opportunities Available for the Ambitious and Efficient Farmer, an Excerpt from 'The Effects of Slavery Upon Nonslave-Holders in the Antebellum South", in Harold D. Woodman, Ed., *Slavery and the Southern Economcy Sources and Readings.* New York: Harcourt, Brace and World.

[83] Sakamoto, Leonardo (2009). "Slave Labor in Brazil" in *Forced Labor: Coercion and Exploitation in the Private Economy*, ed. Beate Andrees and Patrick Belser (Boulder, CO: Lynne Rienner Publishers, 2009), 15-35.

[84] Say, Jean-Baptiste (1803). *A Treatise on Political Economy.* New York: Cosimo Classics, 2007.

[85] Schneider, Dorothy and Schneider, Carl J. *An Eyewitness History: Slavery in America from Colonial Times to the Civil War.* New York: Facts on File, 2000.

[86] Schofield, Phillipp R. *Peasant and Community in Medieval England: 1200-1500.* New York: Palgrave Macmillan, 2003.

[87] Schweninger, Loren (1999). "Counting the Costs: Southern Planters and the Problem of Runaway Slaves, 1790-1860." *Business and Economic History*, vol. 28, no. 2, 267-275.

[88] Searle, Eleanor. *Lordship and Community: Battle Abbey and its Banlieu 1066-1538.* Toronto: Pontifical Institute of Mediaeval Studies, 1974.

[89] Shapiro, Carl and Stiglitz, Joseph (1984). "Equilibrium Unemployment as a Worker Discipline Device." *The American Economic Review*, vol. 74, no. 3, 433-444.

[90] Shiue, C.H. and Keller, W. (2007). "Markets in China and Europe on the Eve of the Industrial Revolution." *The American Economic Review*, vol. 97, no. 4, 1189-1216.

[91] Skaperdas, Stergios (1996). "Contest Success Functions." *Economic Theory*, vol. 7, 283-290.

[92] Skaperdas, Stergios (1992). "Cooperation, Conflict, and Power in the Absence of Property Rights." *The American Economic Review*, vol. 82, no. 4, 720-739.

[93] Simon, Carl and Blume, Lawrence. *Mathematics for Economists*. New York: W.W. Norton & Company, 2006.

[94] Slicher van Bath, B.H. *The Agrarian History of Western Europe: 500-1850*. New York: St. Martin's Press Inc., 1963.

[95] Smith, Adam (1776). *An Inquiry into the Nature and Causes of the Wealth of Nations*. Chicago, University of Chicago Press, 1976.

[96] Stokey, N.L. (2001). "A Quantitative Model of the British Industrial Revolution, 1780-1850." *Carnegie-Rochester Conference Series on Public Polity*, vol. 55, no. 1, 55-109.

[97] Subramanian, M.P. and Hedge, M.R. "Migrant Workers in Udupi Taluk." *Economic and Political Weekly*, vol. 32, no. 31, 1953-54.

[98] Taylor, James (1977). "Exploitation Through Contrived Dependence." *Journal of Economic Issues*, vol. 11, no. 1, 51-59.

[99] Tilly, Charles. *Coercion, Capital and European States: AD 990-1992*. London: Wiley-Blackwell, 1992.

[100] Voigtländer, Nico and Voth, Hans-Joachim (2009). "Malthusian Dynamism and the Rise of Europe: Make War, Not Love." *The American Economic Review: Papers & Proceedings,* vol. 99, no. 2, 248-254.

[101] Voigtländer, Nico and Voth, Hans-Joachim (2012). "The Three Horsemen of Riches: Plague, War, and Urbanization in Early Modern Europe." Forthcoming in the *Review of Economic Studies.*

[102] Wade, Richard D. *Slavery in the Cities*. New York: Oxford University Press, 1964.

Appendix 1.1: Proof of Proposition 3

Part 1

Total differentiation of the landowner best-response function yields:

$$\frac{dm_n^*}{dJ} = \frac{2\sqrt{m_n^*}\left\{\left(\frac{\partial F}{\partial L}\right) + J\left(\frac{\partial^2 F}{\partial L^2}\right)\beta\right\}}{J\left\{\frac{1}{\sqrt{m_n^*}}\left(\frac{\partial F}{\partial L}\right) - J\left(\frac{\partial^2 F}{\partial L^2}\right)\left(\frac{c}{1-c}\right)^{\frac{1}{2}}\right\}} \tag{14}$$

Cursory inspection reveals that, given diminishing marginal product of labor, the denominator must be positive, and thus a positive numerator is necessary and sufficient for $\frac{dm_n^*}{dJ} > 0$. Because m_n^* is positive, we need only to determine the sign of the bracketed term, which requires specifying the production technology. It is straightforward to verify that $\left(\frac{\partial F}{\partial L}\right) + J\left(\frac{\partial^2 F}{\partial L^2}\right)\beta > 0$ under a linear specification. Suppose instead Cobb-Douglas production given by $F(L,T) = L^\alpha T^\gamma$, where for simplicity the productivity parameter A is omitted and $\alpha, \gamma > 0$. This yields:

$$\left(\frac{\partial F}{\partial L}\right) + J\left(\frac{\partial^2 F}{\partial L^2}\right)\beta > 0 \iff \frac{\alpha T^\gamma}{(\beta J)^{1-\alpha}} + \beta J\left[\frac{\alpha(\alpha-1)T^\gamma}{(\beta J)^{2-\alpha}}\right] > 0 \iff \frac{\alpha}{(\beta J)^{1-\alpha}} > 0 \quad \blacksquare$$

Lastly, suppose a CES production technology given by $F(L,T) = k(c_1 L^{-a} + (1-c_1)T^{-a})^{-\frac{1}{a}}$:

$$\left(\frac{\partial F}{\partial L}\right) + J\left(\frac{\partial^2 F}{\partial L^2}\right)\beta > 0 \iff \frac{T}{L} > \left(\frac{a(1-c_1)}{c_1}\right)^{\frac{1}{a}} > 0$$

This requirement on the land-labor ratio is necessary and sufficient for $\frac{dm_n^*}{dJ} > 0$. It should be noted that this restiction is in line with the theory of Domar (1970), which predicts a greater degree of coerced labor in settings where the land-labor ratio is high, as in 16th century Russia, for example.

Part 2

Follows from Part 1 and substituting the laborer best response into $\beta(m, R)$.

Appendix 1.2: Calibration Procedure for Numerical Analysis

In the above simulations the price of agricultural output P is normalized to unity, and in accordance with a perfectly competitive benchmark the marginal cost of production, μ, is assigned the same value. Following Voigtländer and Voth (2012), the amount of arable land available to the landowner (T) is also set to unity, but it should be noted that the ensuing analysis is extremely robust to the value assigned to this parameter, even when augmented by three orders of magnitude. The production technology is assumed to be Cobb-Douglas, and the assumption of constant returns to scale is retained. Also in accordance with Voigtländer and Voth (2009, 2012), both of which investigate the effect of European demographic trends in the Late Middle Ages under a similar calibration and simulation paradigm, the output elasticity of labor is set to .6.[62] In regards to the antebellum South, the existence of increasing returns to scale in slave production has been the subject of much debate and empirical scholarship[63], but because an overwhelming consensus on this important technical issue has yet to be reached, the assumption of constant returns is retained as a useful starting point. Fogel and Engerman (1971a) also employ an output elasticity of slave labor of .6 in their efficiency computations, and thus this parameter is kept constant throughout the analysis of both Medieval Europe and the antebellum Southern United States.

Given the politico-economic aspects of the contexts described in this paper, and the interpretation of c as the institutional power of the landowner *vis-a-vis* laborers, a value of $c > .5$ seems most appropriate. This follows from the fact that in medieval Europe legal disputes regarding peasants were exclusively adjudicated in manorial courts, absent any recourse to an over-arching legal authority, in which the lord himself would often serve as

---

[62]The authors note that this estimate similar to that used in Crafts (1985), and is in line with the average of Stokey's (2001) calibrations.

[63]cf. Fogel and Engerman (1974) and Metzer (1975) for arguments in the affirmative. Russell (1966) provides conflicting evidence.

judge and jury.[64] As previously noted, Fogel and Engerman (1974) make an identical claim concerning the discharge of justice on slave plantations within the antebellum South. In their analysis it is also contended that planters self-interestedly promoted stable nuclear slave families as a means of increasing both fertility and labor productivity, despite the fact that slave marriages were forbidden under state law. "While the existence of slave marriages was explicitly denied under the legal codes of the states, they were not only recognized but actively promoted under plantation codes" (Ibid., p. 128). Thus, in order to recreate the discretion afforded landowners in the application of justice in both contexts, and maintain a realistic efficacy of resistance, c is set to .6.

The sweeping chronological and spatial scale of this exercise clearly precludes a value of J that is appropriate in all contingencies. Dennison (1987) observes that even restricting the unit of analysis to a single estate in 19th century Russia, the Voshchazhnikovo given to the Sheremetyev family following its patriarch's service in the Great Northern War, allows for ample heterogeneity in the number of peasant households per village. For example, Popovo was populated by only 3 households while eponymous Voshchazhnikovo was endowed with 201.[65] Similarly, Peter Kolchin estimates that while 71.9% of American slaveowners in 1860 owned between 1-9 slaves, 2.6% owned between 50-199, and 2.4% of slaves toiled on plantations with more than 199 slaves.[66] Though its techniques are summarily denounced by Fogel and Engerman (1971a), the assumption of 50 slaves per landowner used in Sydnor (1933), as well as a number of other articles in this period which attempted to quantify the profitability of a "representative plantation", will be utilized. Once again, however, the arbitrariness of this designation is mitigated by the robustness of our results to the value ultimately assigned. More specifically, the direction of changes in landowner and laborer indirect utility in response to parameter fluctuations, as well as the type of equilibrium obtained (binding or otherwise) is robust to changes in J by 3

---

[64]Bloch (1962), North and Thomas (1972).

[65]Dennison (1987, p. 31).

[66]Kolchin (1987, p. 54).

orders of magnitude.

The reservation utility of laborers,π, is calibrated to reflect estimates of the amount of time laborers were forced into the service of their landowner each week under both slave and villein labor.. Using the midpoint between the roughly 5 days supplied under the former, and the 3 supplied under the latter, a value of .42 for π seems most appropriate. Lastly, the parameter A has been omitted from the analysis, (i.e., set equal to 1) both out of a desire for parsimony and because a reasonable estimate could not be gleaned from extant econometric studies.

Chapter 2

Coerced Labor and Insurrection: Theory and Evidence From the Antebellum United States

Abstract

This paper investigates some of the causal factors which increased the incidence of slave insurrections and conspiracies in the antebellum Southern United States. The analysis relies on a novel dataset, which is an amalgam of geographic data, occupational data from the Integrated Public Use Microdata Series (IPUMS), county-level census data and a compilation of incidents of slave unrest as recorded by Aptheker (1993). I find that slave insurrections and conspiracies were more likely in areas which, due to natural geographic factors, enjoyed a greater degree of productivity in cotton production, and were less likely in areas naturally endowed with a greater degree of productivity in tobacco. I also find that conspiracies were more likely in counties geographically situated closer to Southern cities, a result which is also corroborated by a survival analysis. Lastly, I find that the likelihood of a revolt was greater in periods in which cotton prices were higher. To interpret these results, I develop a theoretical model of slave insurrection which incorporates slaves' incentives to rebel, as well as slaveowners' incentives to surveil. I find that if the strenuousness of the work regime is severe, as was the case on cotton plantations, and if the costs borne by slaves in the wake of a rebellion decrease, as was the case in urban areas, then revolt is more likely and slaveowners are more likely to devote greater resources toward stymieing such outbreaks.

Introduction

A review of recorded human history illustrates that wage labor is a modern phenomenon. Traditionally an absence of clearly defined, enforceable property rights allowed labor market transactions across the globe to exhibit coercion, forceful appropriation or the threat thereof as a means to secure labor from slaves, serfs, and bonded laborers.[67] Even today coerced labor persists as a thriving institution, particularly in the developing world, as the United Nations' International Labor Organization (UNILO) estimates that there are currently 21 million forced laborers worldwide.[68] While a growing body of literature attempts to elucidate the historical and present-day prevalence of coerced labor[69], relatively little scholarship has been devoted to explaining instances of organized, violent resistance to its imposition. This represents an important lacuna, as violent outbreaks often plague societies which choose to employ coercive institutions as a means to secure their labor.[70] Such violence often entails tremendous opportunity costs in terms of foregone income.[71] Moreover, these conflicts contribute to salient costs associated with

---

[67]Skaperdas (1992) provides a theoretical underpinning for the historical use of coercion. Patterson (1982) argues that slavery and forced labor were common practice in labor markets in most ancient civilizations including Egypt, Greece, Rome and Japan. In the feudal era, restrictions on labor mobility and the various customary labor services serfs were obliged to provide landlords were a defining feature of the "ties of dependence" described by Bloch (1964). Slavery was an integral component of plantation economies formed in the Caribbean, parts of Brazil and Colombia, while coercion was an important factor in the organization of labor in mining operations, encomiendas, as well as the later hacienda system that persisted throughout much into the post-colonial era. See Lockhart and Schwartz (1983) and Curtin (1990).

[68]UNILO (2012). The UNILO also estimates that there are currently 175 million migrant laborers across the globe, and it is well documented that these transients often toil under dubious conditions. See Taylor (1977).

[69]Early contributions include Domar (1970), Fogel and Engerman (1974), Ransom and Sutch (2001, reprint) and Aston and Philpin (1985). See Steinfeld (2001), Genicot (2002), Conning (2004), Acemoglu and Wolitzky (2011) and Naidu and Yuchtman (2013) for more recent discussions.

[70]*cf.* Moore (1966), Wolff (1968), Huizer (1972), Migdal (1974), Scott (1976), Skocpol (1979), Christodoulou (1990) Goldstone (1991). More recently, Murshed and Gates (2005) describe the Kamaiya system of bonded labor as a key motivation behind the Maoist insurgency in Nepal which claimed as many as 15,000 lives from 1996-2006.

[71]Oxfam (2007) estimates that armed conflicts across the African continent, for example, cost roughly $18 billion.

maintaining institutions which provide the basis for coercive labor relations.[72]

The antebellum southern United States provides a unique opportunity to ameliorate this deficiency, and explain instances of violent conflict within the context of coerced labor. First of all, slave insurrections, uncovered conspiracies, and panics were a part of daily life in the American plantation, despite the fact that those detailed below rarely achieved their stated aims. As John Hope Franklin (2002, p. 70-71) states, "The slave was never so completely subjugated as to allay all fears that he would make desperate, bloody attempt to destroy the institution which bound him. Slaveholders could never be quite certain that they had established unquestioned control; fear and apprehension were always present." Wade (1964) argues that fears of unrest in the wake of discovered conspiracies were so trenchant among urban slaveholders that slaves, particularly young males, were sold in large numbers to the countryside to reduce the probability of insurrection. Second, Aptheker (1993), utilizing court minutes, probate records, plantation records (i.e., journal entries, correspondence, etc.), government archives and newspaper articles, provides a detailed account of these violent outbreaks. Lastly, due to the motivating effect of overlapping economic and ethnic cleavages on armed conflict today, the antebellum South is a natural parallel for investigation.[73]

Yet despite the importance of this form of organized resistance, and the available historical record, a rigorous empirical analysis of the causal factors influencing slave unrest in the antebellum Southern United States has yet to be undertaken. Several scholars have offered theories regarding the various precipitates of rebellion, ranging from the density of slave populations,[74] access to transportation via navigable waterways,[75] cotton prices[76]

---

[72]See Wade (1964), Henry (1968), Hadden (2001) and Goldin (1976) for instances of these costs and their defrayal. See Acemoglu and Robinson (2000, 2001) for the role of conflict, or threat of conflict, in eroding coercive institutions.

[73]See Collier and Hoeffler (2004), Murshed and Gates (2005), Gates (2002) and Esteban and Ray (2008) for a discussion of ethnicity and its role in incentivizing armed conflict.

[74]Genovese (1979), Aptheker (1993), Wade (1964).

[75]Morgan and Terry (1982).

[76]See Aptheker (1993) and Wade (1964).

and the size of the free African American population.[77] Although each of these seem plausible *prima facie*, a causal relationship with slave revolts remains to be empirically verified.

This paper theoretically and empirically investigates various channels which explain the incidence of slave insurrections and discovered conspiracies in the antebellum United States. First, the impact of geographic "first-nature"[78] variables, such as those describing geoclimatic productivity and the surrounding terrain, on the incidence of slave unrest is critically evaluated.[79] Next, the relationship between "second-nature" variables, such as distance to the nearest city and the degree of urbanization within a given geographic unit, and the probability of violent outbreak is determined.

In order to rigorously formalize the incentives and risks faced by slaves in deciding whether or not to rebel, and those faced by slaveowners in determining the degree to which their slaves are monitored, I develop a simple model of insurrection. The core predictive ingredients in this model are the intensity of the work regime for slaves, and the technology of surveillance for slaveowners, which is in part determined by profitability. The theory suggests that the relatively more arduous work regime associated with cotton incentivized insurrection on the part of slaves, and as a result greater supervision by cotton planters. The theory also suggests that the distance variables referred to above influence the costs borne by slaves in the event of a successful insurrection. Efforts to control and apprehend runaway slaves, whether through slave patrols, inspection points or deployment of slave catchers, were particularly effective along water routes, but were conversely especially

---

[77]Radford (1976), Sheldon (1970).

[78]See Krugman (1993) and William Cronon (1992).

[79]In this vein, this paper contributes paper adds to a sizable literature which attempts to explain the incidence of violent conflict within the context of varying resource endowments. See Acemoglu et al. (2011), Mehlum et al. (2006), Robinson et al. (2006), Van der Ploeg (2011), among many others. Koubi et al. (2013) provides a useful summary of the various complications that arise in ascertaining causal relationships between resource endowments and the prevalence of conflict. It should be noted, however, that the plausible exogeneity of the productivity measures in my analysis, as well as the focus on intra-state conflict, are a significant advantage over many of these studies. See Aslasken (2010), Torvik (2009), Buhaug and Gates (2002) and Van der Ploeg and Poelhekke (2010) for a discussion.

ineffective in an urban environment. My model predicts that these factors influenced both the calculus of slaves weighing the costs and benefits of an insurrection, as well as the surveillance effort put forth by slaveowners, thus leading to disparate empirical results.

In order to test these predictions I construct a novel dataset in which instances of slave unrest, as recorded by Aptheker (1993), are categorized and coded. This record of events is then combined with geographic characteristics, demographic data and price data, and then mapped onto historical county borders. These comprehensive data offer insights into aspects of American antebellum slave insurrections which have yet to be explored. For example, my empirical analysis implies that slave insurrections and conspiracies were both more likely in areas which, due to natural geographic factors, enjoyed a greater degree of productivity in cotton production, while areas naturally endowed with a greater degree of productivity in tobacco were less likely to experience discovered slave conspiracies. I show that in the period 1800-1860 insurrections and discovered conspiracies both become significantly more likely as the distance from the nearest river increases, and as the distance to the nearest Southern city decreases. Moreover, I find that the probability of an insurrection was greater in years in which cotton prices were higher.

Background: Slave Revolts and Surveillance

Slave revolts, discovered conspiracies and panics played an important role in structuring the antebellum agricultural economy of the South. Persistent fears over insurrection[80], particularly in the wake of failed rebellions, led to a number of costly measures aimed at curtailing or uncovering slave unrest. Institutions of this kind structured daily life within

---

[80]"Rumors of plots and imminent uprising marked the ordinary routine of every city. If whites learned to live with this anxiety, they could not long forget it. Just as the patrols, whipping posts, and auction blockes reminded Negroes of their servitude, so these symbols made the townspeople aware of their own insecurity." (Wade 1964, p. 242).

the antebellum South and, importantly, affected the profitability of slavery as a whole.[81] Given its historical importance, as well as its prominent role in the following analysis, the myriad forms of slave surveillance will be delineated in detail.

The first line of defense in discovering and rooting out rebellious activities was the efforts borne privately by slaveowners themselves. The employment of overseers and managers specifically for surveillance purposes was common practice.[82] For example, the surveillance tasks by overseers on one of the largest plantations in Louisiana were codified as such:

> "It is strictly required of the manager, that he rise at the dawn of the day every morning; that he ring a bell for the assembling of the hands; require all hands to repair to a certain and fixed place, in twenty minutes after the ringing of the bell, and there himself see that all are present, or notice absentees; after which the hands will receive their orders, and be started to their work under charge of their foreman....The manager will, every Sunday morning after breakfast, visit and inspect every quarter.."[83]

Moreover, it was not uncommon for planters to employ spies among their slave populations in order to uncover plots of rebellion, and evidence of this practice can be found in the

---

[81]See Fogel and Engerman (1974) for an introduction to the long, acrimonious debate over the profitability of American slavery.

[82]"On a large plantation the numerous details of oversight required the assistance of an additional manager, without whose aid the owner would have been compelled to remain every day upon his plantation" Gray (1958, p. 545). In fact, in many cases the presence of such managers was required by law. According to Williams (1972, p. 400), the Louisiana state legislature passed a statute in 1815 mandating that "one white man of accountable age per thirty slaves had to be provided on each farm or plantation owning or employing blacks. Failure to comply with the statute carried a monetary fine for offenders." In fact, the presence of such auxiliary supervision over and above that provided by slave patrols and police forces was often mandated by law.

[83]Gray (1958, p. 547). Further evidence for the important surveillance role played by overseers can be found in Davis (1939, p. 47). The author notes that in a contract between Alabama planter William Gould and his overseer, Ludwig Henderson, the latter agreed to "inspect the cabins at different hours of the night as often as once a week" in order to detect subversive activities. Moreover, Henry (1968, p. 18) states "An overseer was necessary for the proper control and management of the negroes on a plantation. He was not only an economic necessity to the plantation, but he acquired the character of a plantation quasi-police officer by virtue of the legal provision that all slaveowners were required to have white men on the plantations, in cases where the owners were not resident throughout the year."

testimonials of former slaves.[84]

If the private activities of slaveowners failed to suppress slave insurrection, an elaborate legal framework and various law enforcement mechanisms provided a second, public line of defense. For example, slave patrols consisting of local militiamen and slave catchers routinely patrolled transportation routes looking for rebellious slaves.[85] River depots in particular served as sites of intense, concentrated slave supervision; slave catchers often devoted themselves to patrolling waterways exclusively, as expertise in navigation and a network of acquaintances could ensure greater profits than that afforded by hunting down slaves on foot.[86] As Schweninger (1999, p. 118) states, "in later years, steamboats proved no better means for escape than poling skiffs. With the aid of strict state laws, local authorities searched steamboats regularly for stowaways. In New Orleans, Natchez, Vicksburg, and other ports, departing steamers were inspected, and those who could not prove their status as a freeman or hired slave were subject to arrest." Virginia in particular attempted to clamp down on its waterways, and the General Assembly passed a law mandating that no more than one third of the crew of any rivercraft could consist of slaves.[87]

---

[84]According to Steward (1857, p. 32), "A domestic slave will for the sake of his master and mistress, frequently betray his fellow-slave...he is often rewarded by his master who knows it is for his interest to keep such ones about him... hence it is that insurrections and stampedes are so generally detected. Such slaves are always treated with more affability than others, for the slave-holder is well aware that he stands over a volcano." Such efforts at subverting potential revolts appear to have been successful, as countless instances in Aptheker (1993) refer to the uncovering of plots through these means. In particular, spies were instrumental in uncovering one of the most infamous slave conspiracies in the antebellum era, that of Denmark Vesey, who planned to set fire to the city of Charleston, South Carolina, slay the cities' white residents, and sail to the black republic of Haiti in 1822. Though rumors of an insurrection in the planning abounded in the months before the failed uprising, the commission of two slaves in particular was critical to ultimately suppressing the uprising. "Another slave, William, now turned informer, and more arrests followed, the most damaging of which was that of Charles, slave of john Drayton, who agreed to act as a spy. This quickly led to complete exposure. One hundred and thirty-one Negroes of Charleston were arrested and 49 were condemned to die. Twelve of these were pardoned and transported, while thirty-seven were hanged, the executions taking place from June 18 to August 9 (Aptheker (1993, p. 271))."

[85]In fact, Hadden (2001) argues that the exigencies of slave supervision explain why organized police forces often appeared in Southern cities before those in New York and Boston.

[86]*Ibid.*, p. 158.

[87]See Egerton (1991).

Southern cities were also the site of intense legal efforts to surveil slaves, particularly in the years following a failed revolt. For example, after the failed plot surmised by Denmark Vesey, in which rebels were to lay siege to Charleston, S.C. in 1822, the mobility of urban slaves was severely restricted, and regulations which forbade African Americans, free or slave, from entering certain public spaces were instituted. Similarly, Sheldon (1970, p. 33) notes the legal reaction in Richmond, Virginia to the discovery of the Gabriel Prosser conspiracy in 1800, and the resultant tightening of laws regulating manumission. Previous scholarship has argued that these and other legal restrictions passed in response to outbursts of slave violence were a precursor to the legalized segregation exhibited throughout much of the South in the postbellum era.[88]

Despite these various precautions, revolts, discovered conspiracies and panics were a salient part of life in the antebellum South. This paper theoretically and empirically stresses the role of the labor regime, in particular that associated with cotton cultivation, as being a fundamental driver of this unrest. The logic of this argument is not novel, as a large body of previous scholarship, relying largely on historical mortality data, points to the difficulty in cultivating this crop.

For example, Steckel (1992) studies the probability of neonatal death among slave children on cotton plantations in South Carolina, Georgia, Alabama and Louisiana in the period 1780-1860, and suggests that the average probability per month in February to April and September to November was 280-390 percent higher than the average probability in other months. The months from February to April corresponded to the preparation and planting season, which was "particularly strenuous because the tasks were physically demanding, little help could be obtained form the old and the young, the owners pressed work at in intense pace to meet deadlines for successful planting of the crop."[89] The months from September to November were peak harvesting season. Due to the fact that

---

[88]See Wade (1964) and Radford (1976, p. 346).

[89]*Ibid.*, p. 492.

pregnant women on cotton plantations often saw little reduction in work load before the fifth month,[90] and continued working in some capacity almost until delivery, Steckel concludes that the seasonal variation in neonatal mortality is likely due to the demands of the cotton work regime.[91] In addition, the work of Steckel (1992) suggests that post neonatal mortality rates, which are also linked to strenuous work during pregnancy, were significantly higher on cotton plantations than those devoted to sugar production. This is particularly surprising given the fact that sugar production is generally very arduous, requiring heavy labor for ditching and plowing, among other tasks.[92]

Moreover, the evidence presented by Johnson (1981) from the 1860 census suggests a linkage between the incidence of sudden infant death syndrome among slave children and the form of labor management (task vs. gang system) employed. In describing these results, Morgan (1998, p. 218) writes:

> "One aspect of the slaves' well-being that has been intensively studied in the antebellum South, namely the susceptibility of slave children to sudden infant death syndrome, reveals a marked contrast between areas of gang and of task labor. The smothering of slave infants, as contemporaries termed this phenomenon, is now thought to be closely related to the harshness of physical labor required of pregnant slave women. Death rates for smothered slave infants were much higher in areas where gang labor prevailed. In Georgia's cotton counties, the smothering death rate was more than four times greater than that of the same state's rice counties."

This observation, coupled with the fact that gang labor was never as pervasive on tobacco plantations as it was on those devoted to cotton,[93] suggests a greater difficulty of work

---

[90]See Campbell (1984) and Jones (1985).

[91]It should be noted that Steckel is not the first scholar to draw connections between strenuous work during pregnancy and neonatal mortality. See Hytten and Leitch (1971) and Tanner (1978) for general reference.

[92]Gray (1958).

[93]Fogel (1989, p. 36) writes, "Although gang-system plantations became more important as time wore

on the latter than the former.

These empirical observations may be explained by the fact that tobacco production was a "care-intensive" process, requiring meticulous care in the tasks of harvesting, curing and packaging,[94] while cotton production was relatively more "effort-intensive."[95] This is evidenced by the fact that tobacco production was often limited to so many plants per hand in order to maintain quality, an important determinant in the market price.[96] In contrast, the development of Eli Whitney's cotton gin, which was instrumental in easing the task of separating seed from fiber, ensured that the "advantages of cotton far outweighed its disadvantages. It neither spoiled as easily as tobacco nor required as much painstaking cultivation."[97] According to Fenoaltea (1984), pain and the threat of punishment are more efficacious in guaranteeing greater effort in effort-intensive production processes, such as those associated with the cultivation of cotton. Conversely, rewards such as profit-sharing agreements and manumission are efficient methods of securing the requisite effort in care-intensive production processes.

on, they never became dominant in tobacco. An analysis of the farms in the tobacco region of Kentucky and Tennessee revealed that 65 percent of the tobacco crop in 1860 was produced on free or small slave farms." This, Fogel argues, was due to the fact that tasks such as the stripping and prizing of tobacco, for example, could not easily be specialized for the "organization of production on an assembly line basis." Cotton production, on the other hand, was more conducive to specialization of tasks (Gray(1958, p. 549)), and "by the 1840's those few Alabama and Mississippi plantations that operated under the task system stood out by their idiosyncrasy" (Miller (1993, 164)). For supporting evidence of the prevalence of the task system in tobacco cultivation, see Gray (1958, p. 552). Similarly, Walsh (1993, p. 172) argues that tobacco production did not exhibit the economies of scale which would have made "assembly-line" gang-system production more efficient. It should be noted that the prevalence of gang labor on large plantations also supports the hypothesis that slaves on cotton plantations were subject to harsher treatment than those devoted to tobacco. See, for example, Olmsted (1904, vol 2 p. 112). Stephen Crawford (1992, p. 541), in attempting to understand the greater frequency of punishment on large plantations writes, "There are at least two possible explanations of the observed effect of plantation size on the frequency of punishment...The gang-labor system, more prevalent on the larger plantations, could also have required increased physical punishment to enforce the more intense labor."

[94]See Gray (1958) and Kulikoff (1986) for discussions of the detailed process by which tobacco was cultivated in this period.

[95]Fenoaltea (1984).

[96]Gray (1958, p. 217).

[97]Reidy (1993, p.139). In addition, Miller (1993 p. 159) notes that "...cotton needed only rudimentary processing at the point of production (unlike sugar and tobacco), plantations that grew the cotton required few workmen with artisanal or other special skills."

"...Pain incentives and ordinary rewards have meaningfully different effects on worker performance. Pain incentives, it would seem, are the more effective in generating effort. The main reason is that effort varies directly with the level of anxiety, and a threat to one's physical integrity produces very high anxiety indeed. A subsidiary reason is that threats can be of immediate pain, while rewards are typically of delayed gratification...On the other hand, pain incentives are the less effective in generating carefulness. One reason is that the ability to work carefully is enhanced by low levels of anxiety but inhibited by high ones, so that the severe tension produced by pain incentives is counterproductive even if one is doing one's best."[98]

If cotton production was particularly onerous for slaves, then the constant expansion of King Cotton during the antebellum period likely contributed to slave unrest. As Olmstead and Rhode (2010) note, this period was one characterized by the westward expansion of agriculture into virgin lands, in particular cotton production, and a reallocation of labor from the Old South to the New South. Biological innovation in the creation of higher-yielding cotton varieties were largely responsible for this shift, as most of these technologies were developed in the Mississippi Valley and were better suited for geoclimatic conditions there than for those common to Georgia and the Carolinas. As a result, cotton was the dominant export of the United States on the eve of the Civil War, and an exploration of the incentives and costs associated with its production remain vitally important.

The framework of incentives and institutional control extant in the antebellum South thus established, the following theory draws predictions regarding their role in fomenting slave rebellion.

---

[98] *Ibid.*, p. 637.

Model

Primitives and Assumptions

The model is positive in nature, and parsimoniously depicts an archetypal slave-slaveowner relationship as a sequential game.[99] The set of players is discrete, and consists simply of a slave and slaveowner, both of whom are assumed to be risk neutral. The strategy set of the slave is discrete, and consists of the decision whether or not to revolt: {*Revolt*, *No Revolt*}. If the slave chooses *Revolt*, they put forth some positive, finite effort $\alpha > 0$ toward planning and executing the rebellion. The strategy set of the slaveowner is also discrete, and includes the decision of whether or not to employ some additional means of slave surveillance in order to monitor the slave: {*Monitor*, *No Monitoring*}. If the slaveowner chooses *Monitor*, they put forth some positive, finite effort $m > 0$ toward discovering and preventing a potential rebellion.

As such, the decision to *Monitor* may be interpreted as the employment of additional overseers, managers, and even spies among the slave community, each of whom aided in the constant supervision of slaves and therefore the uncovering of slaves' plots for rebellion.

The surveillance effort put forth by the landlord, m, and the insurrection effort put forth by the slave, α, together determine the probability (P) that an insurrection, if undertaken, is successful in granting the slave's freedom. This probability is determined by a Tullock (1980) contest success function function,[100] that is:

---

[99]Utilizing the terminology of Fudenberg and Tirole (1991), it is assumed that players are endowed with perfect recall and common knowledge of the game. That is, each player knows the strategic form of the game, knows that their opponent knows it, and knows that their opponents know that they know, and so on. This also ensures that players may costlessly observe the history of play in choosing their strategy.

[100]The use of such functions in the theoretical literature on contests is well established. A number of studies have provided an axiomatic justification for its use; see, for example, Skaperdas (1996) and Clark and Riis (1998). Moreover, Jia (2008) provides a stochastic justification for this ratio form in which the effectiveness of opponents' efforts is noisy. Lastly, Baye and Hoppe (2003) identify conditions under which a variety of rent-seeking contests, innovation tournaments, and patent-race games are strategically equivalent to the Tullock contest.

$$P(\alpha, m) = \frac{\alpha}{\alpha + m + \delta} \tag{15}$$

If the slave decides not to insurrect this tantamount to him setting $\alpha = 0$, and thus the probability of a successful insurrection is 0. Conversely, if the slaveowner chooses *No Monitoring* this is equivalent to him setting $m = 0$, and therefore the probability of a successful insurrection becomes $\frac{\alpha}{\alpha + \delta}$. A positive, finite institutional parameter, (δ), is included to ensure that an insurrection is not guaranteed to be successful (i.e., with probability one) if the slaveowner does not choose *Monitor*. This accords with the historical record of the antebellum United States, in which insurrections were rarely successful in achieving their goal of freeing slaves from bondage. Even if a slaveowner chose not to employ additional, private means of surveiling his slaves, a degree of institutional slave control was guaranteed through police forces, slave patrols, local militias and inspection points along transportation routes, as discussed in the Background Section.

As mentioned previously, it is assumed that the level of surveillance chosen by the landlord has no impact on his agricultural output, and thus the revenue from such output is represented by the exogenous parameter (π). The payoff function of the slaveowner with a linear cost of surveillance may thus be written as:[101]

$$U^O = \pi(1 - P) - m, \tag{16}$$

where it is implicitly assumed that if the slave successfully rebels, then the output garnered by the slaveowner is 0.[102]

For simplicity, the utility earned by a slave if he does not insurrect ($w > 0$), as well as the utility earned by successfully revolting and securing freedom are assumed to be

---

[101]It should be noted that the results presented below are robust to a specification in which the marginal cost of surveillance is convex.

[102]This assumption is for parsimony, and is not necessary for the results presented below. All that is required is that the revenue garnered when an insurrection occurs is strictly less than that when there is no insurrection.

exogenous. In the event of a successful revolt, the slave earns a payoff of $F - c - \alpha$; that is, the utility gained from earning one's freedom (F) less the costs associated with evading capture (c) and exerting effort in the planning of said revolt (α). The cost parameter c represents the efforts made by runaways slaves to avoid local patrols, inspection points and hired bounty hunters. It is assumed throughout the following analysis that $F - c - \alpha > w$, which simply affirms slaves' preference for freedom, despite the associated costs, as opposed to bondage. Putting these elements together, the payoffs earned by the slave as a function of their strategy may be written as:

$$U^s = \begin{cases} w & if \ No \ Revolt \\ P(F - c) - \alpha & if \ Revolt. \end{cases} \tag{17}$$

This utility function implicitly assumes that the slave earns a punitive payoff of 0 if they attempt an insurrection and are unsuccessful, although the results detailed below are qualitatively maintained as long as this punitive payoff is less than w. This specification is reasonable given the record of harsh repercussions faced by slaves caught engaging in rebellious activities.[103]

In order to most accurately mirror the conditions of the antebellum southern United States, the interaction between the slave and slaveowner is modelled as a sequential game in which the slaveowner is the first-mover. As discussed in the Background Section, the antebellum period was one characterized by the constant westward expansion of cotton agriculture into the more productive lands of the New South. As such, the model depicts an environment in which a slaveowner, perhaps after settling previously uncultivated land on the ever-expanding frontier, first chooses their strategy for slave surveillance before commencing agricultural production. Figure 2.1 illustrates this timing with an extensive form representation of the game.

---

[103] *cf.* Wade (1964), Aptheker (1993), Genovese (1979), Sheldon (1979) and Radford (1976).

$$\left(\tfrac{m(\pi-\alpha-m-\delta)+\pi\delta}{\alpha+m+\delta}, \tfrac{\alpha(F-c)}{\alpha+\delta+m} - \alpha\right) \qquad (\pi-m,w) \qquad \left(\tfrac{\pi\delta}{\alpha+\delta}, \tfrac{\alpha(F-c)}{\alpha+\delta} - \alpha\right) \qquad (\pi,w)$$
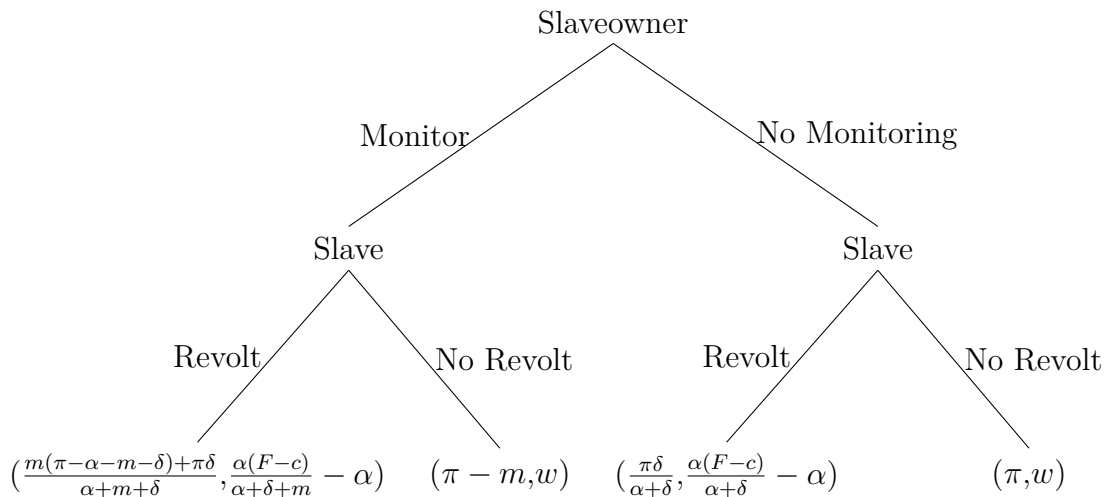
Figure 2.1: Extensive Form Representation

Equilibria and Proposition

The solution concept employed in the following analysis is that of subgame perfect Nash equilibrium (SPNE), which will be determined through backward induction. As such, the analysis will begin with an examination of the slave's best-responses.

Slave Best-Responses

Given the payoff functions described in Section 10.1, the best-responses of the slave can be determined by simply weighing the relative expected utilities of insurrecting and remaining on the plantation in the service of the slaveowner. Therefore, after observing the strategy *No Monitoring* by the slaveowner, the slave will:[104]

$$
\begin{cases}
Revolt \text{ if} & \frac{F-c}{\alpha+\delta} - \alpha \geq w \\
No\ Revolt & \text{otherwise.}
\end{cases}
\tag{18}
$$

---

[104]It is assumed that the slave will insurrect if the expected utility from doing so is equal to that yielded by not insurrecting.

Similarly, after observing the strategy *Monitor* by the slaveowner, the slave will:

$$
\begin{cases}
Revolt \text{ if} & \frac{F-c}{\alpha+m+\delta} - \alpha \geq w \\
\\
No\ Revolt & \text{otherwise.}
\end{cases}
\tag{19}
$$

Trivially this implies three potential cases depending on the values of the exogenous parameters, each of which will be numbered for ease of exposition. First, if w is sufficiently small, so that $w \leq \frac{\alpha(F-c)}{\alpha+m+\delta} - \alpha < \frac{(F-c)\alpha}{\alpha+\delta} - \alpha$ (Case 1), then *Revolt* constitutes a dominant strategy for the slave, and thus an insurrection will occur regardless of whether or not the slaveowner chooses *Monitor* or *No Monitoring*. Second, if w is sufficiently large, so that $\frac{(F-c)\alpha}{\alpha+m+\delta} - \alpha < \frac{(F-c)\alpha}{\alpha+\delta} - \alpha < w$ (Case 2), then *No Revolt* constitutes a dominant strategy for the slave, and thus he will not attempt an insurrection, irrespective of whether or not the slaveowner decides to employ additional surveillance effort. An interesting third cases results if $\frac{(F-c)\alpha}{\alpha+m+\delta} - \alpha < w \leq \frac{(F-c)\alpha}{\alpha+\delta} - \alpha$ (Case 3), and therefore additional surveillance by the slaveowner acts as an effective deterrent to rebellious activity on the part of the slave.

This simple analysis highlights some of the salient incentives faced by slaves in rationally choosing whether or not to revolt. First of all, as one would expect, an insurrection is more likely to take place the lower the utility garnered from laboring for the slaveowner, or equivalently, the more difficult the work regime on the plantation. As discussed in the Background Section, there existed variation across the antebellum south in terms of the arduousness of various work regimes, and this variation can largely be explained by the primary crop in production. Thus, cotton cultivation would result in a lower w for the slave *vis-a-vis* tobacco.

It is also plausible that in the Deep South, higher cotton prices would manifest themselves in the model as a lower w. Aptheker (1993) argues that when the profitability of agriculture was high, incentives were aligned for slaveowners to extract as much output as possible from their chattels. This resulted in longer working hours, more strenuous work

per hour and more intense harvest and planting seasons. As such, one would expect to observe more frequent revolts during years in which cotton prices were higher, and this is corroborated in the data.

The foregoing theory also highlights the importance of the costs of avoiding capture in the event of a successful insurrection (c) on the slave's decision making; as such costs decrease, and the slave is more easily able to evade police, slave patrols, bounty hunters, etc., the planning of an insurrection becomes more likely. Due to the widely accepted customs of "hiring-out" and "living out",[105] urban slaves were endowed with a freedom of movement between owner and employer, albeit highly regulated, that nevertheless would have been utterly alien to the plantation field hand.[106]. Moreover, as discussed in the Background Section, navigable waterways were often the site of intense, coordinated slave surveillance measures. As a result, the model predicts that the costs associated with evading capture (c) and planning a rebellion (α) would be smaller as the distance to a Southern city decreased, and the distance to a navigable waterway increased.

Slaveowner Best-Responses and Equilibria

The best-responses of the slave thus established, backward induction proceeds by specifying the optimal strategies of the slaveowner. As before, the equilibrium strategy of the slaveowner is dependent on a number of exogenously determined parameters, and will be

---

[105]Under these practice masters who owned more African Americans than they could utilize either at home or in their business hired some to labor-strapped employers. This custom greatly lessened "the rigidity of slavery, allowing a constant reallocation of the labor supply according to demand" (*Ibid.*, p. 38). Goldin (1976, p. 35) also observes that, "not only were urban slaves hired out, but many...lived apart from their place of work. These slaves were allowed to locate their own place of residence and buy their own meals."

[106]Cities thus offered opportunities for runaways to hide their identities, create new ones and pose as free African Americans, live with relatives, mingle with others and plan an embarkation for more distant locales. Frederick Douglas (1855, reprinted 2009), comparing the life in Baltimore with his early days as a field hand in the Maryland countryside, aptly summarizes these points, "A city slave is almost a free citizen, he enjoys privileges altogether unknown to the whip-driven slave on the plantation." In addition, Franklin and Schweninger (1999) argue that the opportunities for slaves to commingle in an urban environment, perhaps at the local groghouse, church or cabaret, also eased the search for sympathizers willing to aid and abet runaways.

evaluated in cases.

First of all note, note that if Case 2 obtains, so that $\frac{(F-c)\alpha}{\alpha+m+\delta} - \alpha < \frac{(F-c)\alpha}{\alpha+\delta} - \alpha < w$, then *No Monitoring* is the best-response for the slaveowner and the strategy profile {*No Monitoring, No Revolt*} constitutes a SPNE. Intuitively, it is not optimal for the slaveowner to employ additional overseers, spies, etc., and bear the associated cost, if the laboring utility of the slave (w) is such that the slave would never wish to plan an insurrection. Conversely, if the slave always earns a higher utility by not revolting, even if the slaveowner decides not to employ additional surveillance, then of course this strategy will be adopted in equilibrium. Case 2 is therefore unique in that the revenue garnered by the slaveowner, π, does not factor into their equilibrium strategy.

By contrast, in order for the slaveowner to choose *Monitor* in Case 1, where $w \leq \frac{(F-c)\alpha}{\alpha+m+\delta} - \alpha < \frac{(F-c)\alpha}{\alpha+\delta} - \alpha$, his agricultural revenue must be sufficiently large enough to incentivize additional surveillance. In particular, it can be shown that if:

$$\pi \geq \frac{(\alpha+\delta)(\alpha+\delta+m)}{\alpha}, \tag{20}$$

then the strategy profile {*Monitor, Revolt*} obtains in equilibrium,[107] otherwise {*No Monitoring, Revolt*} obtains as an SPNE. The profitability of American slavery on the eve of the civil war has been the subject of intense debate, as Fogel and Engerman (1974), Fogel (2003), Genovese (1972, 1965), Ransom and Sutch (2001), David and Temin (1979) and several others, with varying degrees of acrimony, have weighed in on this important issue.[108] Fogel and Engerman (1974) argue that slavery was "generally a highly profitable investment which yielded rates of return that compared favorably with the

---

[107]Here I have made the simplifying assumption that if the expected utility from *Monitor* is equal to the expected utility of *No Monitoring*, then the slaveowner chooses *Monitor*. This assumption is retained throughout the following analysis.

[108]If in the language of Fenoaltea (1989, p. 304), this debate may be termed a "Great War", then a crucial battlefield is the issue of slave-labor productivity. Some historians have argued that slave labor was of such poor quality and given so reluctantly that the plantation system was too inefficient to be viable (see, for example, Genovese (1972, 1989) and Cairnes (1862)), while Fogel and Engerman (1971) argue that plantations employing slave-labor were more productive than free farms in the North.

most outstanding investment opportunities in manufacturing." This also accords with the argument of Conrad and Meyer (1958), and is reaffirmed by Fogel (2003). Although the methodologies employed by Fogel and Engerman (1974) have been contested,[109] it is reasonable to assume, given the proclivity of slaveowners to monitor their slaves mentioned above, that profits were sufficiently large to incentivize planters to attempt the suppression of rebellion.

A threshold condition similar to (20) also determines the equilibrium behavior of the slaveowner under Case 3, in which it is assumed that: $\frac{(F-c)\alpha}{\alpha+m+\delta} - \alpha < w \leq \frac{(F-c)\alpha}{\alpha+\delta} - \alpha$. It can be shown that if:

$$\pi \geq \frac{m(\alpha+\delta)}{\alpha}, \tag{21}$$

then the strategy profile $\{Monitor, No\ Revolt\}$ obtains, otherwise $\{No\ Monitoring, Revolt\}$ is the unique subgame perfect Nash equilibrium. Thus the slave is willing to revolt if the slaveowner chooses not to employ additional surveillance, but is effectively deterred from engaging in such activity if the slaveowner chooses $Monitor$. Once again, given the historical record of the antebellum South, it is reasonable to assume that the revenues for planters were sufficiently high to incentivize such surveillance, particularly if a slave revolt was perceived to be a potential threat. This is corroborated by the observation that most revolts were uncovered and stymied before they could be brought to fruition.

Proposition and Discussion

Proposition 1 summarizes this analysis, and will be utilized to garner predictions regarding the surveillance and revolt efforts put forth by slaves and slaveowners on tobacco versus cotton plantations, as well as in urban versus rural environments.

PROPOSITION 1

---

[109]See, for example, the lengthy critique by Sutch (1975).

If the labor regime is sufficiently laborious for the slave, or if the costs associated with evading capture in the event of a successful revolt are sufficiently small, so that $w \leq \frac{(F-c)\alpha}{\alpha+m+\delta} - \alpha$, and if the revenue garnered by the slaveowner is sufficiently high, so that $\pi \geq \frac{\delta(m+\delta)+\alpha(\alpha+m+2\delta)}{\alpha}$, then $\{Monitor, Revolt\}$ will be the unique subgame perfect Nash equilibrium. Conversely, if the labor regime for the slave is sufficiently mild, so that $\frac{(F-c)\alpha}{\alpha+\delta} - \alpha < w$, then $\{No\ Monitoring, No\ Revolt\}$ will obtain in equilibrium.

PROOF: See previous sections for a discussion.

The logic of Proposition 1 is straightforward. If the production process is sufficiently stringent for the slave, or if the cost of retaining their freedom after an insurrection is sufficiently small, there is a greater incentive for him to revolt and attempt to win his freedom through violent means. In order to deter the slaves from adopting this course of action which, if successful, would impose sizable costs in terms of agricultural revenue,[110] the slaveowner employs additional surveillance in order to make a successful insurrection less likely.[111] If, however, w or c are so small that *Revolt* becomes a dominant strategy, then surveillance effort of the slaveowner will not be effective in preventing an insurrection, and instead will be aimed at ensuring its success is less likely.

It was previously argued that, from the perspective of the slave, the arduousness of labor was the primary distinction of toiling on cotton versus tobacco plantations. Empirical and theoretical evidence suggest that while tobacco production was care-intensive, it was much less physically taxing *vis-a-vis* cotton production. Proposition 1 thus predicts that slave insurrections, and consequently greater surveillance effort on the part of planters, will be more likely on cotton plantations than tobacco plantations. Due to spatial variation in the stringency of slave surveillance, Proposition 1 also predicts that insurrections, as well as efforts to quell them on the part of slaveowners, should be more prevalent near cities, and less prevalent near navigable waterways. . Lastly, Proposition

---

[110]See Parker (1993) for the costs imposed by runaway and rebellious slaves.

[111]This prediction is corroborated by the historical record, as state-organized slave patrols in Virginia and the Carolina were instigated during periods of heightened fear of slave insurrection (Hadden 2001).

1 predicts that slave revolts in the Cotton South should be higher during years in which cotton prices were higher, as this would have also increased the strenuousness of slaves' working environment.

Data

Revolts, Conspiracies and Panics

The source most heavily utilized for data on slave insurrections and discovered conspiracies between 1800-1860 is Herbert Aptheker's *American Negro Slave Revolts* (1993). This detailed work is the culmination of over 5 decades of investigation into court minutes, probate records, plantation records (i.e., journal entries, correspondence, etc.), government archives and newspaper articles. To the best of my knowledge, the only other empirical paper which has drawn upon this compilation is Kilson (1964), which is mainly concerned with the taxonomy of slave revolts, specifically classifying them as either systematic, vandalistic or opportunistic. It should be noted that Kilson arrives at a smaller number for organized slave resistance taking place in the United States during the period of investigation, but this may be attributed to our inclusion of discovered conspiracies as a dependent variable. It should also be noted that Aptheker's opus is not without criticism.[112] Though some refer to him as a "pioneering scholar",[113] others have charged that the instances of rebellion documented are either exaggerated or rely on scanty evidence. Kenneth Stampp aptly explains the controversy by noting that at the time Aptheker began his research in 1927, the dominant view of the American slave was one of docility, dependence and submission. In fact, over thirty years later slaves were described as such:

> Sambo, the typical plantation slave, was docile but irresponsible, loyal

---

[112]See, for example, the recent exchange between George L. Fishman and Carl N. Degler in the *Journal of American History* (1990).

[113]Rodriguez (2007)

but lazy, humble but chronically given to lying and stealing; his behavior was full of infantile silliness and his talk inflated with childish exaggeration. His relationship with his master was one of utter dependence and childlike attachment: it was indeed his childlike quality that was the very key to his being.[114]

Thus it is sometimes argued (by Stampp included) that Aptheker's book exaggerates instances of militant action on the part of slaves in order to repudiate the paternalistic view of him as "Sambo." To mitigate this tendency, and in line with Wilson's (1964) scholarship, the following analysis distinguishes between "insurrections" and "conspiracies", to be defined presently.

An "insurrection" is defined as any event in which multiple slaves resorted to violent action to obtain their freedom; this includes instances of "opportunistic" or "vandalistic" rebellion referred to by Kilson. A typical entry in Aptheker which would be classified as an insurrection is as follows:

> In August 1858, about 55 slaves on a plantation...near Coffeesville, Mississippi, decided they would no longer submit to whippings, and became unmanageable. The overseer obtained assistance from his neighbors, but the slaves, armed with axes, hatchets, clubs, scythes and stones, barricaded themselves...One white man was severely injured in attempting to get at the rebellious Negroes. It was only when, after a few days, some seventy-five armed men came to the plantation from surrounding communities that the slaves were overpowered.[115]

A discovered "conspiracy" is defined as any event in which multiple slaves were tried and convicted in a court of law for crimes related to the planning and execution of a revolt.

---

[114]Elkins (1976, p. 82), reprinted. The inherent laziness of slaves has also been used as evidence the long-standing debate over the viability and profitability of American slavery, *cf.* Cairnes(1969), Ruffin(1857) and Genovese(1965).

[115]Aptheker (1993, p. 351).

Court records documenting instances of these trials are in large part from the work of Catterall (1998). A typical conspiracy entry, take from the Governor's Papers of Raleigh, NC, is as follows:

> Sir the inhabitants of Sampson have been alarmed with the insurrection of the Negroes - We have ten or fifteen negroes in Jail, and we have such proof that most of them will be bound over to our Supreme Court. We have testimony that will implicate most of the negroes in the county...the people of Duplin County have examined ten or fifteen negroes & found two guilty, and have put them to death...[116]

An "insurrection event" is defined as one in which either an insurrection, discovered conspiracy or panic occurred. Instances of such events has been cross-referenced with Rodriguez (2007) and Carroll (1968), and linked with county-level census data to be described below. In the entire period under investigation, 1800-1859, there were 52 recorded insurrections, 103 conspiracies and 63 panics. Due to a paucity of reliable records, it is likely that in each time period the number of events is grossly underestimated.[117] Figures 2.2 and 2.3 below illustrate the geographic and temporal distribution of insurrection events from 1800-1860.

For the purposes of the empirical analysis, insurrection and conspiracy outcomes for a given county are expressed as simply an indicator for whether such an event was observed during the period of study. That is, $EvInsurrect_i$ and $EvConsp_i$ are indicators for whether an insurrection or discovered conspiracy was observed in county i between 1800-1860.

---

[116] *Ibid.*, p. 309.

[117] Moreover, Wade (1964, p. 194) and Aptheker (1993) note that incidents of slave unrest often went unreported in order to quell widespread panic. "Even at moments of great tension, as in Charleston during the Vesey affair or in St. Louis after the burning of McIntosh, a free black little was revealed, because city officials drew a veil over the vents and secured a news blackout from local editors."

Figure 2.2 Geographic Distribution of Insurrection Events
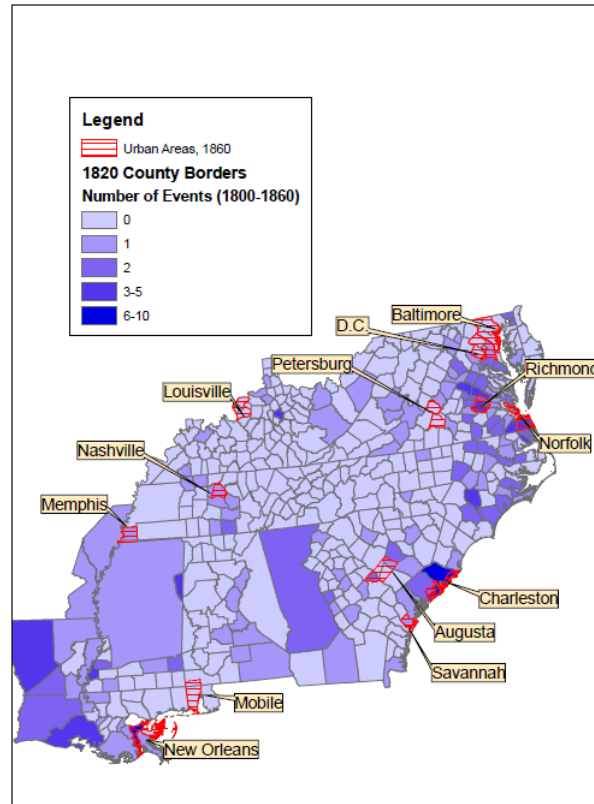
Source: Aptheker (1993) and Author's Calculations

Figure 2.3 Time Series of Revolts and Discovered Conspiracies
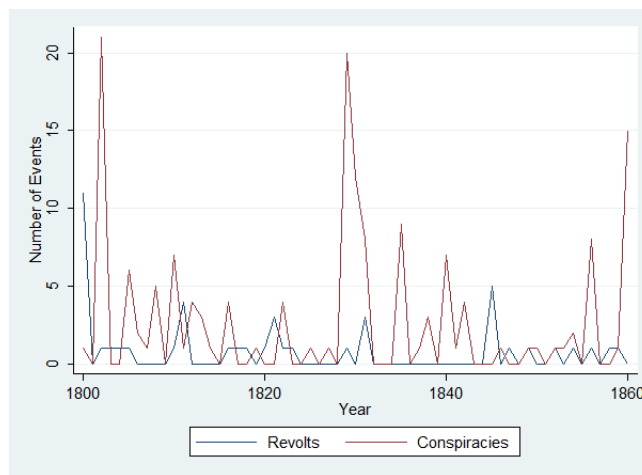
Source: Aptheker (1993) and Author's Calculations

GAEZ Data

The most novel component of my dataset is that garnered from the Food and Agriculture Organization of the United Nations (FAO), which created the Global Agro-Ecological Zones (GAEZ) data beginning in 2000. This micro-level dataset is extremely rich in its detail and applications, and as a result is becoming an increasingly utilized tool among economists.[118] The output from this database is a GIS raster file containing high-resolution data on the potential yield of tobacco and cotton for each grid-cell, and its construction is described in detail in Appendix 2.2. These data are then linked with geo-referenced county border files available from the Minnesota Population Center's National Historical Geographic Information System (NHGIS). Multiple grid-cells fall within the borders of each county; for example, the median county contains 108 grid-cells. As a result, to glean a county level measure of tobacco and cotton productivity, I simply average over all the grid-cells within a given county. It should once again be reiterated that because the GAEZ output is a model-based measure of productivity, as opposed to directly observable yields, productivities at a given location are plausibly exogenous to other economic activity. This exogeneity is preserved by the fact that, although the GAEZ project meticulously tests its predictions, for example under controlled experiments at agricultural research stations, it does not form these predictions by estimating any statistical relationship between observed inputs and outputs. Visual illustrations of the GAEZ output in tons per hectare are illustrated in Figures 2.4 and 2.5.

---

[118]*cf.* Costinot et al. (2014), Marden (2014), Nunn and Qian (2009), Costinot and Donaldson (2011).

Figure 2.4: GAEZ-Predicted Cotton Productivity
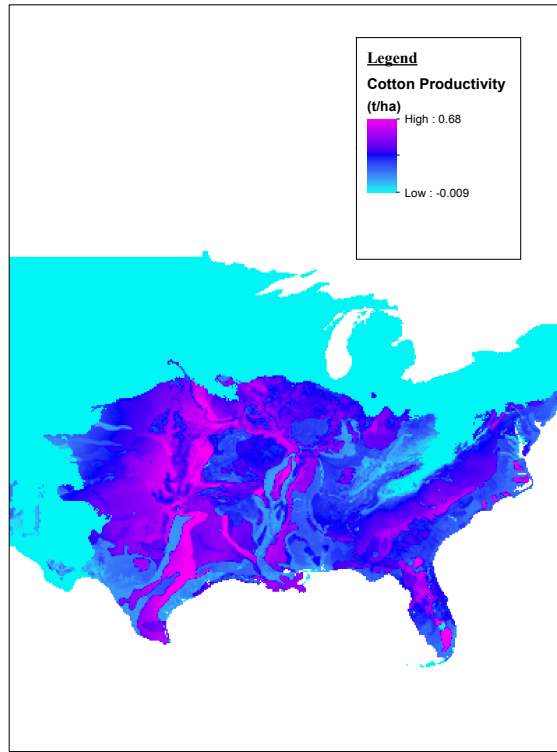
Source: GAEZ Database and Author's Calculations

Figure 2.4 aids in explaining the general westward expansion of cotton production from the Old South to the New South witnessed in the antebellum period. As Olmstead and Rhodes (2010) note, in the early 1790s production of cotton was concentrated along the coastal tidewaters of Georgia and South Carolina, but by 1839 the geographic center of upland cotton had shifted to west-central Alabama, and by 1859 shifted westward beyond the Mississippi-Alabama border. As the fertile lands of Texas, Louisiana and Mississippi were incorporated into the Union, so the dominion of King Cotton expanded. Similarly, Figure 2.5 helps illuminate the preeminence of tobacco production in the Piedmont region of Virginia and North Carolina, particularly in the colonial period; as a swath of high-productivity land sweeping southwest from the Chesapeake is clearly noticeable.

Figure 2.5: GAEZ-Predicted Tobacco Productivity
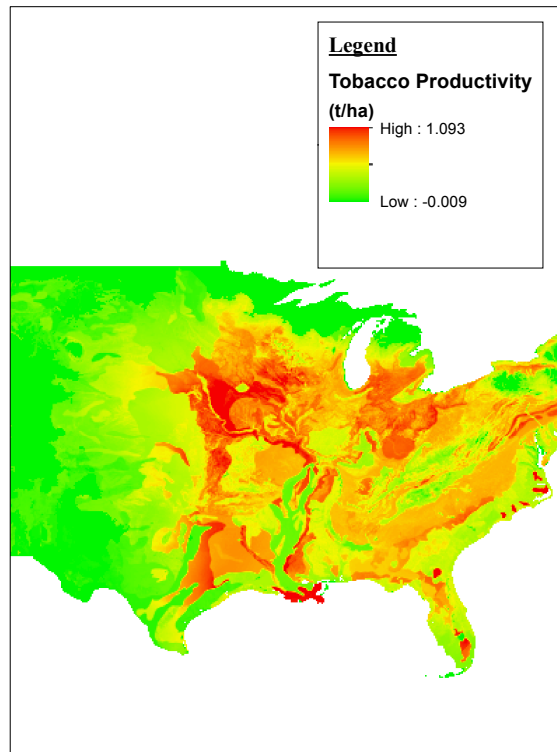
Source: GAEZ Database and Author's Calculations

Additional Geographic and Census Data

Additional geographic data for each county has also been compiled, and these variables include the Euclidean distance in miles to the nearest river, nearest Southern city and nearest free state, calculated using arcGIS software. In this procedure, if a river or Southern city falls within a given county, the distance variable is automatically assigned a zero, otherwise the Euclidean distance from the midpoint of the county to the nearest city or river is retained. Geo-referenced data on U.S. rivers is obtained from Esri (2014). The Southern cities used in the analysis are those which had at least a population of 3000 in 1810 (the first year in which reliable data can be obtained), and at least a population

of 10,000 in 1860. The cities which met both of these criteria are: New Orleans, LA, Mobile, AL, Savannah, GA, Augusta, GA, Charleston, SC, Memphis, TN, Nashville, TN, St. Louis, MO, Louisville, KY, Petersburg, VA, Richmond, VA, Norfolk, VA, Washington D.C. and Baltimore, MD.

County-level census data used in the empirical analysis below is from two sources: Haines (2010) and the Minnesota Population Center. Up until 1900 censuses in the United States were conducted only on a decennial basis. Beginning in 1840 these decennial censuses become much more detailed, both in spatial scope and the variety of variables available. Demographic variables such as total population ($TotPop$), urban population ($UrbPop$), slave population ($SlavePop$), white population ($WhtPop$) and an indicator for whether a county had access to a navigable waterway ($NavWater$) are included. The independent variable of interest in examining the merits of the Wade hypothesis is county-level urban population, which should be positively correlated with the probability of an event if the theory is correct. In addition, these censuses contain information on the value of agricultural output ($ValAgProd$), value of manufacturing output ($ValManProd$), and manufacturing employment ($ManEmpl)$ and investment ($ManInvest$). Moreover, and importantly for the instrument variable strategy employed below, educational variables such as the number of private ($PrivSchl$) and public schools, enrollment and literacy rates are included in theses censuses as well. Appendix 2.1 displays the summary statistics for these data.

A perennial issue which trammels this analysis, or any other attempting to investigate 19th century United States history, is the fact that county boundaries were in a constant state of flux during this period. Persistent territorial expansion in the pursuit of manifest destiny, via the purchase of new lands from foreign governments (Louisiana Purchase) or the dislocation of Native Americans (Creek cessions of 1805,1806,1821 and 1826), made county borders in the period 1800-1860 (and onward) far more fluid than rigid. If the over-riding goal in compiling these data is to create a panel of observations which are

consistent through time, then data for a given county in, say, 1840 is effectively useless if its borders were re-organized in 1835.

As a result, following the method outlined in Hornbeck (2010) and Perlman (2013), county borders are adjusted to hold geographical units constant through time for the 1840-1860 panel. Using historical U.S. county boundary files,[119] county borders in later decades are intersected with those of a base year using ArcView GIS software. When later counties fall within more than one base year county, data for each piece are calculated by multiplying the later county data by the share of its area in the base year county. For those later decades, each base year county is then assigned the sum of all the pieces falling within its area. Of course, this procedure relies on the assumption that data are uniformly distributed across a given county, though I do not view this to be particularly unrealistic.

Cotton Price Data

National cotton price data are taken from *The Historical Statistics of the United States (2000)*, and are in dollar per 10 pound units. Previous scholarship by Aptheker (1993) and Wade (1964) suggests that during, or immediately after, years in which cotton prices were high, slaveowners utilized whatever means necessary to increase production. This included mandating longer working hours, intensifying the pace of harvesting and planting, and acquiring additional slaves. This would have reduced the quality of living and working conditions for slaves on cotton plantations, and thus my model predicts that this should lead to more insurrection activity by slaves. Although this logic has intuitive appeal, to the best of my knowledge the relationship between cotton prices and slave revolts has yet to be empirically verified. Figures 2.6 and 2.7 present time series plots of cotton prices and the number of revolts and discovered conspiracies.

---

[119]Carville, Hepen, and Otterstrom (1999).

Figure 2.6: Revolts and Cotton Prices, 1800-1860
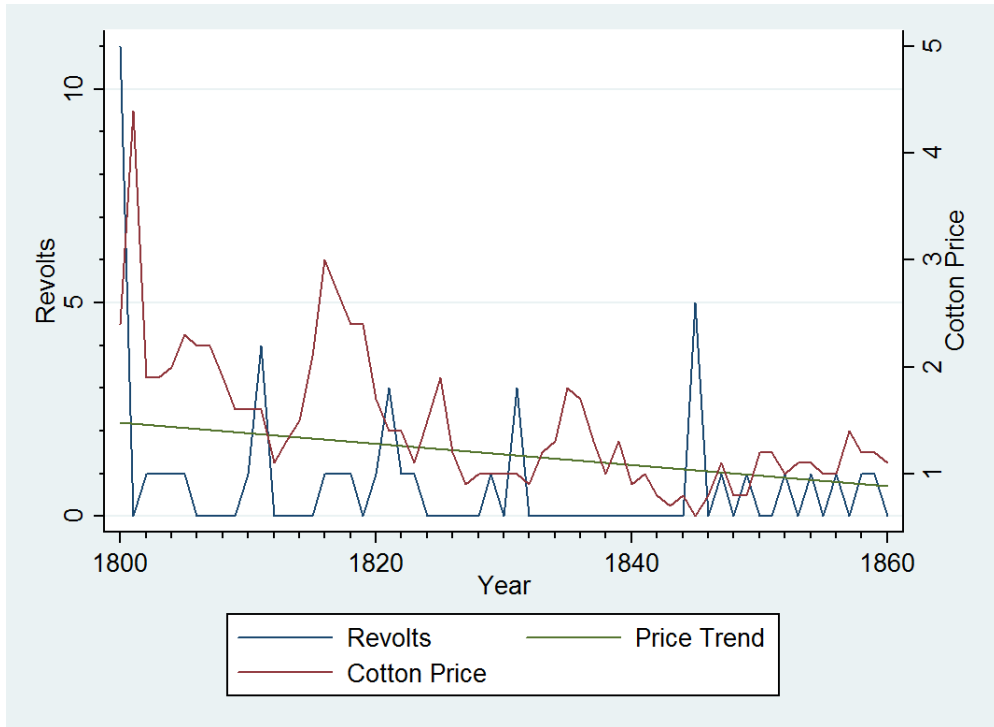
Figure 2.7: Conspiracies and Cotton Prices, 1800-1860
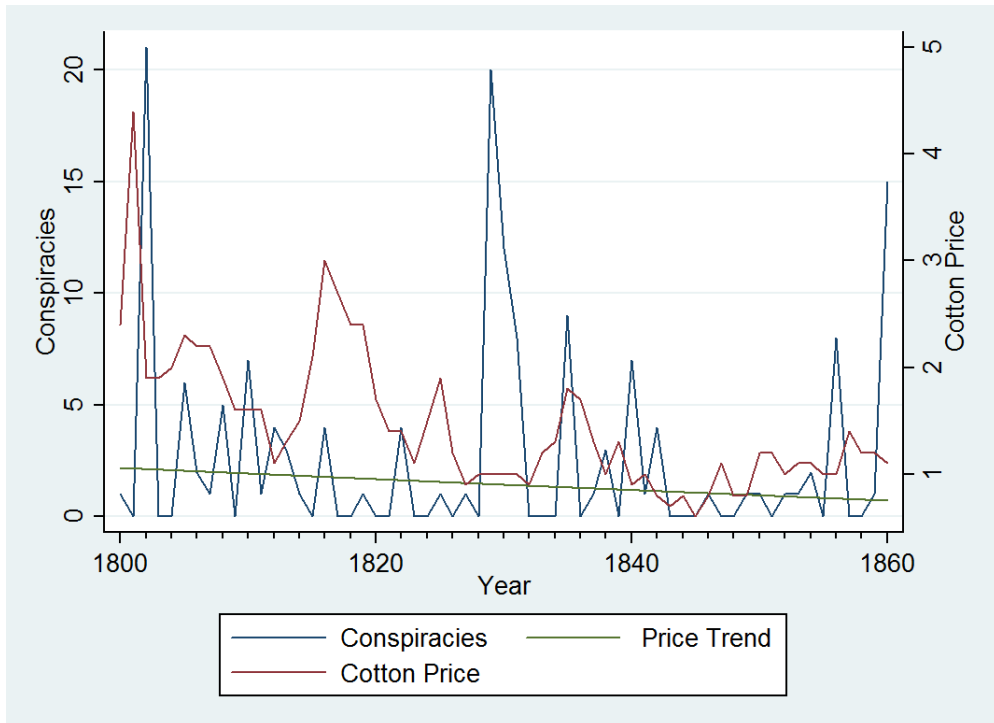
Empirical Results

The following results will elucidate how the strenuousness of the work regime, in conjunction with the surveillance efforts put forth by slaveowners, determine the insurrection behavior observed among slaves in the antebellum South. The analysis begins by investigating the role of time-invariant, "first-nature" factors such as geography and geographically-determined productivity in order to test the predictions of Proposition 1. To further buttress this argument, and explore the dynamic causes of slave unrest, cotton price data is introduced and the methods of duration analysis are also employed. As such, the dynamic results lend another layer to the analysis, but also provide additional robustness.

Geography, Slave Insurrections and Conspiracies

The following analysis will delineate the results of a Linear Probability Model (LPM) and from probit regressions of the form:

$$Pr(Y_i = 1 | X) = F(X'\beta), \tag{22}$$

where Y_i is either $EvConsp_i$ or $EvInsurrect_i$, β is a vector of coefficients of interest, and X is a matrix of geographic independent variables, as well as a control for the number of years a given county existed during the period of investigation,[120] and F is a link function. It should once again be reiterated that because the independent variables employed below are of a purely geographic nature, and because technological limitations of the day hindered drastic improvements to agricultural lands,[121] each of the right-hand-side variables in equation (22) are plausibly exogenous, and thus causal inferences can be

---

[120]This is included in order to control for potential biases that might arise simply because counties in Virginia, for example, are observed over the entire period 1800-1860, while counties in Alabama are only observed upon entering the union in 1819.

[121]*cf.* Rubin (1975).

made from the empirical analysis.

As a first step in empirically validating the theoretical predictions of Proposition 1, it must first be verified that the counties which the GAEZ data predict are the most productive in tobacco and cotton did in fact produce these crops. It could be the case, for example, that the general upward trend in cotton prices during the pre-war era incentivized cotton production even in areas which were not particularly suited for it. To alleviate this concern, Appendix 2.2 presents a simple regression in which a large, significant correlation is determined between actual production of these crops and that predicted by the GAEZ database.

Table 2.1 illustrates empirical results in which *EvConsp* and *EvRevolt* represent indicators for whether such an event was observed in a given county between 1800-1860, *CotProd* and *TobacProd* represent the predicted productivities for these crops gleaned from the GAEZ database, and *DistCity*, *DistNorth*, *DistRiver* represent the Euclidean distance to the nearest city, free state and river, respectively. Lastly, $NumYears$ represents the number of years a given county fell within the time period of study.

A plausible detraction from the estimates in Table 2.1 is that there exists a high degree of multicollinearity between the geographic independent variables. Table 2.9 in Appendix 2.1 presents the variance inflation factor (VIF), $\sqrt{VIF}$ tolerance, and R-Squared statistics for these variables, all of which are within an acceptable range, and therefore multicollinearity should not present problems for the coefficient and t-statistic estimates. It could also reasonably be argued that the coefficient estimates in Table 2.1 give a misleading picture of the actual marginal effects of predicted cotton and tobacco productivities on the probability of discovered conspiracies and insurrections. It could be the case that for certain ranges of cotton productivity, for example, there exists a negative relationship between productivity and the probability of an insurrection or discovered conspiracy, even though the net effect is positive. To alleviate this fear, Figure 2.8 plots the predicted probabilities of insurrection events as a function of the predicted cotton and tobacco pro-

ductivities. It is immediately clear from the plots that a monotonic, and largely linear, relationship exists between these probabilities and the predicted productivities garnered from the GAEZ database.

To control for the potentiality of omitted variable bias, the Euclidean distance of each county to the nearest free state (*DistNorth*) is included as a control in each of these regressions. It could be the case, for example, that counties in the Upper South were simply less productive in tobacco and cotton than those in the Lower South, and it is this correlation that is driving the results. Figure 2.5 lends potential support to this claim, as the areas of Southern Louisiana and Eastern Texas exhibit a greater predicted productivity in tobacco than Kentucky, Tennessee or Virginia. Inclusion of this variable, however, does not qualitatively affect the results present

Figure 2.8: Marginal Effects of Predicted Productivities
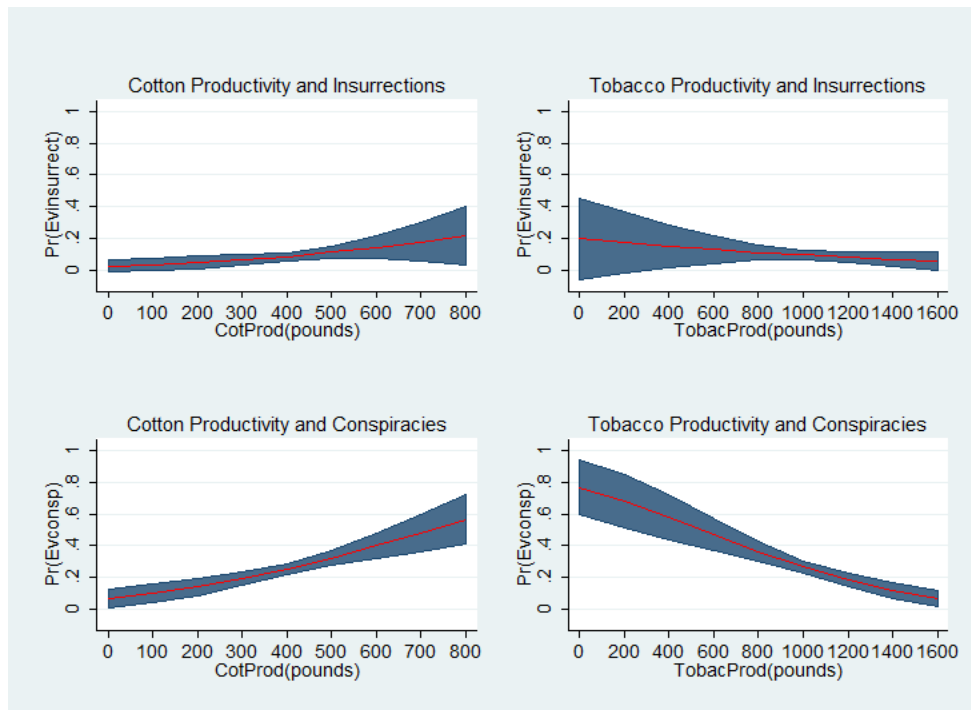
Table 2.1: Productivity, Geography and Revolts

| | LPM | | | | Probit | | | |
| | EvConsp | | EvRevolt | | EvConsp | | EvRevolt | |
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
CotProd	1.09***	1.49***	.340*	.524***	4.832***	5.34***	3.215*	4.02**
	(2.91)	(4.27)	(1.94)	(3.17)	(3.71)	(4.39)	(1.78)	(2.38)
TobacProd	-.831***	-1.07***	-.083	-2.32*	-3.153***	-3.59***	-1.002	-1.75*
	(-3.33)	(-4.61)	(-0.60)	(-1.76)	(-4.21)	(-5.00)	(-.099)	(-1.82)
DistCity	-.001**		-.003		-.00377***		-.000825	
	(-2.31)		(-.16)		(-2.80)		(-.47)	
DistNorth	.002	.001	.0003	-.003	.000713*	.003	.000145	-.002
	(1.25)	(.72)	(0.32)	(-0.29)	(1.74)	(0.89)	(.26)	(-0.54)
DistRiver	.0014**		.001***	.002	.00450***		.00665***	
	(2.35)		(2.97)	(1.45)	(2.81)		(3.49)	
NumYears	.0017	.003	.001	.002	.00478	.009	.00952	.013
	(0.78)	(1.28)	(0.90)	(1.45)	(.79)	(1.49)	(1.09)	(1.56)

Dependent variable is an indicator for whether an insurrection or discovered conspiracy occurred within a given county in the period 1800-1860. Coefficient estimates are reported for Linear Probability Model (LPM) and Probit models. T-statistics are reported in parentheses, with heteroskedasticity-robust standard errors employed in the estimation. Significance levels reported are as follows: * p<0.10, ** p<0.05, and *** p<0.01.

The results of Table 2.1 suggest that counties which were inherently more productive in cotton were more likely to experience discovered conspiracies and insurrections, while counties inherently more productive in tobacco were less likely to experience discovered experiences. This accords well with the prediction of Proposition 1. Due to the fact that cotton production was more laborious for slaves *vis-a-vis* tobacco, it was more likely that the utility garnered from toiling in the service of their slaveowner was less than

the w necessary to prevent them from rebelling. Moreover, perspicacious and profit-oriented cotton planters, aware of the taxing nature of cotton production and the desire of their chattels to rebel, put forth greater efforts to uncover such plots, leading to more discovered conspiracies. Conversely, slaves on tobacco plantations enjoyed a relatively less arduous work regime, and were therefore less inclined to risk the severe punishment that was doled out in the wake of a failed rebellion. As a result, tobacco planters presiding over a relatively less militant pool of slaves were less likely to voluntarily incur the costs associated with greater surveillance, and therefore discovered conspiracies were less likely in those areas where tobacco was most productive.

The coefficient estimates on *DistRiver* and *DistCity* also accord with the predictions of Proposition 1, which argued that as the costs associated with evading capture decrease, surveillance effort by slaveowners increases and the propensity for slaves to rebel increases. The variables *DistCity* and *DistRiver* may be considered proxies for such costs. Often times cities served as a convenient embarkation point for more distant destinations, but also as a place for temporary refuge. By virtue of being near a Southern city rebel slaves were able to reach distant destinations, and evade capture in the meantime, at a lower cost than slaves whose plantations were in the hinterlands. In line with the prediction of Proposition 1, this smaller cost incentivized slaveowners to put forth a greater degree of surveillance effort, which led to greater success in uncovering slave plots.

As discussed in the Background Section, nearness to navigable rivers also imposed greater costs associated with evading capture, as river depots often served as sites of intense, concentrated slave supervision. In addition, impropriety on the part of compassionate steamboat captains was mitigated by legal mandates making them personally responsible, with the threat of fines and criminal prosecution, if they were found to be harboring slaves, even unwittingly. As a result, runaway slaves near such waterways often took circuitous routes into the countryside, and took great pains to avoid rivers in the

future, in order to avoid detection and confuse potential captors.[122] Such detours would have imposed considerable costs on runaway slaves, who were often forced to traverse rugged terrains in order to bypass river checkpoints. This lends an interpretation to the positive coefficients on *DistRiver* in each of the regressions listed in Table 2.1 that is in line with the prediction of Proposition 1. Greater distance from navigable waterways ensured that rebellious slaves did not have to bear the additional cost of avoiding river patrols and inspection points, thus incentivizing insurrection. As a result, slaveowners in the open countryside, without the benefit of river slave catchers and patrols, put forth greater private surveillance efforts, leading to a higher incidence of discovered conspiracies.

Time Series and Duration Analysis

Thus far, the analysis has focused on the relationship between slave work regime, slaveowner surveillance and insurrection in a static context. In order to broaden the scope of this analysis, as well as confirm or refute previous analyses, I will now investigate the factors affecting the incidence of slave rebellion in a dynamic setting. In particular, I focus on a factors which, according to previous scholarship and Proposition 1, affected the strenuousness of slaves' work regime: cotton prices and cotton productivity. A number of previous authors have pointed toward a positive correlation between cotton prices and the laboriousness of work for slaves, including Aptheker (1993), Genovese (1979), Steckel (1986a, 1986b, 1986c, 1992) and Wade (1964). In these works it is argued that more strenuous and longer working conditions prevailed during years in which cotton prices were higher, thus tipping the calculus of slaves toward more revolts. To date, however, a rigorous examination of this hypothesis has not been conducted. Moreover, as described

---

[122]"...Western Virginia and Kentucky slaves found the Ohio River a formidable barrier. Authorities in counties along the river were on the lookout for those who might be trying to pass themselves off as hired hands or free persons. At certain jumping off points and portage locations, sheriffs were particularly vigilant." As a result, "when it might be suspected that they would take to the river, some slaves who lived along the Mississippi deliberately struck out across the countryside, away from the river..." (*Ibid.*, p. 112).

in detail in the Background Section, areas in which cotton productivity was high should also witness more trenchant slave unrest, as the cultivation of this crop was exceedingly difficult, even relative to labor-intensive crops such as sugar.

Examining once again the time series plot in Figure 2.6, there appears to be at least anecdotal evidence of a positive correlation between cotton prices and the incidence of revolt. The periods 1800-1806, 1814-1820 and 1845-1860, in particular, each exhibit upswings in both the price of cotton and the number of insurrections. Moreover, it appears that more revolts occur during years in which the price of cotton is substantially above its clear, downward trend. This correlation is corroborated by Probit regressions and a linear probability model of the form:

$$Revolt_{it} = \alpha + \gamma' CottonTrend_{it} + \Gamma' Z_{it} + \delta_t + \lambda_i + \varepsilon_{it} \tag{23}$$

where $Revolt_{it}$ is an indicator for whether a revolt occurred in time t, δ_t is a year indicator, λ_i is a vector of county-level time-invariant omitted variables (random effects), Z_{it} is a vector of control variables, and γ is the coefficient of interest. The variable $CottonTrend$ represents deviations in cotton price from its downward trend, which is estimated by simply regressing cotton prices on time and collecting the residuals. Table 2.2 presents estimates of Equation 23, and as a robustness check regressions in which the raw cotton price data (*Cotton Price*) are employed are also reported. As can be seen in Table 2.2, deviations from the trend in cotton prices are a statistically significant predictor of revolts. In addition, the coefficients on raw cotton prices are also positive and statistically significant. This accords with the prediction of Proposition 1, as years in which cotton prices were exceptionally high would have led to more deleterious working conditions for slaves.

Table 2.2: Cotton Prices and Revolts, 1800-1860

	LPM		Probit	
Deviation From Trend	.0232***		3.2512**	
	(2.45)		(1.98)	
Cotton Price		.016284***		4.0956*
		(3.19)		(1.71)
Cotton Productivity	1.01*	0.98*	.88*	2.21**
	(1.83)	(1.75)	(1.92)	(2.00)
DistCity	-.000020*	-.0000129*	-.0058**	-.0032**
	(-1.87)	(-1.91)	(-2.30)	(-2.53)
DistRiver	.0000122**	.0000122*	.00362**	.00152**
	(2.10)	(1.79)	(2.01)	(1.99)
DistNorth	.00005	.00002	.00025	.00014
	(0.20)	(0.14)	(0.45)	(0.37)
NumYears	.0008	.0001	.0007	.0003
	(0.15)	(0.12)	(0.16)	(0.20)

Note: Dependent variable is an indicator for whether a revolt occurred within the period of investigation. z-scores are reported in parentheses, with robust standard errors clustered at the county level. * $p<0.10$, ** $p<0.05$, and *** $p<0.01$

The relationship between strenuousness of the work regime and slave unrest may also be investigated through the use of duration analysis methods, which have a number of distinct advantages over traditional regression methods. First of all, analyses of this kind allow the researcher to ask a slightly different question: conditional on no revolts or conspiracies having occurred within a given county in the previous periods, what are

the factors that effect the *hazard*[123] of these events occurring moving forward? Secondly, duration analysis allows for a more simplified investigation and presentation of the effect of categorical variables.[124] Lastly, the Cox (1972) proportional hazards model, which will be used throughout the following analysis, is a semi-parametric model requiring few (but stringent) assumptions.

In particular, the identifying assumption is that the effect of each predictor on the hazard function is identical over time, and the shift in hazard due to corresponding unit differences in each predictor is identical across the full predictor range. If both of these conditions are satisfied, the hazards are said to be proportional. Due to both the importance of these assumptions for my identification strategy, as well as their tendency to be violated in practice, there satisfaction in the data will first be verified before presenting the results.

Schoenfeld (1982) illustrated that, using individual contributions to the derivative of the log partial likelihood, regression residuals for each individual may be calculated for each covariate; as such, the residual may be thought of as the observed minus the expected values of the covariates at each failure time. If these residuals exhibit a random or unsystematic pattern at each failure time, this provides evidence for the proportional hazards assumption; whereas temporal trends in these residuals suggest its violation. Figure 2.9 plots the Schoenfeld (1982) residuals for the GAEZ-predicted cotton productivity, as well as an interaction between cotton productivity and cotton price. As is clearly evident in the figure, no temporal trends exist in the residuals and thus the proportional hazards assumption is satisfied.

---

[123]See Singer and Willett (2003).

[124]This is in part due to the fact that, in the Cox (1972) proportional hazards model, the baseline hazard function is not estimated. This precludes making *absolute* statements about hazard as a function of the independent variables, but allows the researcher to focus on factors affecting the *relative* hazard.

Figure 2.9: Schoenfeld (1982) Residuals for Two Covariates
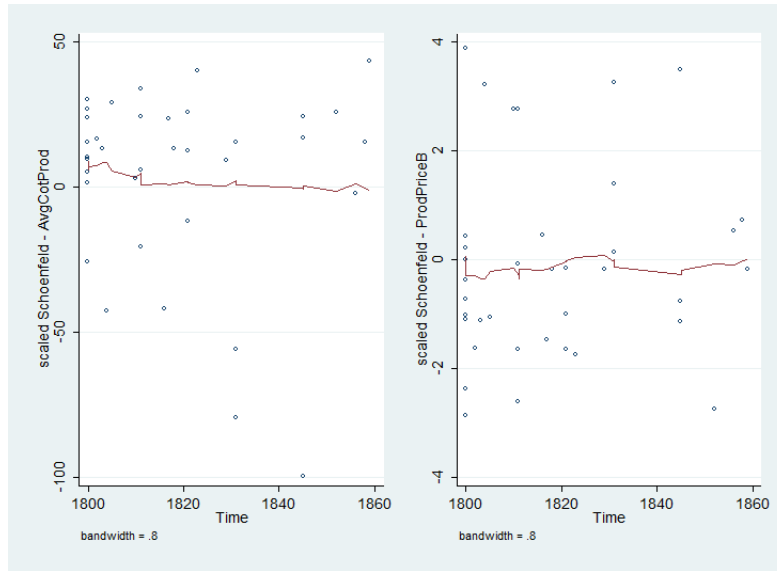
Figure 2.10 Cumulative Hazard Functions for Revolts and Cotton Productivity
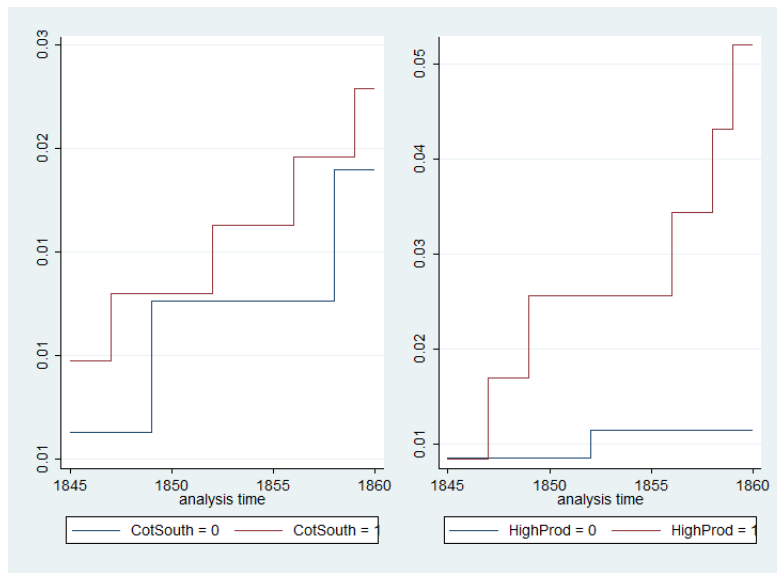
In order to fully utilize the advantages of the Cox (1972) model, two new measures of productivity are introduced, though they are based on the FAO GAEZ database previously described: *CotSouth* is an indicator for whether a given county falls within the Cotton Belt states of Alabama, Mississippi, Louisiana, Georgia, South Carolina and Arkansas, while *HighProd* is an indicator for whether the GAEZ-predicted cotton productivity within a given county is in the 75th percentile of the sample.

91

Table 2.3: Hazard Ratios for Revolts

Cotton South	1.378**		1.256**	
	(2.32)		(2.25)	
HighProd		1.26*		1.35*
		(1.78)		(1.83)
TobacProd	.24329	.3356	.4552*	.3289**
	(-1.03)	(-1.23)	(-1.97)	(-2.30)
DistCity	.98652***	.8875***	.7562***	.6689***
	(-3.20)	(-2.89)	(-3.15)	(-3.10)
DistRiver	.9835	.7568	.8825	.7521
	(-0.98)	(-1.15)	(-1.42)	(-1.45)
DistNorth	1.0032*	1.0056*	1.0065*	1.0025**
	(1.85)	(1.92)	(1.80)	(2.50)
Cotton Price	1.0011	1.002		
	(0.36)	(0.75)		
Deviation from Trend			1.0050**	1.0035**
			(2.15)	(2.02)

Note: This table presents hazard ratios calculated from a proportional hazards model with revolts as the dependent variable. z-scores are in parentheses and significance levels are as follows: * p<0.10, ** p<0.05, and *** p<0.01.

As is clearly evident from the cumulative hazard functions plotted in Figure 2.10, regardless of how how cotton productivity is quantified, those areas which have greater cotton productivity experience a larger hazard for revolts in the period 1840-1860.[125] This

---

[125]I temporally restrict the sample in this analysis to accord with the fact that many areas in the heart of the Cotton Belt had yet to begin producing cotton until this time period. See Olmstead and Rhode (2010) for a discussion.

accords with the prediction of Proposition 1, which argues that the labor regime was more strenuous for slaves in these areas.

Table 2.3 presents hazard ratios with both *CotSouth* and *HighProd* used as measures of cotton productivity, and revolts as the dependent variables. The hazard ratios for both variables accord with with Figure 2.10, as well as the predictions of Proposition 1. The hazard of experiencing a revolt is 26-38% higher in areas in which cotton productivity was higher, and the result is statistically significant. In addition, deviations from the trend in cotton prices are correlated with a greater hazard for revolt. Lastly, Table 2.3 reaffirms previously discussed predictions of Proposition 1 regarding distance to cities and navigable waterways, as both of these variables exhibit a negative correlation with hazard of revolt.

Conclusion

This paper investigates the relationship between various factors, such as geography and urbanization, and the incidence of slave unrest in the antebellum South. I develop a novel, theoretical model of slave rebellion to determine how the arduousness of the work regime, and the costs associated with a successful revolt, impact the calculus of slaves as well as that of their owners in determining the optimal level of surveillance. The model predicts that as the work regime becomes more strenuous, and the costs borne by slaves in the event of a successful rebellion become less severe, insurrection becomes more likely. As a result, these same parameter deviations incentivize greater surveillance on the part of slaveowners attempting to stymie such plots before they can be brought to fruition. To test these assertions, I compiled a novel dataset using predicted cotton and tobacco productivities from the FAO's GAEZ database, geographic variables calculated using arcGIS software, records of slave unrest compiled by Aptheker (1993), county-level census data and MCD-level occupation data. Various regressions utilizing incidences

of slave unrest in the period 1800-1860 imply that slave insurrections and discovered conspiracies were in fact more likely in cotton producing counties, as predicted by the model. In addition, proxies for the costs borne by slaves in the wake of a rebellion, such as distance to the nearest river or Southern city, were shown to have a significant impact on the prevalence of insurrections and discovered conspiracies. Counties that were closer to Southern cities and farther away from navigable rivers were shown to be significantly more likely to experience a discovered conspiracy in the period 1800-1859, a result that is also corroborated by a duration analysis. In addition, years in which cotton prices were high are correlated with a greater incidence of revolt. These results suggest that the stringency of the work regime and the ferocity of surveillance efforts, both public and private, were causal factors in determining the degree and success of slave unrest in the antebellum South.

References

[1] Abadie, Alberto and Imbens, Guido W. (2006). "Large Sample Properties of Matching Estimators for Average Treatment Effects." *Econometrica*, vol. 74, no. 1, p. 235-267.

[2] Abadie, Alberto, Drukker, David, Herr, Jane and Imbens, Guido W. (2004). "Implementing Matching Estimators for Average Treatment Effects in STATA." *The STATA Journal*, vol. 4, no. 3, p. 290-311.

[3] Aptheker, Herbert. *American Negro Slave Revolts*. New York: International Publishers, 1993.

[4] Acemoglu, Daron and Robinson, James. (2000). "Why Did the West Extend the Franchise? Democracy Inequality, and Growth in Historical Perspective." *Quarterly Journal of Economics*, vol. 115, no. 4, p. 1167-1199.

[5] Acemoglu, Daron and Robinson, James. (2001). "A Theory of Political Transitions." *The American Economic Review*, vol. 91, no. 4, p. 938-963.

[6] Acemoglu, Daron and Robinson, James. (2006). "Economic Backwardness in Political Perspective." *American Political Science Review*, vol. 100, no. 1, p. 115-131.

[7] Acemoglu, Daron, Golosov, Michael, Tsyvinksi and Yared, Pierre. (2011). "A Dynamic Theory of Resource Wars." *Quarterly Journal of Economics*, vol. 127, no. 1, p. 283-331.

[8] Aslasken, Silje. (2010). "Oil and Democracy: More Than A Cross-Country Correlation?" *Journal of Peace Research*, vol. 47, no. 4, p. 421-431.

[9] Aston, T.H., and Philpin, C.H.E., eds. *The Brenner Debate: Agrarian Class Structure and Economic Development in Pre-Industrial Europe*. Cambridge: Cambridge University Press, 1985.

[10] Bateman, Fred and Weiss, Thomas. "Comparative Regional Development in Antebellum Manufacturing." *The Journal of Economic History*, vol. 35, no. 1, p. 182-208.

[11] Baye, M.R. and Hoppe, H.C. (2003). "The Strategic Equivalence of Rent-Seeking, Innovation, and Patent-Race Games." *Games and Economic Behavior*, vol. 44, p. 217-226.

[12] Besley, Timothy and Persson, Torsten. (2011). "The Logic of Political Violence." *Quarterly Journal of Economics*, vol. 126, no. 3, p. 1411-1445.

[13] Bloch, Marc. *Feudal Society, Vol. 1: The Growth of Ties of Dependence*. Chicago: University of Chicago Press, 1964.

[14] Buhaug, Halvard and Gates, Scott. (2002). "The Geography of Civil War." *Journal of Peace Research*, vol. 39, p. 417-433.

[15] Cairnes, John Elliott. *The Slave Power*. 1862. New York: Harper (Torchbook Edition), 1969.

[16] Campbell, John. (1984). "Work, Pregnancy, and Infant Mortality Among Southern Slaves." *The Journal of Interdisciplinary History*, vol. 14, no. 4, p. 793-812.

[17] Catterall, Helen. *Judicial Cases Concerning American Slavery and the Negro*, 5 vols. New York: William S. Hein & Co., 1998.

[18] Christodoulou, C. *The Unpromised Land: Agrarian Reform and Conflict Worldwide*. London: Zed Books, 1990.

[19] Clark, D.J. and Riis, C. (1998). "Contest Success Functions: An Extension." *Economic Theory*, vol. 11, p. 201-204.

[20] Cobb, James C. *Industrialization and Southern Society, 1877-1984*. Lexington: University of Kentucky Press, 1984.

[21] Collier, Paul and Hoeffler, Anke. (2004). "Greed and Grievance in Civil War." *Oxford Economic Papers*, vol. 56, p. 563-595.

[22] Conning, J. (2004). "On the Causes of Slavery or Serfdom and the Roads to Agrarian Capitalism: Domar's Hypothesis Revisited." *Working Paper.*

[23] Conrad, Alfred H. and Meyer, John R. (1958). "The Economics of Slavery in the Antebellum South." *Journal of Political Economy*, vol 66, p. 95-130.

[24] Costinot, Arnaud and Donaldson, Dave. "How Large are the Gains from Economic Integration? Theory and Evidence from U.S. Agriculture, 1880-2002", *Working Paper,* 2011.

[25] Cox, David R. (1972). "Regression Models and Life-Tables", *Journal of the Royal Statistical Society*, vol. 34, no. 2, p. 187-220.

[26] Crawford, Stephen C. "Punishments and Rewards," in Robert Fogel and Stanley Engerman, eds., *Without Consent or Contract: The Rise and Fall of American Slavery, Conditions of Slave Life and the Transition to Freedom, Technical Papers, Volume II*, New York: W.W. Norton Company, 1992.

[27] Cronon, William. *Nature's Metropolis: Chicago and the Great West*. New York, W.W. Norton, 1992.

[28] Curtin, P.D. *The Rise and Fall of the Plantation Complex*. Cambridge, Cambridge University Press, 1990.

[29] David, P.A. and Temin, P. (1979). "Explaining the Relative Efficiency of Slave Agriculture in the Ante-Bellum South: Comment." *American Economic Review*, vol. 69, 213-218.

[30] Davis, Charles. *The Cotton Kingdom in Alabama*: *Perspectives in American History.* Montgomery: Alabama State Department of Archives and History, 1939.

[31] Douglas, Frederick. *The Life and Times of Frederick Douglas: From 1817-1882.* London: Christian Age Office, 1882.

[32] Eaton, Clement (1960). "Slave-Hiring in the Upper South: A Step Toward Freedom." *Mississippi Valley Historical Review,* vol. 46, no. 4, p. 663-678.

[33] Egerton, Douglas R. (1991). "'Fly Across the River': The Easter Slave Conspiracy of 1802." *The North Carolina Historical Review*, vol. 68, no. 2, p. 87-110.

[34] Elkins, Stanley. *Slavery: A Problem in American Institutional and Intellectual Life.* Chicago: University of Chicago Press, 1976.

[35] Esteban, Joan and Ray, Debraj. (2008). "Polarization, Fractionalization and Conflict." *Journal of Peace Research*, vol. 45, no. 2, p. 163-182.

[36] Fenoaltea, Stefano. (1984). "Slavery and Supervision in Comparative Perspective: A Model." *The Journal of Economic History*, vol. 44, no. 3, p. 635-668.

[37] Fenoaltea, Stefano (1989). "The Slavery Debate: A Note from the Sidelines," in *Articles On American Slavery: Economics, Industrialization, Urbanization, and Slavery*, ed. Paul Finkelman (New York: Garland Publishing, Inc., 1989), 182-187.

[38] Fishman, George L. and Degler, Carl N (1990). "Letters to the Editor." *The Journal of American History*, vol. 77, no. 1, p. 375-394.

[39] Fogel, Robert W. and Engerman, Stanley L. (1971). "The Relative Efficiency of Slavery: A Comparison of Northern and Southern Agriculture in 1860." *Explorations in Economic History*, vol. 8, 353-367.

[40] Fogel, Robert W. and Engerman, Stanley L. *Time on the Cross: The Economics of American Negro Slavery.* New York: Little, Brown & Company, 1974.

[41] Fogel, Robert. *Without Consent or Contract: The Rise and Fall of American Slavery.* New York: W.W. Norton & Company, 1989.

[42] Fogel, Robert. *The Slavery Debates, 1952-1900: A Memoir.* Baton Rouge: Louisiana State Press, 2003.

[43] Franklin, J.H. *The Militant South, 1800-1861.* Champaign, IL: University of Illinois Press, 2002.

[44] Fudenberg, Drew and Tirole, Jean. *Game Theory.* Cambridge, MA: The MIT Press, 1991.

[45] Gates, Scott. (2002). "Recruitment and Allegiance: the Microfoundations of Rebellion." *Journal of Conflict Resolution,* vol. 46, no. 1, p. 111-130.

[46] Genicot, G. (2002). "Bonded Labor and Serfdom: A Paradox of Voluntary Choice." *Journal of Development Economics,* vol. 67, no. 1, pl 101-127.

[47] Genovese, Eugene D. *The Political Economy of Slavery: Studies in the Economy & Society of the Slave South.* New York: Pantheon, 1965.

[48] Genovese, Eugene. *Roll, Jordan, Roll: The World the Slaves Made.* New York: Vintage Books, 1972.

[49] Genovese, Eugene D. *From Rebellion to Revolution.* Baton Rouge: Louisiana State University Press, 1979.

[50] Goldin, Claudia D. *Urban Slavery in the American South: 1820-1860.* Chicago: University of Chicago Press, 1976.

[51] Goldstone, J.A. *Revolution and Rebellion in the early Modern World.* Berkeley: University of California Press, 1992.

[52] Gray, Lewis Cecil. *History of Agriculture in the Southern United States to 1860.* Gloucester, MA: Peter Smith, 1958.

[53] Hadden, Sally E. *Slave Patrols: Law and Violence in Virginia and the Carolinas.* Cambridge, MA: Harvard University Press, 2001.

[54] Hagen, W.W. (1985). "How Mighty the Junkers? Peasant Rents and Seigneurial Profits in Sixteenth-Century Brandenburg." *Past and Present,* no. 108, p. 80-116.

[55] Harsanyi, John C. (1973). "Games with Randomly Disturbed Payoffs: A New Rationale for Mixed-Strategy Equilibrium Points." *International Journal of Game Theory,* vol. 2, issue 1, p. 1-23.

[56] Henry, H.M. *The Police Control of the Slave in South Carolina.* New York: Negro Universities Press, 1968.

[57] Hilton, R.H. (1949). "Peasant Movements in England before 1381." *The Economic History Review,* vol. 2, no. 2, p. 117-136.

[58] Hytten, F.E. and Leitch, I. *The Physiology of Human Pregnancy.* Oxford: Blackwell Publishers, 1971.

[59] Huizer, G. *The Revolutionary Potential of Peasants in Latin America.* Lexington, MA: Lexington Books, 1972.

[60] Jayadev, Arjun and Bowles, Saumel. (2006). "Guard Labor." *Journal of Development Economics*, vol. 79, p. 328-348.

[61] Johnson, Michael P. (1981). "Smothered Slave Infants: Were Slave Mothers at Fault?" *The Journal of Southern History*, vol. 47, no. 4, p. 493-520.

[62] Jones, Jacqueline. *Labor of Love, Labor of Sorrow: Black Women, Work, and the Family from Slavery to the Present.* New York, Basic Books, 1985.

[63] Kilson, Marion D. (1964). "Towards Freedom: An Analysis of Slave Revolts in the United States." *Phylon*, vol. 25, no. 2, 175-187.

[64] King, Gary and Zeng, Langche. (2001). "Logistic Regression in Rare Events Data." *Political Analysis*, vol. 9, no. 2, p. 137-163.

[65] Koubi, Vally, Spilker, Gabriele, Bohmelt, Tobias and Bernauer, Thomas. (2013). "Do Natural Resources Matter for Interstate and Intrastate Armed Conflict?" *Journal of Peace Research*, p. 1-17.

[66] Krugman, Paul. (1993). "First Nature, Second Nature, and Metropolitan Location." *Journal of Regional Science*, vol. 33, no. 2, p. 129-144.

[67] Kulikoff, Alan. *Tobacco and Slaves: The Development of Southern Cultures in the Chesapeake, 1680-1800.* Chapel Hill: University of North Carolina Press, 1986.

[68] Lockhart, J. and S.B. Schwartz. *Early Latin America: A History of Colonial Spanish Latin America and Brazil.* Cambridge: Cambridge University Press, 1983.

[69] Lundman, R.J. *Police and Policing: An Introduction.* New York: Holt, Rinehart and Winston, 1980.

[70] Mahaffy, J.P. (1890). "The Slave Wars Against Rome." *Hermathena*, vol. 7, no. 16, p. 167-182.

[71] Marden, Samuel. "Agricultural Reforms and 'Growth Miracles': Evidence from China", *Working Paper,* 2014.

[72] Mas-Colell, Andreu, Whinston, Michael D. and Green, Jerry R. *Microeconomic Theory.* New York: Oxford University Press, 1995.

[73] Mehlum, Halvor, Moene, Karl and Torvik, Ragnar. (2006). "Institutions and the Resource Curse." *The Economic Journal*, vol. 116, p. 1-20.

[74] Migdal, J.S. *Peasants, Politics and Revolution: Pressure Toward Political and Social Change in the Third World.* Princeton, NJ: Princeton University Press, 1974.

[75] Miller, Steven F. "Plantation Labor Organization and Slave Life on the Cotton Frontier: The Alabama-Mississippi Black Belt, 1815-1840," in Ira Berlin and Philip D. Morgan, eds., *Cultivation and Culture: Labor and the Shaping of Slave Life in the Americas*, Charlottesville: University Press of Virgina, 1993.

[76] Moore, B. *Social Origins of Dictatorship and Democracy: Lord and Peasant in the Making of the Modern World.* Boston: Beacon Press, 1966.

[77] Morgan, Philip D. "Task and Gang Systems: The Organization of Labor on New World Plantations," in Stephen Innes, ed., *Work and Labor in Early America*, Chapel Hill: University of North Carolina Press, 1988.

[78] Morgan, Philip D. and George D. Terry (1982). "Slavery in Microcosm: A Conspiracy Scare in Colonial South Carolina." *Southern Studies,* vol. 21, p. 121-145.

[79] Murshed, S.M. and S. Gates (2005). "Spatial-Horizontal Inequality and the Maoist Insurgency in Nepal." *Review of Development Economics*, vol. 9, no. 1 p. 121-134.

[80] Nunn, Nathan and Qian, Nancy. "The Potato's Contribution to Population and Urbanization: Evidence From an Historical Experiment", *NBER Working Paper, Number 15157*, 2009.

[81] Olmstead, Alan L. and Rhode, Paul W. (2010). "Productivity Growth and the Regional Dynamics of Antebellum Southern Development." *NBER Working Paper #16494*.

[82] Olmsted, Frederick Law. *A Journey in the Seaboard Slave States in the Years 1853-1854.* New York: G.P. Putnam's & Sons, 1904.

[83] Olmsted, Frederick Law. *A Journey in the Back Country.* New York: Nabu Press, 2010.

[84] Parker, Freddie L. *Running for Freedom: Slave Runaways in North Carolina, 1775-1840.* New York: Garland Publishing, Inc., 1993.

[85] Patterson, O. *Slavery and Social Death: A Comparative Study.* Cambridge: Harvard University Press, 1982.

[86] Radford, John P. (1976). "Race, Residence and Ideology: Charleston, South Carolina in the Mid-Ninteenth Century." *Journal of Historical Geography*, vol. 2, no. 4, p. 329-346.

[87] Ransom, Roger L. and Richard Sutch. *One Kind of Freedom: The Economic Consequences of Emancipation.* Cambridge: Cambridge University Press, 2001.

[88] Reidy, Joseph P. "Obligation and Right: Patterns of Labor, Subsistence, and Exchange in the Cotton Belt of Georgia, 1790-1860" in Ira Berlin and Philip D. Morgan, eds., *Cultivation and Culture: Labor and the Shaping of Slave Life in the Americas*, Charlottesville: University Press of Virgina, 1993.

[89] Robinson, James, Torvik, Ragnar and Verdier, Thierry. (2006). "Political Foundations of the Resource Curse." *Journal of Development Economics*, vol. 79, no. 2, p. 447-468.

[90] Rubenstein, Ariel and Osborne, Martin J. *A Course in Game Theory*. Cambridge, MA: MIT Press, 1994.

[91] Rubin, Julius. (1975). "The Limits of Agricultural Progress in the Nineteenth-Century South", *Agricultural Hisotry*, vol. 49, no. 2, p. 362-373.

[92] Ruffin, Edmund. *The Political Economy of Slavery*. Washington: L. Towers, 1857.

[93] Schoenfeld, D. (1982). "Residuals for the Proportional Hazards Regression Model." *Biometrika*, vol. 69, no. 1, p. 239-241.

[94] Scott, J.C. *The Moral Economy of the Peasant: Rebellion and Subsistence in Southeast Asia*. New Haven, CT: Yale University Press, 1976.

[95] Sheldon, Marianne B. (1970). "Black-White Relations in Richmond, Virginia, 1782-1820." *The Journal of Southern History,* vol. 45, no. 1, p. 27-44.

[96] Simon, Carl P. and Blume, Lawrence. *Mathematics for Economists*. New York: W.W. Norton & Company, 2006.

[97] Skaperdas, S. (1992). "Cooperation, Conflict, and Power in the Absence of Property Rights." *The American Economic Review*, vol. 82, no. 4, p. 720-739.

[98] Skaperdas, Stergios (1996). "Contest Success Functions." *Economic Theory*, vol. 7, 283-290.

[99] Skocpol, T. *States and Social Revolutions: A Comparative Analysis of France, Russia and China*. Cambridge: Cambridge University Press, 1979.

[100] Singer, Judith D. and Willett, John B. *Applied Longitudinal Data Analysis*. Oxford: Oxford University Press, 2003.

[101] Stampp, Kenneth M. (1971). "Rebels and Sambos: The Search for the Negro's Personality in Slavery." *The Journal of Southern History*, vol. 37, no. 3, p. 367-392.

[102] Stampp, Kenneth M. *Peculiar Institution: Slavery in the Antebellum South*. New York: Vintage, 1989.

[103] Steckel, Richard H. (1986a). "Birth Weights and Infant Mortality Among American Slaves." *Explorations in Economic History*, vol. 23, p. 173-198.

[104] Steckel, Richard H. (1986b). "A Peculiar Population: The Nutrition, Health, and Mortality of American Slaves From Childhood to Maturity." *Journal of Economic History*, vol. 46, p. 721-74.

[105] Steckel, Richard H. (1986c). "A Dreadful Childhood: The Excess Mortality of American Slaves." *Social Science History*, vol. 10, p. 427-465.

[106] Steckel, Richard H. "Work, Disease, and Diet in the Health and Mortality of American Slaves," in Robert Fogel and Stanley Engerman, eds., *Without Consent or Contract: The Rise and Fall of American Slavery, Conditions of Slave Life and the Transition to Freedom, Technical Papers, Volume II*, New York: W.W. Norton Company, 1992.

[107] Steinfeld, Robert J. *Coercion, Contract, and Free Labor in the Nineteenth Century.* Cambridge: Cambridge University Press, 2001.

[108] Steward, Austin. *Twenty-Two Years a Slave and Forty Years a Freeman.* Rochester, NY: William Alling, 1857.

[109] Sutch, Richard. (1975). "The Treatment Received by American Slaves: A Critical Review of the Evidence Presented in *Time on the Cross.*" *Explorations in Economic History*, vol. 12, p. 335-438.

[110] Tanner, J.M. *Fetus Into Man: Physical Growth from Conception to Maturity.* London: Open Books, 1978.

[111] Taylor, James (1977). "Exploitation Through Contrived Dependence." *Journal of Economic Issues*, vol. 11, no. 1, 51-59.

[112] Taylor, R.H. (1928). "Slave Conspiracies in North Carolina." *The North Carolina Historical Review*, vol. 5, no. 1, p. 20-34.

[113] Torvik, Ragnar. (2009). "Why Do Some Resource-Abundant Countries Succeed While Others Do Not?" *Oxford Review of Economic Policy*, vol. 25, no. 2, p. 241-256.

[114] Van der Ploeg, Frederick, and Poelhekke, Steven. (2010). "The Pungent Smell of 'Red Herrings': Subsoil Assets, Rents, Volatility, and the Resource Curse." *Journal of Environmental Economics and Management*, vol. 60, no. 1, p. 44-55.

[115] Van der Ploeg, Frederick. (2011). "Natural Resources: Curse or Blessing?" *Journal of Economic Literature*, vol. 49, no. 2, p. 366-420.

[116] Wade, Richard D. *Slavery in the Cities.* New York: Oxford University Press, 1964.

[117] Walsh, Lorena S. "Slave Life, Slave Society, and Tobacco Production in the Tidewater Chesapeake, 1620-1820," in Ira Berlin and Philip D. Morgan, eds., *Cultivation and Culture: Labor and the Shaping of Slave Life in the Americas*, Charlottesville: University Press of Virginia, 1993.

[118] Walton, Gary M. and Rockoff, Hugh. *History of the American Economy.* Mason, OH: Thomson South-Western, 2005.

[119] Wesley, Charles H. *Negro Labor in the United States, 1850 to 1825.* New York: Vanguard Press, 1927.

[120] Williams, R.E. (1972). "Slave Patrol Ordinances of St. Tammany Parish, Louisiana, 1835-1838." *The Journal of the Louisiana Historical Association*, vol. 13, no. 4, p. 399-412.

[121] Wolf, E. *Peasant Wars of the Twentieth Century.* New York: Harper and Row, 1968.

[122] Wooldridge, Jeffrey M. *Econometric Analysis of Cross Section and Panel Data.* Cambridge, MA: MIT Press, 2010.

[123] Wright, Gavin. *Old South, New South.* New York: Basic Books, 1986.

Appendix 2.1: Summary Statistics and Data Concerns

Table 2.4: Summary Statistics for GAEZ and Geographic Data

	CotProd (t/ha)	TobacProd (t/ha)	DistRiver (mi)	DistCity (mi)	DistNorth (mi)
mean	.2123	.4915	32.828	75.5635	258.5748
s.d.	.0917	.1443	40.8814	53.5020	186.6176
min	0	0	0	0	0
max	.4212	.8369	201.5633	305.0933	785.953

"CotProd and "TobacProd" refer to predicted productivities in tons per hectare obtained from the GAEZ database, and the method for arriving at these estimates is described in detail in Section 3. "DistRiver", "DistCity" and "DistNorth" variables refer to the Euclidean distance, in miles, from the midpoint of each county to that feature, respectively.

Table 2.5: 1860 Agricultural Summary Statistics

	CotProd (tons)	TobacProd (tons)	More100	More500
mean	742.13	129.61	184.37	15.79
standard deviation	1944.10	500.13	186.846	27.71
min	0	0	0	0
max	28298.6	6723.28	1325	197

Data from Haines (2010) and Minnesota Population Center

Table 2.6: Agricultural, Manufacturing and Education Statistics, by Year

	ValManProd	ManInvest	ManEmpl	ValAgProd
1840				
mean	65549.84	70585.42	247.264	469382.9
standard deviation	282374.9	225823.1	593.3811	459252
min	0	0	0	0
max	5881778	4294702	11229	2845941
1850				
mean	234003.4	126430	213.8188	634524.2
standard deviation	1361218	520948	1087.001	513602.6
min	0	0	0	34561
max	2.45e+07	9929332	23863	4069086
Total				
mean	151058.1	98932.52	230.287	553209.8
standard deviation	993102.2	404397.8	879.1472	494377.7
min	0	0	0	0
max	2.45e+07	9929332	23863	4069086

Data from Haines (2010) and Minnesota Population Center

Table 2.7 : Population Statistics for 1840-1859 Panel, by Year

	UrbPop	SlavePop	WhtPop	TotPop
1840				
mean	637.2774	3326.502	6210.327	9824.855
standard deviation	5753.379	4086.69	5812.114	8936.076
min	0	3	384	821
max	102313	58539	105331	134379
1850				
mean	1093.656	4079.889	7581.049	11975.83
standard deviation	8743.838	4512.572	8931.344	11719.13
min	0	29	395	1314
max	169054	44376	174853	210646
Total				
mean	865.4668	3703.196	6895.688	10900.34
standard deviation	7402.233	4319.91	7563.49	10472.8
min	0	3	384	821
max	169054	58539	174853	210646

Data from Haines (2010) and Minnesota Population Center

Table 2.8: Occupational and Foreign-Born Statistics, By Year

	GuardLabor	ForeignBorn
1850		
mean	3.82	2.39
standard deviation	67.11	28.76
min	0	0
max	5155	2387
1860		
mean	4.48	2.88
standard deviation	96.44	40.91
min	0	0
max	8056	3880

Data are taken from the IPUMS 1850 and 1860 occupational data, and 1950 occupational classification guidelines are utilized.

Table 2.9: Multicollinearity Diagnostics

	VIF	$\sqrt{\text{VIF}}$	Tolerance	R-Squared
CotProd	2.75	1.66	0.367	0.6363
TobacProd	2.65	1.63	0.3767	0.6233
DistCity	1.14	1.07	0.8742	0.1258
DistNorth	1.65	1.28	0.6070	0.3930
DistRiver	1.18	1.08	0.8506	0.1494

This table presents multicollinearity diagnostics for the variables utilized in the main regressions. See Data section for description of the construction of each of these variables.

Appendix 2.2: GAEZ Data

Detailed Explanation of FAO's GAEZ Database

The overarching goal of the GAEZ project is to provide farmers and government agencies with accurate information regarding the optimal crop choice. To this end, the GAEZ project first collected data on the characteristics of 154 crops to determine the required environmental conditions for their cultivation. The FAO then employed a team of researchers to compile climatic data for the global climatic database of the Climate Research Unit (CRU) at the University of East Anglia; the data extracted from this database include variables such as precipitation, frequency of wet days, mean temperature, diurnal temperature range, vapor pressure, cloud cover, sunshine, ground-frost frequency, and wind speed. A second set of data collected refer to land-specific characteristics (e.g. soil type) which are taken from the FAO's Digital Soil Map of the World (DSMW), and information on the slope of soils from the GTOPO30 Database developed at the U.S. Geological Survey (USGS) EROS Data Center. Together these data provide detailed information for 2.2 million grid-cells spanning the entire globe, where each grid-cell is .5 degrees by .5 degrees, and therefore comprises an area of 56 km^2 at the equator.

These data are then fed into state-of-the-art agronomic models, in which hundreds of parameters have been calibrated using extant research from the agronomic literature and field experiments from agricultural research stations, to predict potential yields (tons per hectare) for 17 different crops. These predictions consider "agro-climatic" constraints such as variability in water supply and existence of pests and weeds, as well as "agro-edaphic" suitability (i.e., soil erosion) for each grid-cell. In order to remove the effect of aberrant weather in any particular year while still taking climate conditions into account, the final GAEZ output used in my analysis is an average of runs of the GAEZ models using daily weather records observed in each year from 1961 to 1990. Lastly, in order to control for

varying levels of complementary inputs such as irrigation, fertilizers, machinery and labor, the GAEZ models allow for the user to choose the level of sophistication in the production process, which I set to "intermediate" to mirror the realities of the antebellum South.[126]

Cotton Production and GAEZ-Predicted Cotton Productivity

In order to verify the theoretical predictions of Proposition 1, it must first be verified that the counties which the GAEZ data predict are the most productive in tobacco and cotton did in fact produce these crops. I estimate the model:

$$Y_i = \alpha + \beta GAEZ_i + \varepsilon_i \tag{24}$$

where Y_i is actual production of tobacco or cotton in county i in 1860, α is an intercept term, β is the coefficient of interest, $GAEZ_i$ represents the predicted productivity of cotton or tobacco in county i as predicted by the GAEZ database, and ε_i is a randomly distributed error term. Table 14 illustrates the coefficient of interest and the t-statistics in parentheses from regressions in which robust standard errors are employed to mitigate any effects of heteroskedasticity. As is clear from the table, the coefficients on the predicted tobacco and cotton productivities are large, positive, and highly significant, which suggests that the naturally-determined productivity of a crop within a given area was an important factor in determining whether or not it would be grown. The strength of these first-stage results also suggests that the predicted productivities garnered from the GAEZ database can serve as viable instruments for actual production.

---

[126]These are also the settings chosen by Nunn and Qian (2009) in their study of the contribution of the potato to European population growth and urbanization, which covers a similar time period. The results below are robust to this specification.

Table 2.10 GAEZ Productivity and Actual Production in 1860

	Cotton Production, 1860	Tobacco Production, 1860
GAEZ Cotton	13680.4***	
(predicted)	(10.81)	
GAEZ Tobacco		371448.4***
(predicted)		(5.78)

Note: dependent variable is actual cotton or tobacco production in 1860. Results are reported for the coefficient estimates of GAEZ-predicted cotton and tobacco productivity, in metric tonnes per hectare. See Data Section 3.2 for a discussion of the construction of these variables. T-statistics are reported in parentheses, with heteroskedasticity-robust standard errors employed in the estimation. Significance levels reported are as follows: * p<0.10, ** p<0.05, and *** p<0.01.

Chapter 3

The Wade Hypothesis Revisited: Theory and Evidence from the Antebellum Southern United States

Abstract

This paper investigates some of the causal factors which fomented slave insurrections, discovered conspiracies and panics in the antebellum Southern United States. The analysis relies on a novel dataset, which is an amalgam of decennial census data and a compilation of incidents of slave unrest as recorded by Aptheker (1993), as well as a theoretical model of slave rebellion. An influential strand within the economic history literature, referred to herein as the Wade hypothesis, which attributes the relative decline of Southern industry and urbanization to the inherent difficulty in supervising slaves in an urban environment, is critically analyzed. The finding that the probability of a slave insurrection event is not correlated with the degree of urbanization in a given county is interpreted as evidence against a direct interpretation of this hypothesis. However, the finding that police forces in Southern cities were significantly larger than those in Northern cities supports a more nuanced interpretation of this theory.

The man in whose favor no laws of property exist, probably feels himself less bound to respect those made in favor of others. When arguing for ourselves, we lay it down as fundamental, that laws, to be just, must give reciprocation of right; that without this, they are mere arbitrary rules, founded in force, and not in conscience, and it is a problem which I give to the master to solve, whether the religious precepts against the violation of property were not framed for him as well as his slave? and whether the slave may not justifiably take a little from one who has taken all from him, as he may slay one who would slay him?

-Thomas Jefferson

Introduction

A cursory review of recorded human history illustrates that free labor is very much a modern phenomenon. Traditionally an absence of clearly defined, enforceable property rights allowed labor market transactions across the globe to exhibit coercion, forceful appropriation or the threat thereof as a means to secure labor from direct producers, whether slave, serf, or bonded laborer.[127] Even today coerced labor remains a thriving institution, particularly in the developing world, as the United Nations' International Labor Organization estimates that there are currently 21 million forced laborers worldwide.

To the extent that institutions regulating the extraction of forced labor were prevalent

---

[127]See Skaperdas (1992) for a theoretical investigation. Patterson (1982) argues that slavery and forced labor were common practice in labor markets in most ancient civilizations including Egypt, Greece, Rome and Japan. In the feudal era, restrictions on labor mobility and the various customary labor services serfs were obliged to provide landlords were a defining feature of the "ties of dependence" described by Bloch (1964). See North (1981 and Hagen (1985) for a discussion. Slavery was an integral component of plantation economies formed in the Caribbean, parts of Brazil and Colombia, while coercion was an important factor in the organization of labor in mining operations, encomiendas, as well as the later hacienda system that persisted throughout much into the post-colonial era. See Lockhart and Schwartz (1983) and Curtin (1990). More recently, Naidu and Yuchtman (2013) highlight the inherently coercive nature of Master and Servant Laws which persisted in Britain until 1875.

throughout historical time and space, so were instances of organized, violent resistance to their imposition.[128] This correlation is abundantly apparent in the slave economy of the antebellum Southern United States, as slave insurrections, uncovered conspiracies, and panics were a routine aspect of life.[129] As such, the antebellum South witnessed the creation of elaborate, costly institutions of slave surveillance that would have important ramifications for the profitability of slavery as a whole.[130] Slaveowners often employed overseers and managers tasked solely with monitoring slave unrest, and it was not uncommon for planters to employ spies among their slave populations in order to uncover plots of rebellion.[131] Along with these private surveillance measures, an elaborate legal framework and various law enforcement mechanisms provided a second, public line of defense. For example, slave patrols consisting of local militiamen and slave catchers routinely patrolled transportation routes looking for rebellious slaves.[132] Southern cities in particular served as sites of intense, concentrated slave supervision, with laws regulating

---

[128]The Servile Wars of ancient Rome constitute perhaps the most famous example. See Mahaffy (1890). In regards to peasant-landlord relations in feudal Europe, Marc Bloch (1970, p. 175) writes "to the eyes of the historian...agrarian revolt appeared as inseparable from the seigneurial regime as is, for example, the strike from large-scale capitalist enterprise."Peasant unrest also led to bloody confrontations in Catalonia in 1486, culminating in the Sentence of Guadalupe, as well as the French *Grande Jacquerie* of 1358, peasant revolts in Germany in 1525, England in 1381, Flanders in the 1320's and the convulsions of the Calabrian peasantry from 1469-75. See Hilton (1949) for a close inspection of English peasant revolts and their role in the abrogation of serfdom. Moving forward in time, Genovese (1979) provides a detailed chronology of the numerous slave revolts which occurred throughout the New World during the colonial era.

[129]As John Hope Franklin (2002, p. 70-71) states, "The slave was never so completely subjugated as to allay all fears that he would make desperate, bloody attempt to destroy the institution which bound him. Slaveholders could never be quite certain that they had established unquestioned control; fear and apprehension were always present."

[130]See Fogel and Engerman (1974) for an introduction to the long, acrimonious debate over the profitability of American slavery.

[131]"On a large plantation the numerous details of oversight required the assistance of an additional manager, without whose aid the owner would have been compelled to remain every day upon his plantation" Gray (1958, p. 545). In fact, according to Williams (1972, p. 400), in many cases the presence of such managers was required by law. For the employment of spies, see Steward (1857, p. 32). These efforts appear to have been successful, as countless instances in Aptheker (1993) refer to the uncovering of plots through these means. In particular, spies were instrumental in uncovering one of the most infamous slave conspiracies in the antebellum era, that of Denmark Vesey, who planned to set fire to the city of Charleston, South Carolina, slay the cities' white residents, and sail to the black republic of Haiti in 1822.

[132]In fact, Hadden (2001) argues that the exigencies of slave supervision explain why organized police forces often appeared in Southern cities before those in New York and Boston.

every facet of slaves' economic and social lives.[133] Indeed, Frederick Law Olmsted while traveling through Charleston, South Carolina noted that beyond the outwardly amenable relations between slave and slaveowner "you come to police machinery such as you never find in towns under free governments: citadels, sentries, passports, grape-shotted cannon, and daily public whippings...for accidental infractions of police ceremonies."[134]

This paper focuses on an influential strand within the economic history literature, first put forth by Cairnes (1862) and Wesley (1927), and later reinvigorated by Wade (1964), which attributes the backwardness of Southern industry on the eve of the Civil War to the inherent difficulties posed by monitoring urban slaves.[135] Referred to in this paper as the "Wade hypothesis", it argues that the various freedoms enjoyed by slaves in cities, for example those afforded by the hiring-out system, posed such difficulties in controlling slave populations that an ever-present fear of rebellion eventually led urban slaveholders to shed their chattels. Despite the intuitive appeal of this argument, its veracity has yet to be rigorously tested with data. To ameliorate this deficiency, I employ a novel dataset and theoretical framework to investigate whether the likelihood of insurrections, conspiracies or panics was in fact higher in urbanized areas. Using Probit and Linear Probability Models with panel data from the period 1800-1860, I find no county-level correlation between the degree of urbanization and the likelihood of slave unrest. As a definitive explanation for the reticence of the South to industrialize remains elusive, I regard this as an instructive negative result.

A potential explanation, and one that offers a more nuanced interpretation of Wade's analysis, is the finding that police forces were significantly larger in Southern cities than Northern cities.[136] This result supports a narrative put forth by Wade (1964), Hadden

---

[133]Wade (1964)

[134]Olmsted (2010, p. 444).

[135]It should be noted that Wade's theory continues to be debated in the literature; see, for example, Acemoglu and Robinson (2006).

[136]Radford (1976) argues that this system of control was the precursor to state-instituted segregation witnessed in the postbellum period."The antebellum attitudes in Charleston survived Reconstruction, and so too did the antebellum residential patterns. It was not until much more recently that backyard

(2001), Olmsted (2010) and Radford (1976) which suggests that the exigencies of slave control and supervision necessitated the creation of organized police forces in Southern cities even before those in the larger, more densely populated Northern cities. Thus, I find that while urbanization did not directly lead to more insurrections, it did pose salient costs, relative to agrarian slavery, in the form of more trenchant slave surveillance and supervision.

This paper contributes to the existing literature by providing a rigorous empirical analysis of a theory of slave insurrection. Previous scholarship has offered various explanations for violent slave unrest, ranging from the size of the free African American population[137], the density of slave populations[138], access to transportation via navigable waterways[139] and cotton prices. While each of these seem plausible, a causal relationship with slave revolts has yet to be determined in each case.[140] Aptheker (1993), which serves as an important data source for this work, provides an excellent discussion of these theories, as well as a detailed description of antebellum slave unrest, but stops short of developing a comprehensive framework for determining their root cause. Given the historical importance of this form of organized resistance in shaping the antebellum economy, this represents a significant deficiency.

In order to formalize the incentive to rebel faced by slaves in urban and rural environments, as well as the incentives to monitor such behavior by slaveowners, a theoretical model of slave insurrection is also developed. The model is sufficiently general to accommodate Wade's central claim, namely that the primary distinction between town and

---

residence and backyard attitudes toward blacks disappeared." Sheldon (1970, p. 33) also notes the legal reaction in Richmond Virginia to the discovery of the Gabriel Prosser conspiracy in 1800, and the resultant tightening of laws regulating manumission.

[137]See Aptheker (1993) and Wade (1964).

[138]See Genovese (1979), Aptheker (1993), Wade (1964).

[139]Morgan and Terry (1982).

[140]The closest relative is the work of Murshed and Gates (2005). The authors empirically isolate contributing factors in the Maoist insurgency in Nepal, which claimed as many as 15,000 lives from 1996-2006. "The concept of horizontal or inter-group inequality, with both an ethnic and caste dimension, is highly relevant in explaining the Nepalese Civil War" (*Ibid,* p. 121).

country within the system of Southern slave labor was the degree to which institutional controls, such as police forces, the legal system, etc. regulated the daily life of slaves. Nevertheless, the model is less general than that developed in Finn (2016) in order to more accurately mirror the fundamentals of Wade's argument. The theory predicts that in an urban environment, greater efforts will be put forth to surveil slave population as a means to disincentivize rebellion.

Wade Hypothesis

At least as early as Kaldor (1966) and Rostow (1960) economists have have stressed the importance of industrialization, mechanization and a robust manufacturing sector in sustaining long-run economic growth. It is often argued that industrial sectors, *vis-a-vis* agricultural, enjoy greater labor productivity due to technological spillovers, economies of scale and human and physical capital accumulation.[141] Moreover, at least as early as North (1961), economic historians have recognized that industrialization, mechanization and a robust manufacturing sector were decidedly lacking in the American South on the eve of the Civil War. North's argument rested on the observation that Southern states' comparative advantage in staple crop production could be exploited with relatively little capital investment, in part due to geography. "Efficient development of the cotton trade was accomplished with relatively minor amounts of capital for social overhead investment or dependent industries. Internal transport problems were mitigated by the abundance of rivers in the South."[142]

Numerous scholars following North have similarly noted the backwardness of Southern industry, and the reticence of the region to urbanize. Bateman and Weiss (1981) note

---

[141]*cf.* Chenery et al. (1986), Lewis (1954), Fei and Ranis (1964) and Fagerberg and Verspagen (1999) for a discussion of this "structural change bonus." For recent evidence in favor of this view, see Timmer and de Vries (2008). The authors note that from 1963-2005 South Korea witnessed an average annual productivity growth rate of 4.5%, roughly half of which is attributed to the manufacturing sector.

[142]*Ibid.*, p.125.

that capital per establishment (in dollars) in New England was roughly three times that of Southern states, while capital per capita was almost eight times higher in the former compared to the latter. In a similar vein, Cobb (1984, p. 6) illustrates that in 1860 total manufacturing output in South was less than that of either Pennsylvania, New York or Massachusetts. In regards to urbanization, Genovese (1965, p. 171) and Wright (1986) similarly highlight large disparities between the two regions: in 1860 the urban population of the Lower South was 7% of the total population, while in New England the percentage was 37, and in the Middle Atlantic states 35. A lack of infrastructure in the South, alluded to by North above, has also been emphasized and empirically verified by a number of scholars. The density of railroads, defined as miles of track divided by land area, was three times higher in the North than in Southern states. Estimates regarding canal mileage paint a similar picture.[143] The net effect of these failings was that before the Civil War GDP per capita in the South was 70% of the national average, and this was despite a recent boom in cotton prices. [144]

Though historians and economists have reached a near consensus on the retardation of Southern industry, there is far less agreement as to why exactly this was the case. Eugene Genovese (1967) and Barrington Moore (1966), followed by Laraghi (1978), Weiner (1978) and Billings (1979) have advanced an influential Marxist interpretation of Southern society which argues that a dominant planter class successfully opposed the rise of an urban bourgeoisie, due to ideological antipathies, before and after the Civil War. Wright (1986) instead argues that because slaves were a moveable asset, there existed no incentive for plantation owners to support investment in public goods like infrastructure, and manufacturing suffered as a result. Lastly, Claudia Goldin (1976) argues this trend can be attributed to a higher elasticity of demand for slaves in cities. As Goldin notes, "The low rural elasticity indicates that there were few substitutes for slave labor in agriculture.

---

[143]Wright (1986, p. 21).
[144]Barro and Sala-i-Martin (1992), Easterlin (1960).

That is, slaves were especially well suited for staple crop production. The high urban elasticity suggests that there were more and closer substitutes for slaves in urban activities...”[145] As a result, fed by a rising demand for products of Southern agriculture, most notably cotton, the increase in slave prices witnessed by much of the South in the decades leading up to the civil war[146] led many urban employers to draw upon these substitutes, namely immigrant labor.

The focus of this paper, however, will be the argument posed by Wade (1964), which asserts that the dual tasks of slave management and supervision were inherently more difficult in an urban environment, and this invoked an ever-present fear of rebellion on the part of urban slaveholders which ultimately rendered slavery and urbanization incompatible. A cursory look at Figure 3.1 lends tentative support to this assertion, as *prima facie* there appears to be a relationship between the number of insurrection events, such as outright revolt, discovered conspiracies and panics, and the distance to a major metropolis. Many of the areas which experienced multiple insurrection events during the period under investigation are in close proximity to the 13 Southern cities with populations above 10,000 in 1860. Underlying Wade's premise is the observation that most cities in the South rapidly shed their slave populations in the two decades before the Civil War, which is validated by estimating:

$$UrbSlaves_{it} = \alpha + \beta YEAR + \varepsilon_{it} \tag{25}$$

where $UrbSlaves_{it}$ denotes the urban slave population in county i in period t. The results of this regression using decennial census data in 1840 and 1850, described below, is presented in Table 3.1.

---

[145]Goldin (1976, p. 125).

[146]In Louisiana, for example, the average price of a slave in 1850 was $488, but by 1860 it had jumped to $1,000 (*Ibid.*, p. 72).

Table 3.1: Downward Trend in Urban Slaves, 1840-1860

	UrbanSlaves
YEAR	-0.0188***
	(-3.72)
_cons	36.08***
	(3.86)

Note: Dependent variable is urban slave population in a given county in 1840 and 1850. County fixed effects are employed and standard errors are clustered at the county level. T-statistics are reported in parentheses, with significance levels as follows: * p<0.10, ** p<0.05, and *** p<0.01.

Clearly there is a downward trend in the number of city slaves during the period of interest. Yet Wade posits that a greater degree of freedom enjoyed by slaves as a result of their urban environs, and the resultant fears of rebellion on the part of slaveowners, ultimately compelled urban masters to shed their chattels. For example, as a result of the widely accepted customs of "hiring-out" and "living out"[147], urban slaves were endowed with a freedom of movement between owner and employer, albeit highly regulated, that nevertheless would have been utterly alien to the plantation field hand.

In addition to more fluid working and living conditions, cities also offered slaves greater opportunities for commingling, perhaps at the local groghouse, church or cabaret, and this also gravely piqued the suspicions of slaveholders.[148] Lastly, and partially as a result of

[147]Under these practice masters who owned more African Americans than they could utilize either at home or in their business hired some to labor-strapped employers. This custom greatly lessened "the rigidity of slavery, allowing a constant reallocation of the labor supply according to demand" (*Ibid.*, p. 38). Goldin (1976, p. 35) also observes that, "not only were urban slaves hired out, but many...lived apart from their place of work. These slaves were allowed to locate their own place of residence and buy their own meals."

[148]According to the editor of the *Daily Delta*, "Should a servile outbreak ever occur in the city of New

these impediments to slave supervision, urban slaves enjoyed higher rates of literacy on average than their counterparts in the fields. This was viewed as contributing factor in the Denmark Vesey plot in Charleston, S.C. in 1822, as unrest among literate slaves was stoked by the success of the Saint Domingue revolt, as well as deliberations over the Missouri Compromise.[149] Frederick Douglas, comparing the life in Baltimore with his early days as a field hand in the Maryland countryside, aptly summarizes these points, "A city slave is almost a free citizen, he enjoys privileges altogether unknown to the whip-driven slave on the plantation."[150]

Wade argues that the liberties granted to slaves as a result of their urban environs kept slaveholders in a perpetual state of suspicion and fear, and as a result "papers continued to demand increased police vigilance, municipal officials sought wider powers and additional arms from state government, and vigilante committees stood ready to quash the colored rebels."[151] Fears of unrest in the wake of discovered conspiracies were so trenchant among urban slaveholders that slaves, particularly young males, were sold in large numbers to the countryside to reduce the probability of insurrection.[152] This reaction was accelerated by the availability of cheap immigrant labor alluded to by Goldin, as well as the fact that the financial burdens of policing and restricting slave autonomy were increasingly shifted to slaveowners through taxes and permits.[153] According to Wade, these factors led to an inherent and incontrovertible incompatibility between urbanization and slavery that ultimately led to the decline of Southern industry.

Orleans we shall have to thank the keepers of these Negro cabarets and club houses for it, within the precincts of whose damned halls, at the dead hour of midnight, heaven knows what plots are hatched against our peace.*" New Orleans Daily Delta*, September 10, 1854.

[149]Wade (1964, p. 239).

[150]Douglas (1855, reprinted 2009).

[151]Wade (1964, p. 227).

[152]"Rumors of plots and imminent uprising marked the ordinary routine of every city. If whites learned to live with this anxiety, they could not long forget it. Just as the patrols, whipping posts, and auction blockes reminded Negroes of their servitude, so these symbols made the townspeople aware of their own insecurity." (*Ibid.*, p. 242). Sheldon (1979, p. 36) makes a similar point when describing the reaction of Richmond, VA citizens to a discovered conspiracy during the War of 1812.

[153]Goldin (1976, p. 2).

To test this hypothesis, the analysis below investigates whether insurrections, uncovered conspiracies, and panics were in fact more likely to occur in urban settings, and develops a theory to explain these results. A simplistic reading of Wade's hypothesis predicts a correlation between the degree of urbanization and the prevalence of such events, particularly panics. As will be shown below, however, I do not find any evidence for such a correlation in the data. Instead, I find that Southern cities employed much larger police forces than Northern cities, which yields more nuanced evidence for the inherent contradiction between urbanization and slavery described by Wade (1964).

Figure 3.1: Insurrections and Urban Areas
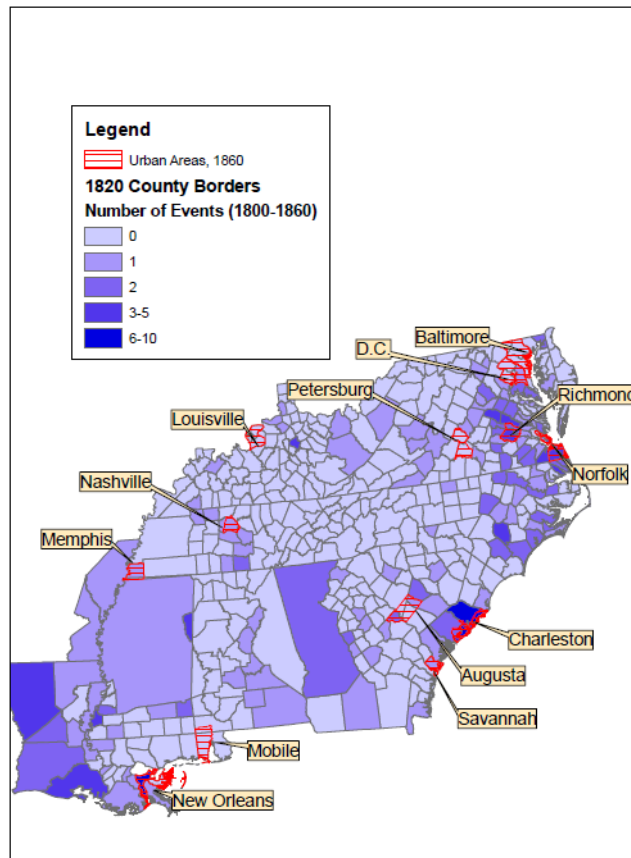
Source: Aptheker (1993) and Author's Calculations

Model

The following partial equilibrium model analyzes the incentives faced by slaves and slave-owners in deciding how much effort to put forth toward insurrecting and surveillance, respectively. The ultimate goal of this analysis is to highlight those factors which contributed to or hindered the prevalence of slave revolts, conspiracies and panics in the antebellum South, and how they might differ between urban and rural environments. To this end a contest-success function, common in the theoretical literature on conflict, is used to formalize a basic tradeoff between production and appropriation.[154]

Primitives and Assumptions

The model is positive in nature, and parsimoniously depicts an archetypal slave-slaveowner relationship as a sequential game.[155] The set of players is discrete, and consists of a single slaveowner and a set J of identical slaves, each of whom supply a given quantity of labor in homogenous quality. For simplicity it shall be assumed that the set of slaves has a cardinality of J (i.e., $|J| = J$), and that $J > 2$.

The strategy set M of the slaveowner is compact, bounded by zero from below and an arbitrarily large, but finite, Δ from above so that his strategy consists of some $m \in [0, \Delta]$.[156] The choice of m in part determines the quantity of labor the slaveowner is able

---

[154]It is often recognized that the work of Haavelmo (1954) was the first to investigate this tradeoff. Later contributions include Tullock (1980), Hirshleifer (1988) and Skaperdas (1992). Skaperdas (1996) and Jia (2008) provide derivations of variants of the functional form employed in this paper, the former via an axiomization approach and the latter using stochastic methods, in which the determination of a "winner" in the contest is noisy. That said, the following theory most closely follows the work of Grossman (1991), which embeds the decision to insurrect in a general equilibrium setting. In the context of slave revolts, however, Grossman's theory seems inappropriate because it assumes total agricultural production is split between the participants in a successful rebellion.

[155]Utilizing the terminology of Fudenberg and Tirole (1991), it is assumed that all players are endowed with perfect recall and common knowledge, so that they may costlessly observe the history of play in choosing an optimal strategy.

[156]In fact, given the structure of the slaveowner's utility function explained below, it can be shown that the optimal choice of m will always be finite, and thus the assumption of an arbitrary upper bound Δ is somewhat superfluous in ensuring the their strategy set is compact. This results from the assumptions of diminishing marginal product of labor and a constant, finite marginal cost of coercion, denoted μ below.

to forcibly extract from his slaves, and as such represents supervisory efforts such as the employment of overseers tasked with monitoring labor productivity. The strategy space of slave $j \in J$ consists of a compact set bounded by zero from below and 1 from above, which represents all feasible choices of insurrection effort, as well as the decision to *Flee,* and earn a reservation utility π[157], or *Stay* and toil under the slaveowner's purview. Thus, a complete strategy profile is a tuple from the cartesian product $[0, 1] \times [Flee, Stay]$. Each slave $j \in J$ is endowed with one unit of a resource, say time or work-effort, the proportions of which, given the decision to *Stay,* are distributed between private production on a personal garden plot or leisure (λ_j), coerced labor (β), and insurrecting[158] ($r_j \in [0, 1]$). Equation (26) expresses this distribution of the peasants' resource:

$$\lambda_j + r_j + \beta(m, R) = 1. \tag{26}$$

Where $R \equiv \sum_{j \in J} r_j$ to represent the communal nature of resistance efforts.

The timing of the game is as follows[159]:

Stage 1: The slaveowner chooses $m \in M$.

Stage 2: Each slave $j \in J$ chooses *Flee or Stay.* If the slave flees, they receive a

---

[157]Which may represent the Von Neumann-Morgenstern expected utility from stealing away and posing as a wage laborer in the nearest city, for example. "It was a unusual planter who could boast that none of his slaves had absconded during a given year. In fact, the vast majority admitted just the opposite, and some complained about 'habitual' runaways, or those who ran off two, three, and four times each year. Traveling through the southern states during the 1850s, Frederick Law Olmsted noted that at virtually every plantation he visited masters complained about runaways" Schweninger (1999, p. 267). Wade (1964, p. 209-20) similarly describes the persistent problem of slave flight in Southern cities as well.

[158]It should be noted that r_j may also signify day-to-day acts of "silent sabotage" such as the maiming of draft animals or destruction of lands, tools and facilities. Daniel Dennett (1849), editor of the *Planter's Banner* in Louisiana, spoke about his slaves as such: "On a plantation they can neither hoe, nor ditch, chop wood, nore perform any king of labor with a white man's skill. They break and destroy more farming utensils, ruin more carts, break more gates, spoil more cattle and horses, and commit more waste than five times the number of white laborers do." As an anonymous contributor to the *South-Carolina Gazette* reported, "Mr. James Gray who work'd his negroes late in his Barn at Night, and the next Morning before Day, hurried them out again, and when they came to it, found it burnt down to the Ground, and all that was in it" (quoted in Morgan 1998, p. 154-5).

[159]In the current setup the slaveowner is the first-mover. It should be noted, however, that comparative statics results are robust to an alternative formulation in which slaves choose their insurrection effort in Stage 1.

123

reservation utility $\pi \in (0,1)$, and the slaveowner receives $-\mu m$, where μ represents the marginal cost of supervising labor.

Stage 3: If previously slave $j \in J$ chose *Stay,* they then choose $r_j \in [0,1]$. Letting $L\left(\beta\right)$ represent coerced labor, (T) land[160], (P) the price of agricultural output, (A) a Hicks-neutral productivity parameter and $F : \Re \times \Re_+ \to \Re$ a production technology[161], the payoff functions, if Stage 3 is reached, may be written as:

$$U^S_{j \in J}(r_j, m) = \sum_{j \in J} \lambda_j,$$

$$U^O(r_j, m) = PA * F(L(\beta)), T) - \mu m,$$

where U^S and U^O refer to the payoffs of slaves and the slaveowner, respectively. The utility slave $j \in J$ receives in stage 3 is equal to the proportion of their resource which can be devoted to their private production or leisure.[162] The payoff the slaveowner receives in stage three is equal to the revenue garnered from agricultural production, which takes as inputs labor $L\left(\beta\right)$ and land (T), less the costs associated with coercion. Therefore, a slave in stage 2, having observed the choice of the slaveowner $m \in [0, \Delta]$, will only choose *Stay* if $\sum_{j \in J} \lambda_j(R, m) \geq \pi$.[163] The extensive form representation of the game for a single slave $j \in J$ is shown in the figure below.

---

[160]It is assumed that the quantity of land endowed to the slaveowner is determined exogenously and utilized costlessly.

[161]F is assumed to be a continuously differentiable neo-classical production function, satisfying positive marginal products, strict concavity in its arguments, positive cross partial derivatives, smooth dependence on its parameters and constant returns to scale.

[162]Ransom and Sutch (2001, p. 83) and Fogel and Engerman (1974, p. 127) note that private garden plots were common among plantation slaves, and their allocation was often used as a tool to stimulate labor effort.

[163]It is assumed that slave $j \in J$ chooses *Stay* if $\lambda_j(m, r_j) = \pi$.
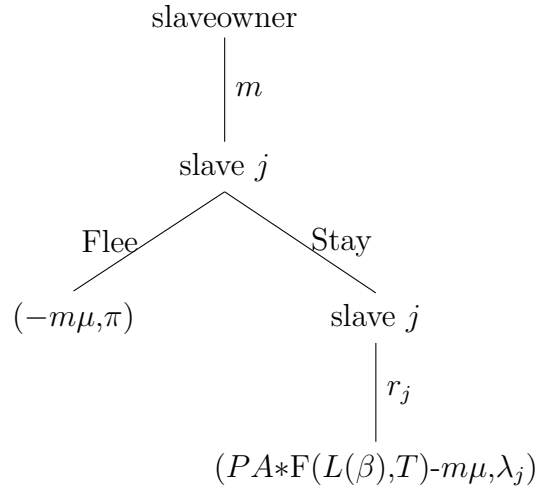
Figure 3.2: Extensive Form Representation

Lastly, the total quantity of labor the slaveowner is able to forcibly extract from all $j \in J$ depends on the contest-success function $\beta(m, r_j)$, which is borrowed from the economic literature on conflict:

$$L\left(\beta\right) = \beta(m, R) * J = \frac{cm}{cm + (1-c)\sum\limits_{j \in J} r_j} J \qquad \text{for } m + R > 0 \text{and } c \in (0,1). \qquad (27)$$

As the functional form for $\beta(m, R)$ plays a critical role in the following analysis, it is worth a brief discussion. It states that the proportion of labor appropriated by the slaveowner from slave $j \in J$ is a function of his individual contribution to coercion (m), the combined level of resistance on the part of slaves $(\sum r_j)$ and the parameter c which determines the relative efficacy of repression versus resistance.[164] Thus $\beta(m, r_j)$ may be considered a conflict technology[165], markedly distinct from those generally encountered in economic theory in that its inputs are combined *adversarially* in the "production" pro-

---

[164]More specifically, it is the *ratio* of coercion to combined resistance that determines β. This can be mostly clearly seen by assuming $c = \frac{1}{2}$, which yields $\beta = \frac{m}{m + \sum r_j}$.

[165]See Hirshleifer (1988); Skaperdas (1992, 1996).

cess. Moreover, the parameter c is critically important in determining the relative power between the slaveowner and slaves, as it represents an asymmetry in the effectiveness of revolt versus surveillance efforts. For example, note that when $m = \sum_{j \in J} r_j > 0$, $\beta = c$; and therefore conflict becomes increasingly unbalanced in the slaveowner's favor as c approaches 1. In the present context, less invasive mechanisms of slave control in cities *vis-a-vis* plantations, in particular those beyond the purview of slaveowners, may be represented by a smaller c. As described above, cities offered slaves much greater autonomy. Lax restrictions on mobility and residence allowed opportunities for socializing and, as a result, coordination between slaves in the plotting of rebellions that affected the balance of power between slave and slaveowner. [166] Finally, the fact that $(\sum r_j)$ is an argument of β is meant to reflect the communal nature of resistance, and assumes coordination and collective action issues have been resolved among slaves.[167]

Equilibrium and Proposition

The solution concept employed is that of subgame perfect Nash equilibrium (SPNE). Given the primitives of the game a pure-strategy SPNE is guaranteed, but to first narrow down the candidate strategy profiles, an immediate result is useful.

LEMMA 1: *Suppose their exists an $m \in [0, \Delta]$ that induces the decision "Stay" by laborers. This m endows the landowner with a strictly higher payoff than an $m' \in [0, \Delta]$ which induces the decision "Flea" by laborers.*

PROOF: Consider a strategy $m_f \in (0, \Delta]$ that induces laborers to choose *Flee*, and a strategy $m_s \in (0, \Delta]$ that leads to the choice *Stay*. Suppose by contradiction that the

---

[166]Note that if both total resistance and monitoring efforts are doubled, "output" remains constant.

[167]Previous scholarship has noted the organizing power of ethnicity, for example. "Most contemporary civil wars in developing countries have an ethnic dimension in the sense of well-defined and ethnically distinct groups fighting one another. One reason is that ethnicity resolves the collective action problem of mobilizing groups to fight one another. Ethnicity, whether based on religion, language, or some other form, is a powerful organizing principle, far superior to social class." Murshed and Gates (2005, p. 122).

payoff to the slaveowner from m_f is greater than the payoff from m_s :

$$\mu(m_s - m_f) > F(\beta(m_s, R), T) \geq 0.$$

But because $\lambda_j(m, r_j)$ is decreasing in m $\forall\, r_j > 0$, it must be the case that $m_f > m_s$, and thus the above statement is a contradiction because the left hand side is negative.

Given this equilibrium condition, the left-hand side of the tree diagram in Figure 14 may be disregarded, and an SPNE will be derived by employing the method of backward induction, beginning with optimal choice r, given that *Stay* was played in the previous proper subgame. The optimality problem of the laborer in stage 3, having observed this history of play, is :

$$\underset{r_j \in [0,1]}{\text{Max}} \sum_{j \in J} \lambda_j(m, r_j), \tag{28}$$

$$s.t.\ \beta = \frac{cm}{cm + (1-c)\sum\limits_{j \in J} r_j}.$$

There are a multiplicity of r_j^* which satisfy the first-order condition to this problem, as only the *total* level of resistance by laborers is important in β, but as a simplifying assumption the symmetric strategy profile in which each laborer devotes an equal proportion of their resources to resistance shall be chosen. That is, it will be assumed:

$$\sum_{j \in J} r_j^* = Jr^*. \tag{29}$$

The reaction function derived leads immediately to the following result.

LEMMA 2:

$$\frac{dr^*}{dm} \quad is \begin{cases} positive & \forall\, m < \frac{1-c}{4c} \\ negative & \forall\, m > \frac{1-c}{4c} \\ 0 & m = \frac{1-c}{4c} \end{cases} \quad and \quad r^* \;\; is \begin{cases} positive & \forall m < \frac{1-c}{c} \\ 0 & \forall m \geq \frac{1-c}{c} \end{cases}$$

PROOF: Inspection of laborer best-response function.

Having obtained r^*, and established that any candidate strategy profile must induce the decision *Stay* by peasants, backward induction proceeds by next solving for the optimal slaveowner strategy m^*. In order to prevent slaves from fleeing, any equilibrium m must satisfy:

$$\lambda_j(m, r^*) \geq \pi, \tag{30}$$

As one would expect, this constraint places an upper bound on m in equilibrium. To simplify the exposition, this upper bound will be defined γ.

The optimality problem of the slaveowner can thus be summarized as:

$$\underset{m \geq 0}{\text{Max}}\; (PA) \cdot F(L(m, r^*), T) - \mu m, \tag{31}$$

$$\text{s.t.}\; m \leq \gamma \quad \text{and}$$

$$\text{s.t.}\; L(m, r^*) = \beta(m, r^*) \cdot J.$$

Cursory examination of the resulting Kuhn-Tucker conditions reveals the possibility of two cases, an equilibrium in which constraint (30) binds and one in which it does not. Yet due to the unrealistic parameter values required for a non-binding equilibrium, our

focus will be on the case in which the slaves' individual rationality constraint binds.[168]

PROPOSITION 1

In an SPNE in which constraint (30) binds:

1. *A decrease in c will lead to greater equilibrium surveillance effort by the slaveowner.*

2. *A decrease in c has an ambiguous effect on the equilibrium insurrection effort put forth by slaves.* R^* *will*
$$\begin{cases} increase & if \quad m^* < \frac{1-c}{4c} \\ decrease & if \quad m^* > \frac{1-c}{4c} \\ not\ change & if \quad m^* = \frac{1-c}{4c} \end{cases}.$$

PROOF: Part 1 follows from Lemma 3 and the fact that γ is decreasing in c. Part 2 follows directly from Lemma 4.

Proposition 1 offers a convenient mathematical summary of Wade's primary argument, and its intuition is straightforward. If institutional mechanisms for slave controls are weaker, as he argues was the case for Southern cities, then c will decrease and *ceteris paribus* the slaveowner will make a larger investment in surveillance, represented by a larger m^*. If the surveillance effort by the slaveowner is sufficiently large, this will lead to a reduction in total insurrection effort by the slaves; if, however, the surveillance effort is below this threshold, then more insurrections will result. This paper illustrates that the greater liberties afforded slaves in urban environments[169] did not foment greater

---

[168]Various simulations have been conducted to investigate which parameter values lead to a non-binding equilibrium. As is evident from the slaveowner objective function, lower and higher values for c and μ, respectively, decrease the returns to applying surveillance efforts, and thus make a non-binding equilibrium more likely. Nevertheless, considered in isolation, a binding equilibrium obtains even when $c = .13$ (which would imply that only 13% of the laborers' time was spent toiling for the slaveowner if both chose equal efforts), and $\mu = 10$, that is, if the marginal cost of production was ten times its price. Moreover, the availability of outside opportunities for slaves (π) should diminish the slaveowner's ability to wantonly extract additional labor, but a binding equilibrium results even for values of $\pi < .01$. Appendix 3.2 gives greater detail to the calibration exercise used in these simulations.

[169]"Newspapers and tracts, the gossip around town, even the conversation in the master's house, indicated that many Americans believed slavery to be evil, or at least unjust. This perception resulted in constant unrest among a significant number of urban slaves, an unrest that manifested itself not only in persistent pressure to widen the latitude within slavery but also in sporadic attempts to get outside it by escape or mutiny." Wade (1964, p. 209)

rebelliousness on the part of slaves, and thus a simplistic rendering of Wade's hypothesis is proven to be false. However, this paper also finds that, on average, otherwise similar Southern cities employed much larger police forces than their Northern counterparts, and thus more stringent measures of slave control were employed in these areas. This suggests that, in line with Proposition 1, urban environments posed a unique set of difficulties with regard to slave supervision that required costly effort to be ameliorated, and therefore supports a more subtle reading of Wade's hypothesis.

Data

Revolts, Conspiracies and Panics

The source most heavily utilized for data on slave insurrections, discovered conspiracies and panics between 1800-1850 is Herbert Aptheker's *American Negro Slave Revolts* (1993). This detailed work is the culmination of over 5 decades of investigation into court minutes, probate records, plantation records (i.e., journal entries, correspondence, etc.), government archives, newspaper articles and various publications. To the best of my knowledge, the only other empirical paper which has drawn upon this compilation is Kilson (1964), which is mainly concerned with the taxonomy of slave revolts, specifically classifying them as either systematic, vandalistic or opportunistic. It should be noted that Kilson arrives at a smaller number for organized slave revolts taking place in the United States during the period of investigation, but this may be attributed to our inclusion of panics and conspiracies as dependent variables. It should also be noted that Aptheker's opus is not without criticism.[170] Though some refer to him as a "pioneering scholar"[171], others have charged that the instances of rebellion documented are either exaggerated or

---

[170]See, for example, the recent exchange between George L. Fishman and Carl N. Degler in the *Journal of American History* (1990).

[171]Rodriguez (2007)

rely on scanty evidence. Kenneth Stampp aptly explains the controversy by noting that at the time Aptheker began his research in 1927, the dominant view of the American slave was one of docility, dependence and submission. In fact, over thirty years later slaves were described as such:

> Sambo, the typical plantation slave, was docile but irresponsible, loyal but lazy, humble but chronically given to lying and stealing; his behavior was full of infantile silliness and his talk inflated with childish exaggeration. His relationship with his master was one of utter dependence and childlike attachment: it was indeed his childlike quality that was the very key to his being.[172]

Thus it is sometimes argued (by Stampp included) that Aptheker's book exaggerates instances of militant action on the part of slaves in order to repudiate the paternalistic view of him as "Sambo." To mitigate this tendency, and in line with Wilson's (1964) scholarship, the following analysis distinguishes between "insurrections", "conspiracies" and "panics", to be defined presently.

An "insurrection" is defined as any event in which multiple slaves resorted to violent action to obtain their freedom; this includes instances of "opportunistic" or "vandalistic" rebellion referred to by Kilson. A typical entry in Aptheker which would be classified as an insurrection is as follows:

> In August 1858, about 55 slaves on a plantation...near Coffeesville, Mississippi, decided they would no longer submit to whippings, and became unmanageable. The overseer obtained assistance from his neighbors, but the slaves, armed with axes, hatchets, clubs, scythes and stones, barricaded themselves...One white man was severely injured in attempting to get at the rebel-

---

[172]Elkins (1976, p. 82), reprinted. The inherent laziness of slaves has also been used as evidence the longstanding debate over the viability and profitability of American slavery, *cf.* Cairnes(1969), Ruffin(1857) and Genovese(1965).

lious Negroes. It was only when, after a few days, some seventy-five armed men came to the plantation from surrounding communities that the slaves were overpowered.[173]

A "conspiracy" is defined as any event in which multiple slaves were tried and convicted in a court of law for crimes related to the planning and execution of a revolt. Court records documenting instances of these trials are in large part from the work of Catterall (1998). A typical conspiracy entry, take from the Governor's Papers of Raleigh, NC, is as follows:

> Sir the inhabitants of Sampson have been alarmed with the insurrection of the Negroes - We have ten or fifteen negroes in Jail, and we have such proof that most of them will be bound over to our Supreme Court. We have testimony that will implicate most of the negroes in the county...the people of Duplin County have examined ten or fifteen negroes & found two guilty, and have put them to death...[174]

A "panic" is defined as an event in which fear and suspicion on the part of slave-holders in a particular county or city was rife, but no direct evidence of an insurrection or conspiracy is documented. This variable is important because it captures the *fear* of rebellion that, while in many cases was misplaced, purportedly played a prominent role in the decline of urban slavery. Of this category, by far the largest subset is events related to incendiary fires, such as those which swept Charleston, S.C. in April of 1838, in which 1,000 houses were destroyed at a loss of roughly $3,000,000.[175] As Radford notes, fires of such a large scale were often attributed to the machinations of slaves and free African Americans. "It was widely believed in the white community that a slave revolt would involve arson if only to create a diversion and stretch manpower to its limits. The Charleston Fire Guard, a volunteer force, mobilized during fires to protect the city

---

[173]Aptheker (1993, p. 351).

[174]*Ibid.*, p. 309.

[175]Radford (1976, p. 332)

against any Negro uprisings that might occur."[176] In fact, fear of rebellion in such cases was so acute that the mayor's office instructed the city guard not to aid in firefighting efforts unless absolutely necessary, and instead make preparations for the onset of an insurrection.[177]

An "insurrection event" is defined as one in which either an insurrection, discovered conspiracy or panic occurred. Each instance of these events has been cross-referenced with Rodriguez (2007) and Carroll (1968), and linked with county-level census data to be described below. In the period 1840-1859, in which census data of greater detail is available, there were 17 recorded insurrections, 50 conspiracies and 22 panics. In the entire period under investigation, 1800-1859, there were 52 recorded insurrections, 103 conspiracies and 63 panics. Due to a paucity of reliable records, it is likely that in each time period the number of events is grossly underestimated.[178]

Census Data

County-level census data used in the empirical analysis below is from two sources: Haines (2010) and the Minnesota Population Center. Up until 1900 censuses in the United States were conducted only on a decennial basis. As a result, for the vast majority of the regressions displayed below census data in any year t is used to explain slave insurrections, conspiracies or panics which occurred in the interval $[t, t+9]$. As an example, census data from 1840 is used to explain events which occurred anytime between 1840 and 1849. These "snapshots" may be used to uncover long-trends that either fomented or hindered slave

---

[176]*Ibid.*, p. 332. Interestingly, Radford also shows that fears of arson in Charleston were so rampant that the brick and mortar houses, as opposed to wooden, became far more popular in the decades leading up to the Civil War.

[177]"Except for those necessary to carry and guard the caisson, the city guard instead of being required to attend fires should on every alarm repair to the guard house under arms." Charleston *Courier*, 31st March 1840.

[178]Moreover, Wade (1964, p. 194) and Aptheker (1993) note that incidents of slave unrest often went unreported in order to quell widespread panic. "Even at moments of great tension, as in Charleston during the Vesey affair or in St. Louis after the burning of McIntosh, a free black little was revealed, because city officials drew a veil over the vents and secured a news blackout from local editors."

unrest.

Up until 1840 decennial census data are not particularly detailed and, as one would expect, provide almost entirely demographic information. Independent variables constructed from these datasets and used in panel regressions covering the period 1800-1859 are total population (*TotPop*), urban population (*UrbPop*, defined as the population living in an unincorporated city of at least 2,500 people), slave population (*SlavePop*), white population (*WhtPop*) and an indicator for whether a county had access to a navigable waterway (*NavWater*). The independent variable of interest in examining the merits of the Wade hypothesis is county-level urban population, which should be positively correlated with the probability of an event if the theory is correct. Appendix 3.1 displays the summary statistics for this panel. Due to data availability constraints, and in order to maintain a balanced panel, states which were not formally included in the Union as of 1800 are not included in these regressions. As a result, Alabama, Mississippi, Louisiana, Texas, Arkansas, Missouri and Florida are omitted. It should be noted that these omissions should not drastically alter results regarding our investigation of the Wade hypothesis, as the only major Southern cities dropped from the analysis are New Orleans, Mobile and St. Louis.[179]

Beginning in 1840 the decennial censuses become much more detailed, both in spatial scope and the variety of variables available. In addition to the population variables described above, the 1840 and 1850 censuses contain information on the value of agricultural output (*ValAgProd*), value of manufacturing output (*ValManProd*), and manufacturing employment (*ManEmpl*) and investment (*ManInvest*). Moreover, and importantly for the instrument variable strategy employed below, educational variables such as the number of private (*PrivSchl*) and public schools, enrollment and literacy rates are included in theses censuses as well. These censuses also include data for several of the states necessarily

---

[179]The remaining Southern cities with more than 10,000 residents in 1860 are Savannah, GA, Augusta, GA, Charleston, SC, Memphis, TN, Nashville, TN, Louisville, KY, Richmond VA, Petersburg, VA, Norfolk, VA, Washington D.C. and Baltimore, MD.

omitted from the 1800-1859 panel.[180] It is because of this richness of the data in later years that an additional panel, composed of 1840 and 1850 cross-sections, is created in the hopes of broadening the scope of our analysis. Tables 19 and 20 in the Appendix displays the summary statistics for this panel.

A perennial issue which trammels this analysis, or any other attempting to investigate 19th century United States history, is the fact that county boundaries were in a constant state of flux during this period. Persistent territorial expansion in the pursuit of manifest destiny, via the purchase of new lands from foreign governments (Louisiana Purchase) or the dislocation of Native Americans (Creek cessions of 1805,1806,1821 and 1826), made county borders in the period 1800-1860 (and onward) far more fluid than rigid. If the over-riding goal in compiling these data is to create a panel of observations which are consistent through time, then data for a given county in, say, 1840 is effectively useless if its borders were re-organized in 1835.

As a result, following the method outlined in Hornbeck (2010) and Perlman (2013), county borders are adjusted to hold geographical units constant through time for both panels. Using historical U.S. county boundary files[181], county borders in later decades are intersected with those of a base year (1800 for the 1800-1859 panel and 1840 for the 1840-1859 panel) using ArcView GIS software. When later counties fall within more than one base year county, data for each piece are calculated by multiplying the later county data by the share of its area in the base year county. For those later decades, each base year county is then assigned the sum of all the pieces falling within its area. Of course, this procedure relies on the assumption that data are uniformly distributed across a given county, though we do not view this to be particularly unrealistic.

---

[180]It should be noted that, due to data availability constraints, Florida and Texas continue to be omitted in this panel.

[181]Carville, Hepen, and Otterstrom (1999).

IPUMS Data

In order to gauge the relative size of police forces in Southern versus Northern cities, and thus make inferences regarding the cost of slave supervision, I collected data from the Integrated Public Use Microdata Series (IPUMS) at the Minnesota Population Center, University of Minnesota, for the years 1850 and 1860. These detailed data were originally collected from individual households, and I aggregated them to the level of minor civil division (MCD) while taking into account disparate weights for each sample. Using the 1950 Census Bureau occupational classification system, I created an MCD-level measure for the number of households reporting a member whose occupation was either "patrol, watchman, or doorkeeper" (code 763), "marshal or constable" (code 771), "policeman or detective" (code 773), or "sheriff or bailiff" (code 782). In line with the analysis of Jayadev and Bowles (2006), I define this variable *GuardLabor*. In addition, in order to control for potential omitted variable bias, I also created an MCD-level measure (*Foreign*) for the number of foreign-born residents in a given MCD, as well as a measure for the number of urban residents (*UrbPop*).[182] Lastly, I also created a number of MCD-level measures for economic activity, including mean income (*Income*), proportion of labor force in manufacturing (*Prpmanu*), proportion of labor force employed in finance (*Prpfinance*) and total real estate value (*Prop*). Taking these data together, I created a balanced panel of 13,808 cross-sectional units observed in 1850 and 1860, with 395 urban MCD's in 1860.

Estimation Strategy and Results

For the vast majority of the following regressions, the dependent variable is an indicator for whether an insurrection, conspiracy, panic or either of these three events occurred in a given county during the period of investigation. The binary nature of these variables

---

[182]In this panel urban status is based on the IPUMS' classification criterion, in which a person is counted as part of an urban population if they live in a city or incorporated place with more than 2,500 inhabitants.

leads to some information loss, as sometimes multiple insurrection events occurred within the same county over a nine year period. As the figure below indicates, however, for the lion's share of counties either one insurrection event or none occurred during the period of investigation. In the 1800-1859 panel, for example, only 30 counties experienced more than one insurrection event over this time frame period, and it should be noted that 8 of these counties contain urban populations. However, it should also be noted that the results presented below are robust to whether indicators or counts are used as dependent variables.

Figure 3.3: Histogram of Revolts and Discovered Conspiracies, 1800-1860
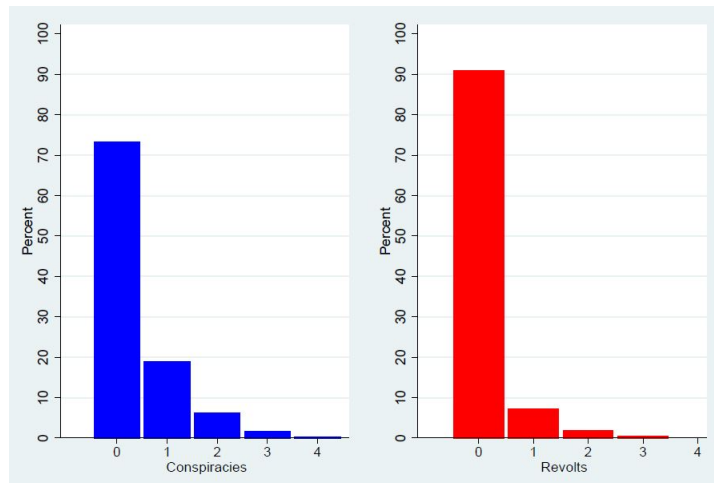
Source: Aptheker (1993) and Author's Calculations

A linear probability model (LPM) is utilized in each of the regressions described below, with robust standard errors accounting for the inherent heteroskedasticity that results from these specifications. In the panel regressions county-level fixed effects are utilized unless otherwise stated, as such this specification requires less stringent exogeneity assumptions than a random effects analysis, and because a Hausman test points to the former as the preferred model (results not shown).[183] As a precaution standard errors are

---

[183]It should be noted, however, that the Hausman test requires strict exogeneity of regressors under both the null and alternative hypotheses, which rules out any feedback from the dependent variable to future values of the independent variables (Wooldridge (2010, p. 288)).

also clustered at the county level to control for serial correlation, although the 10-year gap between cross-sections in a given panel should also ameliorate this issue. Lastly, year indicators are included in each of the regressions below to account for time-dependent shocks that might bias coefficient estimates.[184]

The overarching goal of the following analyses is to test a fundamental assertion of the Wade hypothesis: that slave unrest, whether revolts, discovered conspiracies, or panics, were more likely to occur in urban rather than rural areas. This paper finds that, regardless of the specification utilized or the time period analyzed, no such correlation exists in the data. As will be discussed below, a potential explanation is the increased use of slave surveillance in Southern cities. This offers support for a more nuanced interpretation of Wade's argument, that inherent incompatibilities between urbanization and slavery retarded Southern development.

1800-1859 Panel

The model estimated in each of the regressions below is characterized by:

$$I_{i,t\in[t,t+9]} = \alpha + \beta' X_{it} + \gamma\delta_t + \sigma NavWater_i * \delta_t + \Gamma_i + \varepsilon_{it} \tag{32}$$

where $I_{i,t\in[t,t+9]} \in \{EvEvent_{i,t\in[t,t+9]}, EvConsp_{i,t\in[t,t+9]}, EvEvent_{i,t\in[t,t+9]}\}$

is the dependent variable of interest for county i in period $[t, t+9]$, X_{it} is a vector of independent variables of interest, δ_t is a year indicator and Γ_i is a vector of county-level time-invariant omitted variables (fixed effects). Estimation results for this model in the period 1800-1859 are displayed in Tables 3.2 and 3.3 below.

---

[184]Aptheker argues that economic depression brought on by adverse climate conditions placed a greater work burden on slaves, and thus may have been a precipitate of rebellion. Lingering effects of the disastrous rains which struck Louisiana in 1829, for example, will be controlled for in the specification described in Equation (2)

One immediate result from Table 3.2, in direct contradiction to the Wade hypothesis described above, is that the degree of urbanization in a given county has no statistically significant impact on the probability of an insurrection, conspiracy, or panic. Moreover, Table 3.3 illustrates that this result is robust to the inclusion of non-linear terms. If the institutional mechanisms put in place to supervise slaves were less effective in urban settings, as Wade (1964), Cairnes (1862), Wesley (1927) and Eaton (1960) claim, one would expect a higher probability of insurrection events in these areas. Particularly damning for this hypothesis is the observation that panics, which supposedly were the impetus for massive reductions in city slave populations, were in fact *less* likely in counties that contained urban populations. In summary, I find no evidence for the contention that slave revolts were more likely in urbanized area in the period 1800-1859.

Table 3.2: Free African Americans, Slave Density and Insurrection Events

	EvInsurrect	EvConsp	EvPanic	EvEvent
UrbPop	1.61e-08	-0.00000289	-0.00000513	-0.00000209
	(0.01)	(-0.74)	(-1.45)	(-0.52)
FreeBlk	-0.00000149	0.0000199	0.0000262	0.0000116
	(-0.10)	(0.87)	(1.23)	(0.46)
Slvdensity	0.118	0.188*	0.132	0.274*
	(1.63)	(1.80)	(1.34)	(1.79)
Fixed Effects	Yes	Yes	Yes	Yes
Clustered S.E.	Yes	Yes	Yes	Yes

Dependent variable is an indicator for whether an insurrection, conspiracy or either occurred in a given county in the period 1800-1859. Standard errors are clustered at the county level and county fixed effects are included for all regressions shown. T-statistics are reported in parentheses, with significance levels reported as follows: * p<0.10, ** p<0.05, and *** p<0.01.

139

Table 3.3: Urbanization and the Probability of an Insurrection Event

	EvInsurrect	EvConsp	EvPanic	EvEvent
UrbPop	-0.00000754	0.000000303	-0.0000123	-0.00000480
	(-1.17)	(0.04)	(-1.44)	(-0.55)
UrbPop^2	1.26e-10	-3.91e-11	1.43e-10	1.14e-11
	(1.18)	(-0.27)	(0.93)	(0.06)
UrbPop^3	-4.85e-16	2.33e-16	-4.09e-16	1.18e-16
	(-1.18)	(0.39)	(-0.63)	(0.14)
SlavePop	-0.000000619	0.0000122**	-0.00000107	0.00000850*
	(-0.26)	(2.10)	(-0.39)	(1.81)
Fixed Effects	Yes	Yes	Yes	Yes
Clustered S.E.	Yes	Yes	Yes	Yes

Dependent variable is an indicator for whether an insurrection, conspiracy or either occurred in a given county in the period 1800-1859. Standard errors are clustered at the county level and county fixed effects are included for all regressions shown. T-statistics are reported in parentheses, with significance levels reported as follows: * p<0.10, ** p<0.05, and *** p<0.01.

1840-1859 Panel

Due to the enhanced richness of the data in later years, and as a check for robustness, data spanning the period 1840-1859 is also utilized to estimate Equation (32) above. This allows for Alabama, Mississippi, Louisiana, Arkansas and Missouri to be included in the sample, and therefore so are the cites of Mobile and New Orleans. The inclusion of additional covariates and states, however, does not qualitatively affect the result. Tables 3.4 and 3.5 imply no statistically significant relationship between a county's urban population and the probability of an insurrection, discovered conspiracy or panic. As before, the correlation actually appears to be *negative* in some cases, and this accords with the alternative view of Claudia Goldin that slaves within Southern cities were no more difficult to supervise than

those without, and thus fears of insurrection were not the deciding factor in the decline of urban slavery in the South. To maintain consistency with the 1800-1859 panel, Table 3.4 also illustrates results from a specification which allows for non-linear correlations. Once again, there appears to be no correlation between urbanization and insurrections or panics, and thus further evidence is provided against Wade's central proposition.

Table 3.4: Urbanization and the Probability of an Insurrection Event

	EvInsurrect	EvConsp	EvPanic	EvEvent
UrbPop	-0.00000369	-0.0000329*	0.0000108	-0.0000160
	(-0.45)	(-1.96)	(0.70)	(-0.65)
UrbPop^2	1.38e-11	5.02e-10	-1.95e-10	1.33e-10
	(0.11)	(1.91)	(-0.83)	(0.35)
UrbPop^3	7.23e-18	-1.81e-15	7.49e-16	-3.49e-16
	(0.02)	(-1.87)	(0.86)	(-0.24)
SlavePop	0.0000106	-0.00000161	0.000000548	0.0000126
	(1.24)	(-0.19)	(0.19)	(1.09)
Clustered S.E.	Yes	Yes	Yes	Yes
County Fixed Effects	Yes	Yes	Yes	Yes

Dependent variable is an indicator for whether an insurrection, conspiracy or either occurred in a given county in the period 1840-1859. Standard errors are clustered at the county level and county fixed effects are included for all regressions shown. T-statistics are reported in parentheses, with significance levels reported as follows: * p<0.10, ** p<0.05, and *** p<0.01.

Table 3.5: Free African Americans, Slave Density and Insurrection Events

	EvInsurrect	EvConsp	EvPanic	EvEvent
UrbPop	-0.000000611	0.00000381	0.000000499	-0.00000116
	(-0.41)	(1.25)	(0.37)	(-0.33)
Freeblk	-0.00000885	-0.0000943***	-0.00000870	-0.0000398
	(-1.33)	(-4.47)	(-1.01)	(-1.26)
Slvdensity	0.163	0.202	0.123	0.530*
	(1.24)	(0.81)	(1.20)	(1.90)
1850 Indicator	0.00463	0.0256***	-0.00658	0.0227*
	(0.71)	(2.75)	(-1.27)	(1.95)
NavWater*1850	-0.00529	-0.0139	0.0180	-0.00602
	(-0.42)	(-0.72)	(1.41)	(-0.25)
Clustered S.E.	Yes	Yes	Yes	Yes
County F.E.	Yes	Yes	Yes	Yes

Dependent variable is an indicator for whether an insurrection, conspiracy or either occurred in a given county in the period 1840-1859. Standard errors are clustered at the county level and county fixed effects are included for all regressions shown. T-statistics are reported in parentheses, with significance levels reported as follows: * $p<0.10$, ** $p<0.05$, and *** $p<0.01$.

Police Forces

To this point the analysis summarily refutes the position of Wade (1964) that urbanized areas in the antebellum South experienced a greater degree of slave rebelliousness than those in more rural areas.[185] An explanation which accords with Proposition 1, and offers

[185]Wade (1964, p. 242) writes, "Rumors of plots and imminent uprising marked the ordinary routine of every city. If whites learned to live with this anxiety, they could not long forget it. Just as the patrols, whipping posts, and auction blockes reminded Negroes of their servitude, so these symbols made the townspeople aware of their own insecurity." Sheldon (1979, p. 36) makes a similar point when describing the reaction of Richmond, VA citizens to a discovered conspiracy during the War of 1812. It should be reiterated that Wade was not the first to highlight the problem of slave control in Southern cities, as this observation is found in the work of Cairnes (1862), Wesley (1927) and Eaton (1960).

a more nuanced interpretation of the Wade hypothesis, is that Southern cities put forth greater efforts to police and surveil their slave populations during this period. As these efforts were necessarily costly, they detracted from the profitability of urban slavery and thus retarded industrialization in the South.

The argument that widespread militarization within the South proceeded to serve the goal of slave supervision is not novel. According to Wade (1964, p. 209), the liberties granted to slaves as a result of their urban environs kept slaveholders in a perpetual state of suspicion and fear[186], and as a result "papers continued to demand increased police vigilance, municipal officials sought wider powers and additional arms from state government, and vigilante committees stood ready to quash the colored rebels." In addition, Hadden (2001) notes that organized police forces were, by and large, adopted in Southern cities before those in the North. This is especially remarkable given the greater population density of Northern cities.[187]

The increased police presence in Southern cities can be empirically verified through the use of occupational data garnered from the Integrated Public Use Microdata Series (IPUMS) at the Minnesota Population Center, University of Minnesota, described in the Data Section above. The first column of Table 3.6 presents results from a random-effects[188] panel regression of the form:

$$GuardLabor_{it} = \alpha + \beta_1 SlaveState_i + \beta_2 UrbPop_{it} + \beta_3 Foreign_{it} + \gamma\delta_t + \Gamma_i + \varepsilon_{it}, \quad (33)$$

---

[186]"Newspapers and tracts, the gossip around town, even the conversation in the master's house, indicated that many Americans believed slavery to be evil, or at least unjust. This perception resulted in constant unrest among a significant number of urban slaves, an unrest that manifested itself not only in persistent pressure to widen the latitude within slavery but also in sporadic attempts to get outside it by escape or mutiny."

[187]"In 1835 a public meeting in Mobile, also reacting to presumed colored agitation, set up 'volunteer companies' in each neighborhood...Such sentiment was sporadic, but is recurrence reflected both the extent of the anxieties of the white and the inability to find really effective means to control the colored population."

[188]Once again, a fixed-effects specification cannot be employed because the independent variable of interest, *SlaveState*, does not vary over time.

where $GuardLabor_{it}$ refers to the number of policemen, sheriffs, constables, etc. in urban minor civil division (MCD) i in period t, $UrbPop_{it}$ refers to the number of urban residents in MCD i in period t, $Foreign_{it}$ is the number of foreign-born residents in MCD i in period t, $SlaveState_i$ is an indicator for whether a given MCD falls within a slave state, δ_t is a year indicator, and Γ_i is a vector of county-level time-invariant omitted variables (random effects). β_1 is the coefficient of interest in this regression, and the results of Table 3.6 suggest that urban MCD's in slave states, on average, employed nearly 31 more policemen, patrolmen, marshals, etc., than MCD's in northern states, while controlling for total urban population. Moreover, this regression controls for the possibility that police forces were larger in Southern cities simply because their immigrant populations were larger. As Lundman (1980) argues, the development of police forces in London, New York, and Boston, as well several cities in the American South, were largely in response to the problems presented by massive influxes of immigrants. While there is evidence for this hypothesis in Table 3.6, it does not detract from the large and statistically significant relationship between Southern cities and their employment of guard labor. As a robustness check, the right-hand side of Table 3.6 presents the results from a "between" estimator. These estimates suggests that the management and control of urban slaves in the antebellum South did indeed impose additional costs in the form of augmented police forces, as argued by Wade (1964).

A potential detraction from the estimates in Table 3.6, however, is that factors associated with whether a given MCD belonged in a slave state bias the coefficient estimates. Or it could be the case that economies of scale in slave supervision, coupled with the fact that northern cities were, on average, much larger than southern cities, lead to a misleading picture of policing in the urban South. To alleviate these concerns, I implement a matching estimator as proposed by Abadie et al. (2004). This procedure benefits from an ability to correct for the bias in coefficient estimates and inconsistent standard error

144

estimation that often hinder standard propensity score matching methods.[189] Using aggregated IPUMS data from 1850 and 1860, southern and northern urban MCD's are matched according to economic characteristics such as average income, proportion of labor force in manufacturing, proportion of labor force in finance and total real estate property and demographic characteristics such as total population and share of population identified as immigrant. Table 3.7 presents the coefficient estimates, or the average treatment effect of being in a slave state, using 1850 and 1860 occupational data. As can be seen from the table, the impact of being in a Southern MCD on the size of police forces is qualitatively similar to that presented in Table 3.6. In 1850, southern MCD's had on average roughly 25 more policemen, patrolmen, marshals, etc. than those in northern MCD's, and the difference is significant at the 5% level. The coefficient estimate from 1860 is qualitatively similar, although a larger standard error detracts from the significance.

Table 3.6: Police Occupations and Urbanization, Linear Regression

	R.E. Estimator	Between Estimator
SlaveState	30.54***	25.06***
	(4.74)	(4.31)
UrbPop	-.065	0.0179
	(-0.78)	(0.21)
Foreign	0.0066***	0.00483
	(3.50)	(1.84)

Dependent variable is guard labor in MCD i in period t. Column 1 implements a random effects estimator with standard errors clustered at the MCD level, while column 2 implements the Between estimator with bootstrapped standard errors.T-statistics are reported in parentheses, with significance levels as follows: * p<0.10, ** p<0.05, and *** p<0.01.

[189]See Abadie and Imbens (2006), for example.

These results suggest an explanation for the absence of a correlation between urbanization and slave unrest that accords both with Proposition 10, and a more subtle reading of Wade (1964). The difficulty of slave supervision in Southern cities was overcome through the use of larger, more organized police forces, whose genesis had yet to occur in the North. As such, to the extent that problems of slave management in Southern cities led to greater costs being borne among the slaveholding community, a more nuanced reading of Wade's (1964) fundamental argument remains valid.

Table 3.7: Police Occupations and Urbanization, Matching Estimator

	1850	1860
Guard Labor	24.74***	21.30
	(2.28)	(1.79)

Dependent variables are guard labor in MCD i in 1850 and 1860. Reported results are the coefficient on *SlaveState* from the implementation of a matching estimator as described by Abadie et al. (2004). Northern and Southern MCD's were matched using economic and demographic data. Z-scores are reported in parentheses, with significance levels as follows: * p<0.10, ** p<0.05, and *** p<0.01.

Conclusion

The goal of this paper has been to critically examine an influential strand of the economic history literature which argues that an inherent incompatibility between slavery and urbanization was the fundamental factor in explaining the South's reticence to industrialize in the antebellum period. A theoretical model has been developed to formalize the incentives faced by slaves in deciding the effort to put forth toward rebellious activities, as well as the incentives faced by slaveowners in deciding how vigorously to quell them. This model can be used to mathematically represent the argument made by Richard Wade, namely that the various freedoms granted to urban slaves made the task of their supervision vastly more difficult. Although Wade's argument is theoretically consistent for a given set of parameter values, an empirical analysis of slave revolts in the antebellum period is more damaging. In the overwhelming majority of specifications investigated, a positive and statistically significant relationship between the degree of urbanization in a given county and the probability of insurrection, conspiracies or panics was not uncovered. However, empirical analysis of occupational data also suggests that police forces were larger in Southern than Northern cities, lending to a more nuanced support for Wade's fundamental argument.

References

[1] Acemoglu, D. and James A. Robinson. "Persistence of Power, Elites and Institutions." *NBER Working Paper,* 2006.

[2] Acemoglu, D. and A. Wolitzky (2011). "The Economics of Labor Coercion." *Econometrica*, vol. 79, no. 2, p. 555-600.

[3] Anderson, Perry. *Passages from Antiquity to Feudalism.* London: Verso, 1996.

[4] Aptheker, Herbert. *American Negro Slave Revolts.* New York: International Publishers, 1993.

[5] Aston, T.H., and Philpin, C.H.E., eds. *The Brenner Debate: Agrarian Class Structure and Economic Development in Pre-Industrial Europe.* Cambridge: Cambridge University Press, 1985.

[6] Bardhan P. (1983). "Labor-Tying in a Poor Agrarian Economy: A Theoretical and Empirical Analysis." *Quarterly Journal of Economics*, vol. 98, no. 3, p. 501-514.

[7] Barro, Robert J. and Xavier Sala-i-Martin (1992). "Convergence." *Journal of Political Economy*, vol. 100, p. 223-251.

[8] Bateman, Fred and Weiss, Thomas. "Comparative Regional Development in Antebellum Manufacturing." *The Journal of Economic History*, vol. 35, no. 1, p. 182-208.

[9] Billings, Dwight B. *Planters and the Making of a "New South": Class, Politics, and Development in North Carolina, 1865-1900.* Chapel Hill: University of North Carolina Press, 1979.

[10] Bloch, Marc. *Feudal Society, Vol. 1: The Growth of Ties of Dependence.* Chicago: University of Chicago Press, 1964.

[11] Bloch, Marc. *French Rural History: An Essay on its Basic Characteristics.* Oakland: University of California Press, 1975.

[12] Cairnes, John Elliott. *The Slave Power.* 1862. New York: Harper (Torchbook Edition), 1969.

[13] Carroll, Joseph C. *Slave Insurrections in the United States: 1800-1865.* New York: Negro Universities Press, 1968.

[14] Carville, Earle, John Heppen, and Samuel Otterstrom. *HUSCO 1790-1999: Historical United States County Boundary Files.* Baton Rouge: Louisiana State University, 1999.

[15] Chenery, H., S. Robinson and M. Syrquin. *Industrialisation and Growth: A Comparative Study, World Bank.* Oxford: Oxford University Press, 1986.

[16] Chwe, M. (1990). "Why Were Workers Whipped? Pain in a Principal-Agent Model." *Economic Journal*, 100, p. 1109-1121.

[17] Catterall, Helen. *Judicial Cases Concerning American Slavery and the Negro*, 5 vols. New York: William S. Hein & Co., 1998.

[18] Cobb, James C. *Industrialization and Southern Society, 1877-1984.* Lexington: University of Kentucky Press, 1984.

[19] Conning, J. (2004). "On the Causes of Slavery or Serfdom and the Roads to Agrarian Capitalism: Domar's Hypothesis Revisited." *Working Paper.*

[20] Cronon, W. (1991). *Nature's Metropolis: Chicago and the Great West.* New York: Norton, 1991.

[21] Curtin, P.D. *The Rise and Fall of the Plantation Complex.* Cambridge, Cambridge University Press, 1990.

[22] Domar, E.D. (1970). "The Causes of Slavery or Serfdom: A Hypothesis." *Journal of Economic History*, vol. 30, p. 18-32.

[23] Douglas, Frederick. *My Bondage and My Freedom.* New York: Miller, Orton & Mulligan, 1855 (reprinted 2009).

[24] Eaton, Clement (1960). "Slave-Hiring in the Upper South: A Step Toward Freedom." *Mississippi Valley Historical Review,* vol. 46, no. 4, p. 663-678.

[25] Easterlin, Richard A (1960). "Interregional Differences in Per Capita Income, Population, and Total Income, 1840-1950" in *Trends in the American Economy in the Nineteenth Century, Studies in Income and Wealth*, vol. 24, Princeton University Press, 73-140.

[26] Elkins, Stanley. *Slavery: A Problem in American Institutional and Intellectual Life.* Chicago: University of Chicago Press, 1976.

[27] Engerman, Stanley L., and Kenneth L. Sokoloff (2002). "Factor Endowments, Inequality, and Paths of Development Among New World Economies." *NBER Working Paper no. 9259.*

[28] Engerman, Stanley L., and Kenneth L. Sokoloff (2006). "The Persistence of Poverty in the Americas: The Role of Institutions," in Samuel Bowles, Steven N. Durlauf, and Karla Hoff, eds., *Poverty Traps*, Princeton: Princeton University Press, 2006.

[29] Fagerberg, J. and B. Verspagen. "Modern Capitalism in the 1970s and 1980s" in M. Setterfield ed., *Growth, Employment and Inflation.* Basingstoke: MacMillan, 1999.

[30] Fei, J.C.H. and G. Ranis. *Development of the Labor Surplus Economy: Theory and Policy.* Homewood, Il.: Irwin, 1964.

[31] Finn, Ian P. (2016). "Coerced Labor, Insurrection, and the Economic Costs: Theory and Evidence from the Antebellum South." *Unpublished Working Paper.*

[32] Fishman, George L. and Degler, Carl N (1990). "Letters to the Editor." *The Journal of American History,* vol. 77, no. 1, p. 375-394.

[33] Fogel, Robert W. and Engerman, Stanley L. (1971). "The Relative Efficiency of Slavery: A Comparison of Northern and Southern Agriculture in 1860." *Explorations in Economic History,* vol. 8, 353-367.

[34] Fogel, Robert W. and Engerman, Stanley L. *Time on the Cross: The Economics of American Negro Slavery.* New York: Little, Brown & Company, 1974.

[35] Franklin, J.H. *The Militant South, 1800-1861.* Champaign, IL: University of Illinois Press, 2002.

[36] Fudenberg, Drew and Tirole, Jean. *Game Theory.* Cambridge, MA: The MIT Press, 1991.

[37] Genicot, G. (2002). "Bonded Labor and Serfdom: A Paradox of Voluntary Choice." *Journal of Development Economics,* vol. 67, no. 1, pl 101-127.

[38] Genovese, Eugene D. *The Political Economy of Slavery: Studies in the Economy & Society of the Slave South.* New York: Pantheon, 1965.

[39] Genovese, Eugene D. *From Rebellion to Revolution.* Baton Rouge: Louisiana State University Press, 1979.

[40] Goldin, Claudia D. *Urban Slavery in the American South: 1820-1860.* Chicago: University of Chicago Press, 1976.

[41] Grossman, H.I. (1991). "A General Equilibrium Model of Insurrections." *The American Economic Review,* vol. 81, no. 4, p. 912-921.

[42] Haavelmo, T. *A Study in the Theory of Economic Evolution.* Amsterdam: North-Holland, 1954.

[43] Hagen, W.W. (1985). "How Mighty the Junkers? Peasant Rents and Seigneurial Profits in Sixteenth-Century Brandenburg." *Past and Present,* no. 108, p. 80-116.

[44] Haines, M.R. (2010). Historical, Demographic, Economic, and Social Data: the United States, 1790-2002 [Computer file].

[45] Hilton, R.H. (1949). "Peasant Movements in England before 1381." *The Economic History Review*, vol. 2, no. 2, p. 117-136.

[46] Hirshleifer, Jack (1988). "The Analytics of Continuing Conflict." *Synthese*, vol. 76, no. 2, 201-233.

[47] Hornbeck, R. (2010). "Barbed Wire: Property Rights and Agricultural Development." *The Quarterly Journal of Economics*, vol. 125, no. 2, p. 767-810.

[48] Kaldor, N. *Causes of the Slow Rate of Economic Growth of the United Kingdom, An Inaugural Lecture.* Cambridge: Cambridge University Press, 1966.

[49] Kilson, Marion D (1964). "Towards Freedom: An Analysis of Slave Revolts in the United States." *Phylon*, vol. 25, no. 2, 175-187.

[50] Krugman, Paul R. (1991). "First Nature, Second Nature, and Metropolitan Location." *NBER Working Paper No. 3740.*

[51] Lambert, D. (1992). "Zero-Inflated Poisson Regression, With an Application to Defects in Manufacturing." *Technometrics*, vol. 34, issue 1, p. 123-149.

[52] Lewis, A. (1954). "Economic Development with Unlimited Supplies of Labour." *The Manchester Schools of Economic and Social Studies,* vol. 22, p. 139-191.

[53] Lockhart, J. and S.B. Schwartz. *Early Latin America: A History of Colonial Spanish Latin America and Brazil.* Cambridge: Cambridge University Press, 1983.

[54] Luraghi, Raimond. *Rise and Fall of the Plantation South.* New York: New Viewpoints, 1978.

[55] Mahaffy, J.P. (1890). "The Slave Wars Against Rome." *Hermathena*, vol. 7, no. 16, p. 167-182.

[56] Minnesota Population Center. *National Historical Geographic Information System: Version 2.0.* Minneapolis, MN: University of Minnesota 2011.

[57] Moore, Barrington Jr. *Social Origins of Dictatorship and Democracy: Lord and Peasant in the Making of the Modern World.* Boston: Beacon Press, 1966.

[58] Morgan, Philip D. and George D. Terry (1982). "Slavery in Microcosm: A Conspiracy Scare in Colonial South Carolina." *Southern Studies,* vol. 21, p. 121-145.

[59] Mukherjee, A. and Debraj Ray (1995). "Labor Tying." *Journal of Development Economics*, vol 47, no. 2, p. 207-239.

[60] Murshed, S.M. and S. Gates (2005). "Spatial-Horizontal Inequality and the Maoist Insurgency in Nepal." *Review of Development Economics*, vol. 9, no. 1 p. 121-134.

[61] Naidu, S. and N. Yuchtman (2013). "Coercive Contract Enforcement: Law and the Labor Market in Nineteenth Century Industrial Britain." *The American Economic Review*, vol. 103, no. 1, p. 107-144.

[62] North, Douglas. *The Economic Growth of the United States.* Englewood Cliffs, NJ: Prentice-Hall Inc., 1961.

[63] North, Douglas. *Structure and Change in Economic History.* New York: WW Nortorn & Company, 1981.

[64] Rodriguez, Junius P., editor. *Encyclopedia of Slave Resistance and Rebellion.* Westport, CT: Greenwood Press, 2007.

[65] Patterson, O. *Slavery and Social Death: A Comparative Study.* Cambridge: Harvard University Press, 1982.

[66] Perlman, E. "Dense Enough to be Brilliant: Patents, Urbanization and Transportation in Nineteenth Century America." *Working Paper.*

[67] Ransom, Roger L. and Richard Sutch. *One Kind of Freedom: The Economic Consequences of Emancipation.* Cambridge: Cambridge University Press, 2001.

[68] Radford, John P. (1976). "Race, Residence and Ideology: Charleston, South Carolina in the Mid-Ninteenth Century." *Journal of Historical Geography*, vol. 2, no. 4, p. 329-346.

[69] Ruffin, Edmund. *The Political Economy of Slavery.* Washington: L. Towers, 1857.

[70] Rostow, W.W. *The Stages of Economic Growth: A Non-Communist Manifesto.* Cambridge: Cambridge University Press, 1960.

[71] Schweninger, Loren (1999). "Counting the Costs: Southern Planters and the Problem of Runaway Slaves, 1790-1860." *Business and Economic History*, vol. 28, no. 2, p. 267-275.

[72] Sheldon, Marianne B. (1970). "Black-White Relations in Richmond, Virginia, 1782-1820." *The Journal of Southern History,* vol. 45, no. 1, p. 27-44.

[73] Skaperdas, S. (1992). "Cooperation, Conflict, and Power in the Absence of Property Rights." *The American Economic Review*, vol. 82, no. 4, p. 720-739.

[74] Skaperdas, Stergios (1996). "Contest Success Functions." *Economic Theory*, vol. 7, 283-290.

[75] Stampp, Kenneth M. (1971). "Rebels and Sambos: The Search for the Negro's Personality in Slavery." *The Journal of Southern History*, vol. 37, no. 3, p. 367-392.

[76] Stock, J.H., J.H. Wright, and M. Yogo (2002). "A Survey of Weak Instruments and Weak Identification in Generalized Method of Moments." *Journal of Business and Economic Statistics,* vol. 20, p. 518-529.

[77] Timmer, M.P. and G.J. de Vries (2008). "Structural Change and Growth Accelerations in Asia and Latin America: A new Sectoral Data Set." *Cliometrica,* 2008.

[78] Toman, J.T. (2005). "The Gang System and Comparative Advantage." *Explorations in Economic History*, vol. 42, p. 310-323.

[79] Wade, Richard D. *Slavery in the Cities.* New York: Oxford University Press, 1964.

[80] Weiner, M. *Social Origins of the New South: Alabama, 1860-1885.* Baton Rouge: Louisiana State University Press, 1978.

[81] Wesley, Charles H. *Negro Labor in the United States, 1850 to 1825.* New York: Vanguard Press, 1927.

[82] White, Halbert (1980). "A Heteroskedasticity-Consistent Covariance Matrix Estimator and a Direct Test for Heteroskedasticity." *Econometrica*, vol. 48, no. 4, p. 817-838.

[83] Wish, Harvey (1939). "The Slave Insurrection Panic of 1856." *Journal of Southern History*, vol. 5, p. 206-222.

[84] Wooldridge, Jeffrey M. *Econometric Analysis of Cross Section and Panel Data.* Cambridge, MA: MIT Press, 2010.

Appendix 3.1: Data Summary Statistics

Table 3.8: Population Statistics for 1840-1859 Panel, by Year

	UrbPop	SlavePop	WhtPop	TotPop
1840				
mean	637.2774	3326.502	6210.327	9824.855
standard deviation	5753.379	4086.69	5812.114	8936.076
min	0	3	384	821
max	102313	58539	105331	134379
1850				
mean	1093.656	4079.889	7581.049	11975.83
standard deviation	8743.838	4512.572	8931.344	11719.13
min	0	29	395	1314
max	169054	44376	174853	210646
Total				
mean	865.4668	3703.196	6895.688	10900.34
standard deviation	7402.233	4319.91	7563.49	10472.8
min	0	3	384	821
max	169054	58539	174853	210646

Source: Haines (2010) and Minnesota Population Center

Table 3.9: Agricultural, Manufacturing and Education Statistics, by Year

Independent Variable	ValManProd	ManInvest	ManEmpl	ValAgProd	PrivSchl
1840					
mean	65549.84	70585.42	247.264	469382.9	74.80758
standard deviation	282374.9	225823.1	593.3811	459252	151.2863
min	0	0	0	0	0
max	5881778	4294702	11229	2845941	2372
1850					
mean	234003.4	126430	213.8188	634524.2	131.5627
standard deviation	1361218	520948	1087.001	513602.6	367.7554
min	0	0	0	34561	0
max	2.45e+07	9929332	23863	4069086	7244
Total					
mean	151058.1	98932.52	230.287	553209.8	103.6169
standard deviation	993102.2	404397.8	879.1472	494377.7	284.0282
min	0	0	0	0	0
max	2.45e+07	9929332	23863	4069086	7244

Source: Haines (2010) and Minnesota Population Center

Appendix 3.2: Calibrations for Numerical Analysis

In these simulations the price of agricultural output P is normalized to unity, and in accordance with a perfectly competitive benchmark the marginal cost of production, μ, is assigned the same value. The amount of arable land available to the slaveowner, T, is also set to unity, but it should be noted that the analysis is extremely robust to the value assigned to this parameter, even when augmented by three orders of magnitude. The production technology is assumed to be Cobb-Douglas, and the assumption of constant returns to scale is retained. The existence of increasing returns to scale in slave production has been the subject of intense debate and empirical work[190], but because an overwhelming consensus on this important technical issue has yet to be reached, the assumption of constant returns is retained as a useful starting point. Following Fogel and Engerman (1971) an output elasticity of slave labor of .6 is employed throughout.

The sweeping spatial scale of this exercise clearly precludes a value of J that is appropriate in all contingencies. Peter Kolchin estimates that while 71.9% of American slaveowners in 1860 owned between 1-9 slaves, 2.6% owned between 50-199, and 2.4% of slaves toiled on plantations with more than 199 slaves.[191] Though its techniques are summarily denounced by Fogel and Engerman (1971a), the assumption of 50 slaves per slaveowner used in Sydnor (1933), as well as a number of other articles in this period which attempted to quantify the profitability of a "representative plantation", will be utilized. Once again, however, the arbitrariness of this designation is mitigated by the robustness of our results to the value ultimately assigned. More specifically, the direction of changes in slaveowner and laborer indirect utility in response to parameter fluctuations, as well as the type of equilibrium obtained (binding or otherwise) is robust to changes in J by 3 orders of magnitude.

---

[190]cf. Fogel and Engerman (1974) and Metzer (1975) for arguments in the affirmative. Russell (1966) provides conflicting evidence.

[191]Kolchin (1987, p. 54).

The reservation utility of laborers, π, is calibrated to reflect estimates of the amount of time slaves spent each week in the service of their employers. Given a rough estimate of 6 days per week, a value of .42 for π seems most appropriate. Lastly, the parameter A has been omitted from the analysis, (i.e., set equal to 1) both out of a desire for parsimony and because a reasonable estimate could not be gleaned from extant econometric studies.