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Three Essays in Political Economy

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THREE ESSAYS IN POLITICAL ECONOMY

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ABSTRACT

The first essay provides a theoretical framework that informs the ongoing debate regarding the effect of conservation easement subsidies on local property tax revenue. Supporters claim that conservation easements increase property tax revenue by providing environmental amenities that increase the value of adjacent properties. Critics argue that they decrease property tax revenue by lowering land values and shrinking the tax base. In instances when local property tax revenue decline due to the income tax deductibility of conservation easements, the decline is larger when the demand for land is more elastic, the proportion of non-agricultural land in the county is larger, the agricultural tax benefit is larger, and there is less Ricardian rent on agricultural land.

The second essay examines the role of political parties in affecting presidential control and congressional oversight of antitrust enforcement. The Assistant Attorney General for Antitrust is a presidential appointee who carries out the administration's desired level of antitrust enforcement. Congressional legislators have oversight and appropriations powers over the Antitrust Division. I assume that Democratic and Republican legislators have different preferences about the proper level of appropriations for the Antitrust Division. In spite of these presidential party control and congressional oversight relationships, I do not find any political effect on the number of antitrust cases filed from 1903 to 2005. My result suggests that Division bureaucrats have wide discretion in case

selection and are independent of the influence of the White House and the Congress.

The third essay studies the effect of a change in the sex ratio of males to females on the relative price of human sexual relations. The illegitimate birth rate is used as an instrument for the price of sexual relations. The reduction in the number of available sex partners for women during World War II decreased the price that remaining men had to pay for sex. One result of this lower price is an increase in the number of illegitimate children born during the war. The male scarcity also resulted in females marrying less suitable males who are different from their wives in terms of age, educational attainment, and real income.

DEDICATION

For my parents, Yeoh Chye Teong and Margaret Tan Phaik Suan, with love and gratitude.

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I thank my committee chair, Dr. Robert D. Tollison, for believing in me and supporting my varied research interests. I am particularly grateful to Dr. Tollison for taking me under his wing during a difficult phase in my graduate career. He is a patient advisor, a kind mentor, and a generous friend. It has been a privilege to write this dissertation under his guidance.

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I thank the Property and Environment Research Center and the Earhart Foundation for their generous financial support during my summer fellowship and final year in graduate school. My dissertation is the culmination of my graduate studies at Clemson, Vanderbilt, and Ole Miss. I am unable to acknowledge each

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PREFACE

The three essays in my dissertation encompass topics in public finance, environmental economics, industrial organization, antitrust regulation, public choice, and applied econometrics. In the first essay of my dissertation, mentored by Professor Walter N. Thurman of North Carolina State University, I model the effect of conservation easement subsidies on local property tax revenues. I assume two sectors for the land market within a county: agriculture and non-agriculture. In this essay, I examine easement contracts that prohibit the development of agricultural land. In return for preserving their agricultural land from future development, landowners receive a tax credit for donating the value of the conservation easement to a qualifying, tax-exempt land trust. The value of the conservation easement is the difference between the agricultural use value of a parcel of farmland and the market value if the parcel is sold for development.

The income tax deductibility of conservation easement donations acts as a subsidy that increases the demand for agricultural land. Thus, the inframarginal parcel of land located at the rural-urban fringe sells for a higher price but the change in the proportion of agricultural land relative to non-agricultural land may adversely affect the local property tax revenue. The result predicted by my model depends on the elasticity of land in both sectors, the proportion of non-agricultural land in the county, the agricultural tax benefit, and the existence of Ricardian rent or a cost advantage to farming closer to the city.

In the second essay of my dissertation, I study the role of political party affiliation in explaining antitrust enforcement at the Department of Justice's Antitrust Division. My model relies on modern public choice theory's finding of political self-interest. I assume that the demanders of antitrust cases are Congressional politicians who appropriate budgets to pay for a certain level of cases. These politicians attach some value to antitrust cases because their main constituents, consumers and producers, prefer lower prices and higher profits in the market. Antitrust cases are a source of wealth transfers from producers to consumers, whereas other types of regulation, such as price-protection, entry limits, and licensing requirements are a way of cushioning the producers' falling profits during an economic downturn. I assume the suppliers of antitrust cases are Division bureaucrats who face an increasing marginal cost of litigating additional cases. Putting the demand and supply curves together results in an equilibrium price-quantity pair that is observed each year. The price is the Division's appropriated budget and the quantity is the number of cases filed.

I obtain data from 1903 to 2005 on the number of cases filed, the Division's budget, the size of the economy, and the political party in power in the White House, the Senate and the House of Representatives, to explain the pattern of antitrust filings over the time period. In an alternative estimation, I take into account the sequential decisions involved in the budget appropriations and the Division's case selection. First, I estimate the effect of Congressional political party majorities on the Division's budget. Then, I estimate the effect of

presidential party affiliation on the number of cases pursued by the Division subject to the given budget constraint.

The third essay of my dissertation is co-authored with Professors Robert E. McCormick of Clemson University and Mason S. Gerety of Northern Arizona University. We utilize a demand and supply model of matching mates that results in an equilibrium relative price of sexual relations. Men are net demanders of sex, while women are net suppliers of sex because they face an expected cost of pregnancy. The relative price of sex paid by men to women includes marriage and financial support for any children that may ensue from a sex act. During World War II, however, the exodus of males to fight overseas resulted in a sharp decrease of the sex ratio. Competition between females for the shrinking number of males decreased the relative price of sex that the remaining males had to pay. Thus, males are less regularly required to make a long-term commitment of marriage in order to enjoy regular sexual relations. Our model predicts that the decrease in the sex ratio of males to females during the war results is an increase in illegitimate births during that time period. We obtain data on each state's sex ratio, illegitimate birth rate, income per capita, median years of schooling, population density, and church membership in order to test our model's prediction.

Another implication of the model is the male-female difference in age, education, and income for couples that married during the war. Most of the remaining men that did not get sent to war were either too old or too young to serve in the Armed Forces, had an employment exemption, or were rejected as

unfit for military service. Therefore, women that got married during this period of male scarcity may have matched with men who are less desirable in terms of their age, previous marital status, educational attainment, and real income. We obtain data on 9,969 couples who married during 1936 to 1950 in order to test the validity of this corollary.

TRUSTS AND TAXES: THE EFFECT OF CONSERVATION EASEMENTS ON LOCAL PROPERTY TAX REVENUES[1]

I. Introduction

Conservation easements are an increasingly popular and cost-effective tool for encouraging the conservation of private land.[2] Easement contracts restrict development on land used for agriculture, forestry, wildlife habitat, scenic views, watershed protection, historic sites, recreation, and education (Horwitz 2005). Landowners who donate conservation easements receive tax incentives in the form of charitable contribution deductions that lower their federal and state income tax bills.[3] This income tax deduction works as a subsidy for conservation easements.[4]

The debate regarding the effect of conservation easements on local property tax revenues remains unsettled. Supporters claim that easements increase

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[1] I gratefully acknowledge the generous Graduate Fellowship from the Property and Environment Research Center (PERC) in Bozeman, Montana. I am indebted to Wally Thurman for his excellent mentorship on this project. I thank Dan Benjamin, John Conlon, Bill Dougan, Matt Lindsay, Mike Maloney, Bobby McCormick, Bill Shughart, Chuck Thomas, Bob Tollison, and seminar participants at PERC, the University of Mississippi, and Clemson University for helpful comments on earlier drafts of this paper. The usual caveat applies.

[2] More than nine million acres of U.S. land are now under conservation easements, according to statistics from American Farmland Trust, Land Trust Alliance, The Nature Conservancy, and The Trust for Public Land (Taylor 2004). Conservation easements protect 0.47 percent of the approximately 1.9 billion acres of land in the lower 48 states (Wuerthner 2002). See Parker (2002) for a discussion on the cost-effectiveness of conservation easements versus fee-simple ownership of land for conservation purposes.

[3] To qualify for a tax deduction, the conservation easement donation must be considered a charitable gift by the Internal Revenue Service. The donation must be made to an IRS-qualified, tax-exempt organization, such as a land trust or governmental agency.

[4] I use the terms conservation easement subsidy and income tax deductibility of conservation easements interchangeably, even though the latter term is more precise but unwieldy.

property tax revenues by providing environmental amenities that increase the value of adjacent properties. Critics claim that easements decrease property tax revenues by lowering land values and shrinking the tax base by reducing the amount of land available for urban development. Both arguments have empirical support, so in this paper I model the market for land in a county in order to predict the effect of conservation easement subsidies on local property tax revenues.

Evidence supporting easements' revenue increasing effects shows that preserved agricultural open spaces can increase the value of nearby land parcels (Geoghegan, Lynch, and Bucholtz 2003; Irwin and Bockstael 2001). Geoghegan's (2002) hedonic model estimates that permanent open space *triples* the value of adjacent residential land in Howard County, Maryland, compared to similar developable open space. According to Cheshire and Sheppard (2003, 147), "Open space is an alternative use that is valued by nearby households. It may be available both in the form of a public good that is accessible to local households and in the form of private use (by other consumers or producers) that provides external benefits in the form of visual amenity or spatial separation from noxious uses." Thus, an agricultural conservation easement's environmental amenity value is capitalized into the price of nearby non-agricultural land. Clearly, the higher market value of non-agricultural land increases local property tax revenue.[5] The current paper does not rely on the environmental amenity value of conservation easements to increase local property tax revenues. The exclusion of environmental

[5] See Appendix I for the capitalization of environmental amenity values into the demand for non-agricultural land.

amenity value from the model strengthens my findings because its inclusion is likely to result in a positive tax effect from conservation easement subsidies.

Nevertheless, policymakers, tax administrators, and academic researchers have criticized the negative tax effects of conservation easement subsidies.[6] King and Anderson (2004) cite recent fiscal problems in the lower Hudson Valley, New York as the result of conservation easements eroding the tax base. In a popular press article, Pesch (2005) claims, "Lower property values can result in a decrease in property tax revenue or a shift of the burden onto other taxpayers, possibly decreasing the money available for schools and local government infrastructure." Pesch's article reviews research findings by agricultural economist Steven Taff (2004) who concludes that "conservation contracts significantly and negatively influence [per-acre] sales price" in a sample of 190 recent sales of Minnesota agricultural land.

The first criticism leveled against conservation easements is that they lower land values. Conventional wisdom holds that a conservation easement decreases, by the development premium, the market value of the land it encumbers. For instance, a parcel of farmland located on the urban fringe can command a market price of $1,000,000 if it is sold for development, but it is currently appraised at its agricultural use value of $700,000. Thus, the conservation easement or development premium is valued at $300,000. If the development rights to this parcel are donated to a qualifying tax-exempt organization, such as a land trust,

[6] Aside from concerns about local property tax revenue, policymakers face other problems stemming from conservation easements, such as reduced state income tax revenues, fraudulent easements, and inflated appraisals (Phillips 2005).

the landowner is entitled to a charitable contribution deduction for $300,000 on her federal income tax return. Federal tax law allows a maximum deduction of 30 percent of an individual's Adjusted Gross Income (AGI), carried forward for up to six years or until the value of the charitable contribution is used up, which ever occurs first. Alternatively, a landowner can elect to use a property's "basis" (original purchase price or inherited value) and take an annual deduction of 50 percent of her AGI for six years or until the value of the charitable contribution is used up (Montana Land Reliance; Parker 2004).

Nickerson and Lynch (2001) find that farmland encumbered by agricultural easements sells for lower prices than unencumbered farmland. Critics, however, fail to acknowledge that conservation easements may increase the market value of surrounding land because of environmental amenities (e.g., scenic views, improved wildlife habitat, better air and water quality, less erosion, and less traffic congestion) that accrue from the easement. There are fewer acres of developable land after conservation easements are put into place, but the increased market values and property tax revenues from surrounding lands may be greater than the "loss" in future property tax revenues from the restriction on development of easement lands.

The second criticism brought against conservation easements is that they shrink the local government's tax base by taking potentially developable land out of the real estate market. Thus, it is said, local governments must raise local property tax rates to finance existing levels of local public services provision. This partial equilibrium analysis of developable land, however, does not consider the

equilibrium effects for all parcels of land, both urban and rural. Encouraging conservation easements on agricultural land results in fewer acres allocated to non-agricultural uses, but the price of these non-agricultural lands is higher. Higher prices on the remaining parcels of land imply that local governments collect greater amounts of local property tax revenues on at least some parcels.[7]

Confusion over the public finance implications of conservation easements suggests that there is scope for further inquiry into this issue. To that end, I propose a two-sector model of land taxation to analyze the change in local property tax revenues stemming from the income tax deductibility of conservation easement donations. I show conditions under which conservation easement subsidies change property values and thus, property tax revenues of local governments.

II. Theory and Model

A) A land market with pre-existing ad-valorem taxation and use-value assessment

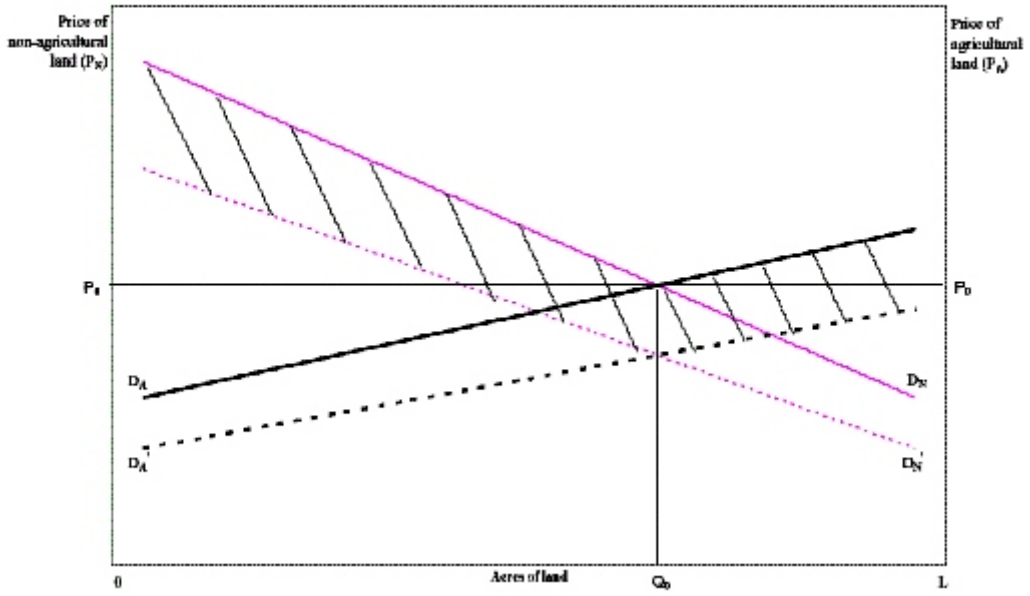
Consider a two-sector model[8] of a county's land market in which landowners have a fixed endowment of land ($\bar{L}$) to allocate to agricultural (A) or

[7] In addition, expenditures decrease due to reduced provision of public services such as fire and police protection to the easement land (Feitshans and Renkow 2002, p. 3). Nor do local school districts need to support an inflow of children into the area, because the easements take potentially developable agricultural land out of the real estate market.

[8] My model is due in part to Friedman (1990).

non-agricultural (N) use.[9] In Figure 1.1 below, the demand curve D_N shows the marginal valuation for each acre of non-agricultural land and D_A depicts the demand for agricultural land.

Figure 1.1 - The Market for Agricultural and Non-agricultural Land with Pre-existing *Ad Valorem* Taxes in Both Sectors

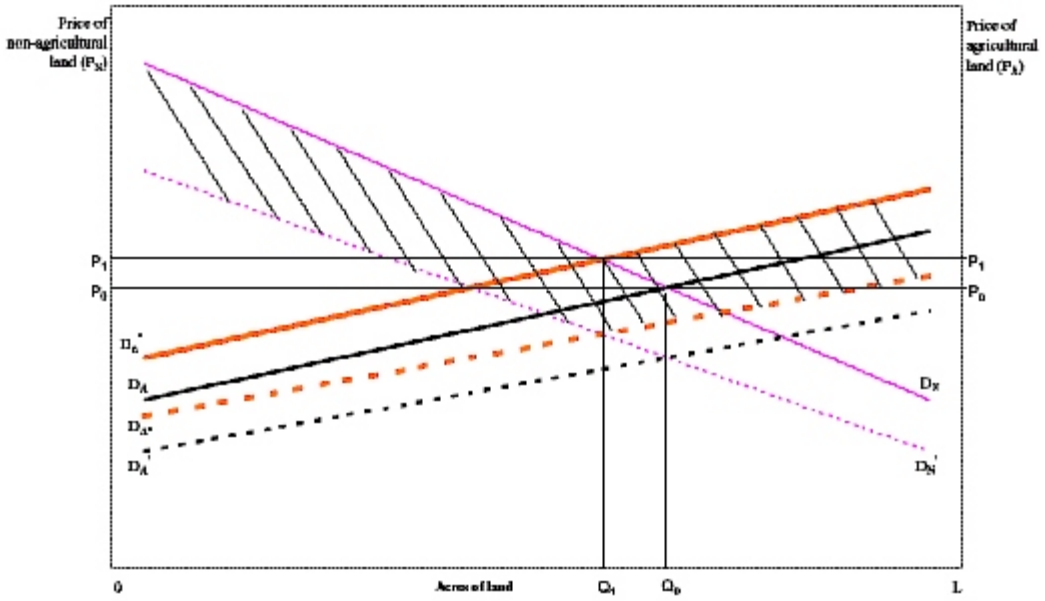


Each parcel of land is taxed ad valorem according to its use-value in agriculture or in non-agriculture. Net-of-tax demand curves (D_A', D_N', and D_N''') are represented by dashed lines in Figures 1.1 and 1.2. The marginal valuation of land is the rental price on a parcel of land that would provide a stream of agricultural (or non-agricultural) use for an interval of time. Land is homogeneous in quality but different parcels of land rent for different prices based on their

[9] Over 60 percent of the private land in the 48 contiguous states of the U.S. is in farms and ranches (Wunderlich 1997 cites the USDA-ERS 1995). I focus on agricultural land because it is the fastest growing category of land for conservation easements (American Farmland Trust).

distance from downtown. The rental price for an acre of non-agricultural land is measured on the left vertical axis, while the rental price of agricultural land is measured on the right vertical axis. The length of the horizontal axis depicts the total amount of land ($\overline{L}$) in the county.

Figure 1.2 - The Market for Agricultural and Non-agricultural Land with Pre-existing *Ad Valorem* Taxes in Both Sectors and a Conservation Easement Subsidy in the Agricultural Sector



The potential for urban development on a parcel of land is a function of its distance from downtown because businesses want to locate in areas with higher population densities. A county's downtown is the urbanized county seat with the local government's administrative and judicial centers, schools, shops, and other commercial businesses. Following Park, Burgess, and McKenzie (1925), my model assumes an urbanized county seat that is centrally located within the county. The county seat is surrounded by an annulus of developable open space or

agricultural land that is suitable for conversion to urban use. This developable open space is, in turn, surrounded by the remaining agricultural land in the county. Developable open space is suitable for conversion into urban use because of its proximity to downtown and its readiness for construction.

Urban land and developable open space are ordered along the horizontal axis in Figure 1.1. For instance, urban land located in the center of downtown is arrayed starting from the origin *0*, while the most valuable agricultural land in the county is arrayed starting from the origin $\bar{I}$. The downward sloping demand curve D_N shows the rental price of non-agricultural land (P_N). Non-agricultural land earns Ricardian rents in excess of P_0, the net-of-tax rental price on the marginal or least productive parcel of land. The Ricardian rent (for location, in this case) declines, the further away from downtown the parcels of non-agricultural land are located.

There are two reasons farmers locate on the outskirts of the urbanized county seat. The first reason is the time and pecuniary costs of transportation and commuting. Urban dwellers live downtown because of the relatively higher time and pecuniary costs of commuting to work or to school from the countryside. The farmer, in contrast, has lower time and pecuniary costs (fewer trips and economies of scale using large trucks) for transporting agricultural produce and farm animals to a market outside the county. The second reason is the nuisance factor of farming. Farmers locate further away from urban dwellers in order to minimize the possibility of nuisance lawsuits. Farming's nuisance factors include pesticide use, aerial spraying, manure odor, dust, flies, and noise (Telega 2003; Oberholtzer and

Higgins 2001). In Figure 1.1, the land most suitable for agriculture is arrayed starting from the origin and commands the highest rental price in agriculture. The rental price of agricultural land (P_A) declines as the parcels of land are located closer to the urbanized county seat.

The use-value assessment of agricultural land is a major source of the agricultural tax benefit in the model. Use-value assessment values farmland according to the average cash rents received from agricultural use of the land. This is in contrast to market value assessment that values land at the recent sales prices of comparable land. Since local property taxes are levied on the assessed value of real property, use-value assessment of the property is typically lower than (but could be equal to) the market value of the land. Therefore, use-value assessment of agricultural land is a function (or a proportion) of the market value of the land parcel.[10]

The placement of an easement on farmland enrolled in an agricultural current use taxation program will not change its property tax. If the property is not enrolled in such a program, its property tax could decrease significantly with the placement of an easement (American Farmland Trust). Thus, use-value assessment lowers the effective property tax rate on agricultural land and raises the rate if the land is converted to urban use.[11] The difference between the agricultural

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[10] In the next section, I model use-value assessment of agricultural land as a function of the market value of land.

[11] According to van der Hoeven and King (2003, p. 2), "North Carolina tax law provides rules that value farmland according to average cash rents received on comparable land." In rapidly urbanizing counties, use-value assessment may result in substantially reduced property taxes. In North Carolina, "Back taxes for up to three years may be recaptured by the county if it is

and non-agricultural rates provides a direct tax on the process of urban land conversion at the urban fringe. Use-value assessment of agricultural land is an example of a tax incentive policy that contains urban sprawl while preserving agricultural land on the urban periphery (Cheshire and Sheppard 2003).[12]

Even though some studies[13] on the urban conversion of agricultural land have incorporated the option value for potential development, I avoid the concept of option value for two compelling reasons. First, use-value assessment of agricultural land does not tax the option value of potential development. Therefore, option value on agricultural land does not change the property tax revenue of local governments. Second, Schmalensee (1972) shows that the sign on option value is ambiguous and depends on the relationship between the marginal utilities of income in different states of nature (Freeman 1992, 262-263).

Figures 1.1 and 1.2 depict both types of land being taxed at the same *nominal* ad-valorem rate, $\tau = \tau_a$. The next section develops a mathematical treatment of how the agricultural use-value assessment (what I call the agricultural tax benefit) lowers the effective rate of taxation on agricultural land relative to non-agricultural land. In Figure 1.1, the equilibrium allocation of land in the non-agricultural sector is given by Q_0 and in agriculture is given by $\bar{L} - Q_0$. The

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determined that the land no longer qualifies for the [use-value taxation] program" (Feitshans and Renkow 2002).

[12] American Farmland Trust (1997).

[13] For example, Tegene, Wiebe, and Kuhn (1999, 204) find that "conventional valuation procedures may systematically overprice easements by exaggerating the returns a parcel would generate if converted to urban use today, and simultaneously underprice easements by failing to recognize the true option value of waiting to convert at the optimal time in the future."

equilibrium after-tax rental price of the marginal parcel of land in both sectors (i.e., located on the "margin" or at the urban fringe) is P_0. At the margin, landowners are indifferent between leasing their land for agricultural or non-agricultural use; thus the equilibrium rental price on the marginal land clears both sectors. Local governments receive the shaded areas in Figures 1.1 and 1.2 as property tax revenue.

Figure 1.2 incorporates the income tax deduction benefits of conservation easements into the model. The Tax Reform Act of 1976 established the federal income tax deductibility of conservation easement donations (Parker 2004). This Act provides a legal basis for the model's treatment of the federal income tax deduction as a subsidy to agricultural landowners who donate conservation easements. Since 1976, owners of agricultural land have received a deduction on their adjusted gross income up to 30 percent of the "fair market" development value on their easement land.[14] The federal income tax deduction is modeled as a subsidy to agricultural land owners that increases the demand for agricultural land (D_A). When D_A shifts up, with no change in the demand for non-agricultural land, the price of marginal land in both sectors increases to P_1. The amount of land allocated to agricultural use also increases from Q_0 to Q_1. The direction of change in local property tax revenue, however, is uncertain because the gain in revenue from the agricultural sector—resulting from higher prices and a larger quantity of agricultural land—may offset the loss of revenue from the non-agricultural sector.

[14] Assuming the landowner's adjusted gross income is large enough for the deduction to occur.

B. Mathematical generalization of the model

This section provides a mathematical generalization of Figures 1.1 and 1.2 that does not assume any specific functional form or elasticities for the demand curves in both sectors. Appendix II provides a full derivation of the equations in this section. I demonstrate the conditions influencing the changes in local property tax revenue due to the income tax deductibility of conservation easement donations. In equilibrium, the quantity of land demanded in both sectors must equal the endowment of land in a county, such that $Q_A + Q_N = \overline{L}$.

Let δ shift the demand curve for agricultural land due to the income tax deduction subsidy of conservation easement donations. Note that $\delta = 1$ is the initial equilibrium and $\delta > 1$ denotes the increase in demand for agricultural land from the subsidy. Graphically, this is represented by an upward shift of D_A to D_A'' in Figure 1.2. The following equilibrium condition describes the net-of-tax prices of agricultural and non-agricultural lands located on the margin at the urban fringe:

$$(1) \qquad (1-\tau_A)\cdot\delta\cdot P_A(Q_A) = (1-\tau_N)\cdot P_N(\overline{L}-Q_A)$$

I follow the Ricardian notion that the marginal land is the least productive—in either agricultural or non-agricultural use—parcel of land in the county. All other parcels of land in both sectors have greater market values than this marginal land. Ricardian rent is the difference in the rental price over and above the rental price for the marginal land. In this model, since land is homogeneous in quality, Ricardian rent is the cost advantage of farming further away from the urbanized county seat.

Equation (2) is the elasticity of agricultural land acres with respect to the conservation easement's income tax deduction subsidy. Equation (2) is the result of converting the log-differentials of equation (1) into demand elasticities and rearranging terms.

$$(2) \qquad \frac{d\ln Q_A}{d\ln \delta} = \frac{-\eta_A \eta_M}{\eta_M + \frac{\alpha}{1-\alpha}\eta_A} = \frac{-1}{\frac{1}{\eta_A} + \frac{\alpha}{1-\alpha}\frac{1}{\eta_M}} = \frac{-(1-\alpha)}{(1-\alpha)\eta_A^{-1} + \alpha\eta_M^{-1}}; \quad where\ \alpha = \frac{Q_A}{\overline{L}}$$

Since demand elasticities in both sectors are defined to be negative, the elasticity of agricultural land acres with respect to the conservation easement subsidy is positive. This result confirms the graphical analysis in Figure 1.2.

Local property taxes are levied on the assessed value of real property. The next equation defines the source of local property tax revenues, denoted *TR*.

$$(3) \qquad TR = \delta \cdot \tau_A(Assessed\ Use\ Value\ of\ Agricultural\ Land) + \tau_N(Assessed\ Market\ Value\ of\ Non-Agricultural\ Land)$$

For non-agricultural land, the assessed value of the property reflects its "fair market value". For agricultural land, the use-value assessment of the property is typically lower than (but could be equal to) the market value of the land. Therefore, I model the assessed use-value of agricultural land as a function of the market value of the land, such that *Assessed Use Value = f(Market Value)* $= f(\int_0^{Q_A} P_A(Q)dQ)$. Therefore, Equation (3) can be defined as follows.

$$(4) \qquad TR = \delta \cdot \tau_A f(\int_0^{Q_A} P_A(Q)dQ) + \tau_N \int_0^{\overline{L}-Q_A} P_N(Q)dQ$$

Finally, Equation (5) is the elasticity of local property tax revenues with respect to

the conservation easement subsidy.[15]

$$(5) \qquad \frac{d\ln TR}{d\ln \delta} = \frac{\phi}{\phi\tau_A + (1-\phi)\tau_N}\left[\tau_A - (1-\alpha)(\tau_N - \mu\tau_A)\left(\frac{MV}{AV_A}\right)\left|\overline{\eta}\right|\right],$$

where $\phi = \frac{\delta\int_0^{Q_A} P_A(Q)dQ}{\delta\int_0^{Q_A} P_A(Q)dQ + \int_0^{\bar{I}-Q_A} P_N(Q)dQ}$ is the agricultural sector's share of the total market value of land in the county. The function $\left|\overline{\eta}\right| = \frac{1}{(1-\alpha)\frac{1}{|\eta_A|} + \alpha\frac{1}{|\eta_N|}}$ is the inverse of the weighted average of inverse elasticities. Therefore, the function $\left|\overline{\eta}\right|$ can be interpreted as an average demand elasticity for land in a county. The sign of the elasticity $\frac{d\ln TR}{d\ln\delta}$ depends on the sign of the term in brackets in Equation (5). The sign of the term in brackets can be written as inequality (6), which is the condition for a decline in tax revenue due to δ.

$$(6) \qquad \frac{\tau_N - \mu\tau_A}{\tau_A} > \frac{1}{(1-\alpha)\left(\frac{MV}{AV_A}\right)\left|\overline{\eta}\right|}$$

The sign and magnitude of the effect of conservation easement subsidies on local property taxes depend on four terms in Equation (5). The first term, $\frac{\tau_N - \mu\tau_A}{\tau_A}$ is the size of the agricultural tax benefit, which also depends on the relationship μ between agricultural use-value and market value of the land. The second term, $(1-\alpha)$ is the proportion of non-agricultural land in the county. The third term, $\frac{MV}{AV_A} = \frac{P_A(Q_A)}{\int_0^{Q_A} P_A(Q)dQ / Q_A}$ is the Ricardian rent factor, which is the ratio of marginal value (the rental price on the marginal parcel of land) to the average

[15] See Appendix II for the derivation of Equation (5).

assessed use-value of agricultural land in the county. The fourth term is the function $|\bar{\eta}|$, which is the average demand elasticity for land in the county.

C. Comparative statics

There are two special cases involving the size of the agricultural tax benefit. Local property tax rates are often specified in mills[16] and levied on the assessed value of the property (Wunderlich 1997). Thus, tax rates are *nominally* equal across both sectors. The first special case, when $\tau_a = \tau_w$, simplifies Equation (6) as follows:

$$(6') \qquad (1-\mu) > \frac{1}{(1-\alpha)\left(\frac{MV}{AV_a}\right)|\bar{\eta}|}$$

Clearly, if there is a one-to-one relationship between assessed use-value and market value, i.e., $\mu = 1$, then Equation (6') will not hold, resulting in an increase in local property tax revenue from the conservation easement subsidy. If, however, there is no relationship between assessed use-value and market value, i.e., $\mu = 0$, then Equation (6') may hold, depending on the relative magnitudes of the other three terms in the denominator on the right-hand side of the inequality. Thus, local property tax revenue is likely to decrease from the conservation easement subsidy.

The second special case arises because the use-value assessment of

[16] A mill is one thousandth of a dollar, or one-tenth of one cent. The millage rate is often a sum of several revenue requirements (i.e., township, county, school district, and special districts for fire and sanitary services) decided by local government, within the limits of state law.

agricultural land lowers its effective rate of taxation such that $\tau_M > \tau_A$. Mathematically, the negative sign for the elasticity of property tax revenues with respect to the conservation easement subsidy depends on condition (6) below.

$$(6) \qquad \frac{\tau_M - \mu\tau_A}{\tau_A} > \frac{1}{\left(\frac{MV}{AV_A}\right)(1-\alpha)\left|\overline{\eta}\right|}$$

In the case of zero agricultural Ricardian rent $\left(\frac{MV}{AV_A} = 1\right)$, the average assessed use-value of agricultural land (AV_A) is equal to the price of marginal land (MV). Thus, equation (6) simplifies to $\frac{\tau_M - \tau_A}{\tau_A} > \frac{1}{(1-\alpha)\left|\overline{\eta}\right|}$, which is sufficient for $\frac{d\ln TR}{d\ln\delta} < 0$. A larger proportion of non-agricultural land in the county, i.e., the larger is $(1-\alpha)$ *ceteris paribus*, the more likely it is that local property tax revenues will decline due to δ. For example, a county that is entirely agricultural, where $Q_A = \overline{L}$ and $\alpha = \phi = 1$, collects more local property tax revenue due to the conservation easement subsidy. Then, the model implies a one-to-one relationship between the subsidy and property tax because the elasticity is $\frac{d\ln TR}{d\ln\delta} = 1$.

The magnitude of the agricultural tax benefit depends on the ratio between τ_M and τ_A and the relationship μ between agricultural use-value and market value of the land. The larger is the ratio $\frac{\tau_M - \mu\tau_A}{\tau_A}$, the larger is the agricultural tax benefit. A larger agricultural tax benefit, *ceteris paribus*, will decrease local property tax revenue due to the conservation easement's subsidy. However, the effects of the Ricardian rent factor, the proportion of non-agricultural land in the county, and the elasticity of land could offset the negative effect of the agricultural

tax benefit on local property tax revenue.

The zero Ricardian rent condition suggests there is no difference in the quality of agricultural land in the county and thus no cost advantage to farming further away from the urbanized county seat. The absence of Ricardian rent implies a perfectly elastic demand curve for agricultural land. For example, suppose the average demand for land in the county is elastic, $|\bar{\eta}| > 1$. Local property tax revenues will then likely decrease due to the conservation easement subsidy. The reverse is true if the average demand elasticity of land is inelastic or $|\bar{\eta}| \in (0,1)$. Here, local property tax revenues likely will increase due to the conservation easement subsidy.

The case of positive Ricardian rent $\left(\frac{MV}{AV_A} \in (0,1)\right)$ on agricultural land implies heterogeneity in the location cost of farming. Farmers and ranchers, on average, pay a Ricardian rent on agricultural land in excess of the rental price on marginal land ($AV_A > MV$). Farmers and ranchers are willing to pay a higher price for agricultural land that lowers their farming cost. Thus, the location or distance from downtown of individual land parcels results in Ricardian rents and different rental prices for different parcels. Furthermore, Ricardian rent influences local property tax revenue through its effect on rental prices. If condition (6) fails to hold in the presence of positive Ricardian rent, then local property tax revenue increases due to the conservation easement subsidy.

Finally, I discuss three special cases for the average elasticity function, $|\eta|$.[17] First, when the average elasticity is unit-elastic, Equation (6) simplifies to $\frac{\tau_u - \mu\tau_r}{\tau_r} > \frac{1}{(1-\alpha)\left(\frac{MV}{AV_a}\right)}$. The decrease in local property tax revenue depends on the relative magnitudes of the agricultural tax benefit, the proportion of non-agricultural land in the county, and the Ricardian rent factor. For given values of the agricultural tax benefit and proportion of non-agricultural land in the county, higher Ricardian rents ($\frac{MV}{AV_a}$ is close to zero) imply a decline in local property tax revenues due to the conservation easement subsidy. Second, when average demand for land $|\eta|$ is elastic, *ceteris paribus*, local property tax revenues are likely to decline due to the conservation easement subsidy. Third, an inelastic demand for land will result in an increase in local property tax revenues due to the conservation easement subsidy.

In summary, $\frac{d\ln TR}{d\ln\delta}$ is more likely to be negative, *ceteris paribus*, with the following conditions: (1) the higher is $\frac{\tau_u - \tau_r}{\tau_r}$, i.e., the larger is the agricultural tax benefit from the lower effective rate of taxation on agricultural land; (2) the larger is $(1-\alpha)$, i.e., the larger is the proportion of non-agricultural land in the county; (3) the closer $\left(\frac{MV}{AV_a}\right)$ is to 1, i.e., the smaller is the Ricardian rent on agricultural

[17] The two extreme cases—perfectly inelastic and perfectly elastic—are quite unlikely but are included here for completeness. When the demand for land is perfectly inelastic, property tax revenue will increase due to the conservation easement subsidy. When the demand for land is perfectly elastic, property tax revenue will decrease due to the conservation easement subsidy.

land, which suggests a smaller cost advantage to farming further away from town; and (4) the larger is the average elasticity $|\bar{\eta}|$, i.e., the more elastic is the demand for land. These results have not been articulated in the public finance literature regarding local property taxation.

D. Empirical application

Empirical application of this model predicts the sign and magnitude of the change in local property tax revenue. *Census of Agriculture*, *County and City Data Book*, and county tax assessors collect data on two out of four terms in Equation (6). For the first term, property tax rates for both sectors are necessary to calculate the agricultural tax benefit. Data on total acres of agricultural land, estimated market value of farmland and buildings, and property taxes paid are available for each county from the quinquennial *Census of Agriculture*. The effective rate of taxation on agricultural land τ_A can be calculated by dividing the amount of property taxes paid in the county by the market value of farmland in the county. These data must be treated with caution because they are generated from a sample survey of farms in a county. The property tax rate on non-agricultural land τ_N can be obtained from the nominal millage rate for the county. The left-hand side of Equation (6), $\frac{\tau_N - \mu\tau_A}{\tau_A}$ is calculated with both tax rates.

The second term, the proportion of non-agricultural land in the county $(1 - \alpha)$, is easily calculated by subtracting acres of agricultural land from total

acres of land in each county. For the third term, the marginal value (*MV*) and average assessed use-value (AV_A) of agricultural land are needed to calculate the Ricardian rent factor. I am not aware of any published sources for these data, but county tax assessors record data on sales of agricultural land parcels. The lowest per-acre sale price may be a rough proxy for marginal value. The average assessed use-value of agricultural land can be calculated from the county's assessment rolls, if the property is classified by agricultural use.

The fourth and final term may prove the most challenging datum to estimate. The share weighted elasticity of demand for land in both sectors are necessary to calculate the average elasticity of land in the county, $|\bar{\eta}| = \frac{1}{(1-\alpha)\frac{1}{|\eta_A|} + \alpha\frac{1}{|\eta_M|}}$. Data for the county's agricultural and total acreage (α) are available publicly from the *Census of Agriculture* but the remaining price and acreage data are only available from county tax assessors. Estimating demand elasticities for land in each sector (η_A and η_M) requires time-series data on price and acreage of recent land sales in the agricultural and non-agricultural sectors for each county. The following is a regression equation for the demand elasticity of land in sector *j*:

$$(7) \qquad \ln P_{jt} = \alpha_0 + \alpha_1 \ln Q_{jt} + \alpha_2 \ln Y_{jt} + \alpha_3 \ln FPI_{jt} + \varepsilon_{jt}$$

P_{jt} is the sale price of land in sector *j* in year *t*, Q_{jt} is the acreage of land sold in sector *j* in year *t*, Y_{jt} is the average level of farm income (or personal income) in the

county, and FPI_{jt} is the Index of Farm Prices.[18] The coefficient $\frac{1}{\alpha_1}$ is the demand elasticity of land in sector *j*. The relative magnitudes of the four terms in Equation (6) predict whether local property tax revenues will increase or decrease with the conservation easement subsidy.

III. Conclusion

This model provides a rich theoretical framework for analyzing the question and to predict the effect of conservation easement subsidies on local property tax revenues. The sign and magnitude of the change in a county's property tax revenue depends on four factors: the agricultural tax benefit, the proportion of non-agricultural land, the Ricardian rent on agricultural land, and the average elasticity of demand for land. For instance, the decline in local property tax revenue due to the income tax deductibility of conservation easements depends, *ceteris paribus*, on the following four factors. First, the decline is larger, the larger is the agricultural tax benefit stemming from the lower effective rate of taxation on agricultural land. This is particularly true in counties with a relatively large agricultural sector. Second, the decline is larger, the larger is the proportion of non-agricultural land in the county. Third, the decline is larger, the smaller is the Ricardian rent on agricultural land, which suggests a smaller cost advantage to farming away from town. Fourth, the decline is larger, the more elastic is the demand for land.

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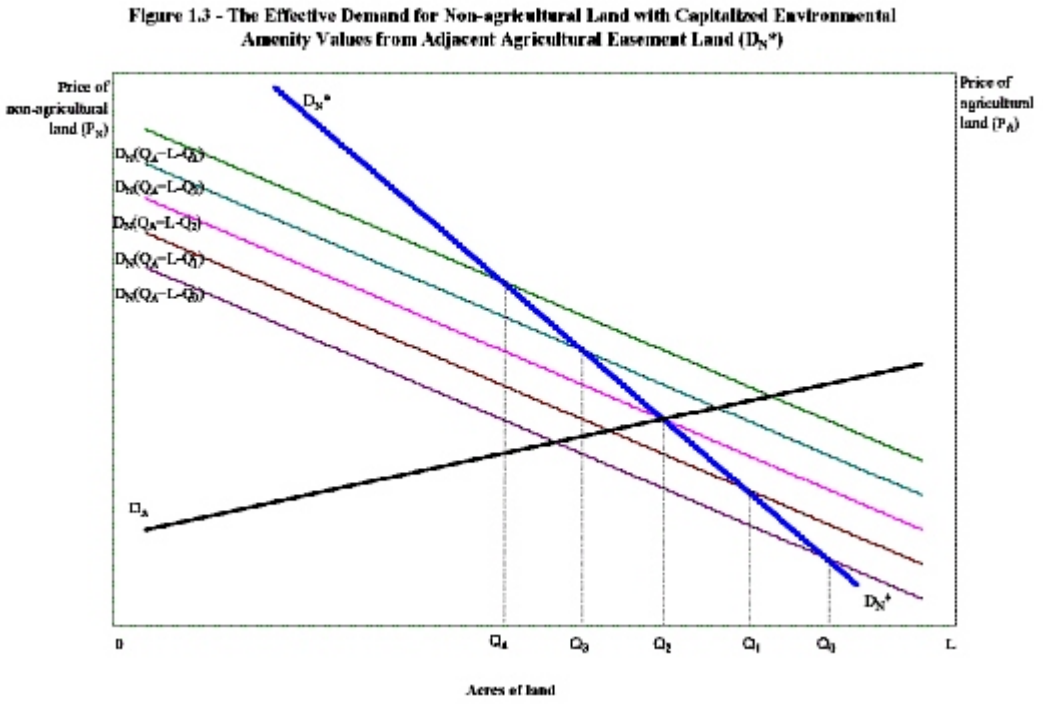
[18] If there is insufficient data on recent sales of land in the county, I may use the number of acres in each sector and the assessed taxable values in each sector.

Appendix I: The effective demand for non-agricultural land

Previous studies (Geoghegan, Lynch, and Bucholtz 2003; Geoghegan 2002; Irwin and Bockstael 2001) have shown that the environmental amenity values (e.g., open space, scenic views, wildlife habitat, watershed protection, or preserved forest) of conservation easements are capitalized into the market price of adjacent land parcels. Specifically, the environmental amenity value increases the demand for non-agricultural land.



In Figure 1.3 above, the demand curve for non-agricultural land shifts upwards, from $D_N(Q_A = \bar{L} - Q_0)$ to $D_N(Q_A = \bar{L} - Q_1)$, when the amount of agricultural land in the county increases from $\bar{L} - Q_0$ to $\bar{L} - Q_1$. Demanders of non-agricultural land (such as residential renters) enjoy the scenic view of open

space and are willing to pay a higher rental price to reside near preserved farmland. When conservation easements are placed on more agricultural land, $\bar{L} - Q_2$, the environmental amenity value of these preserved farmlands are capitalized into the higher marginal valuation for parcels of non-agricultural land. Thus the demand for non-agricultural land increases to $D_N(Q_A = \bar{L} - Q_2)$.

Figure 1.3 depicts non-agricultural demand curves shifting upwards with higher levels of agricultural land. The D_N* curve traces the locus of effective demand for non-agricultural land with capitalized environmental values from agricultural easements. The analytical framework of this paper can be modified to include this effective demand curve for non-agricultural land, but the difficulty in estimating environmental amenity values and thus D_N* precludes this modification.

Appendix II: The derivation of equations (2) and (4)

In equilibrium, the quantity of land demanded in both sectors must equal the endowment of land in a county, such that $Q_A + Q_N = \bar{L}$. Let δ represent the income tax deduction subsidy of conservation easement donations. When $\delta > 1$, the demand curve for agricultural land shifts upwards. The following equilibrium condition describes net-of-tax prices for agricultural and non-agricultural lands located on the "margin" of the urban fringe:

$$(1) \qquad (1 - \tau_A) \cdot \delta \cdot P_A(Q_A) = (1 - \tau_N) \cdot P_N(\bar{L} - Q_A)$$

Log-differentiating equation (1) yields the following:

$$(2) \qquad d\ln\delta + \frac{d\ln P_A(Q_A)}{d\ln Q_A} d\ln Q_A = \frac{d\ln P_N(\bar{L} - Q_A)}{d\ln Q_N} d\ln P_N(\bar{L} - Q_A)$$

Convert the log-differentials into demand elasticity terms:

$$(3) \qquad d\ln\delta + \frac{1}{\eta_A} d\ln Q_A = \frac{1}{\eta_N}\left(-\frac{Q_A}{Q_N} d\ln Q_A\right)$$

Rearranging (3) results in the elasticity of agricultural land acres with respect to the income tax deductibility of conservation easements:

$$(4) \qquad \frac{d\ln Q_A}{d\ln\delta} = \frac{-\eta_A\eta_N}{\eta_N + \frac{\alpha}{1-\alpha}\eta_A} = \frac{-1}{\frac{1}{\eta_A} + \frac{\alpha}{1-\alpha}\frac{1}{\eta_N}} = \frac{-(1-\alpha)}{(1-\alpha)\eta_A^{-1} + \alpha\eta_N^{-1}}; \quad where\ \alpha = \frac{Q_A}{\bar{L}}$$

Local property taxes are levied on the assessed value of real property. The next equation defines the source of local property tax revenues, denoted *TR*.

$$(5) \qquad TR = \delta \cdot \tau_A(Assessed\ Use\ Value\ of\ Agricultural\ Land) + \tau_N(Assessed\ Market\ Value\ of\ Non-Agricultural\ Land)$$

For non-agricultural land, the assessed value of the property reflects its "fair market value". For agricultural land, the use-value assessment of the property is typically lower than (but could be equal to) the market value of the land. Therefore, I model the assessed use-value of agricultural land as a function of the market value of the land, such that *Assessed Use Value = f(Market Value)*

$= f\left(\int_0^{Q_A} P_A(Q)dQ\right)$. Thus, Equation (5) can defined as follows:

$$(5') \qquad TR = \delta \cdot \tau_A f\left(\int_0^{Q_A} P_A(Q)dQ\right) + \tau_N \int_0^{\bar{L}-Q_A} P_N(Q)dQ$$

Applying the chain rule when log-differentiating the term for assessed use-value of agricultural land yields the following result:

$$(6)\qquad \frac{d\ln[\,Assessed\ Use\ Value)]}{d\ln QA} = \frac{d\ln[f(Market\ Value)]}{d\ln QA}$$

$$= \frac{d\ln[f(\int_0^{Q_A} P_A(Q)dQ)]}{d\ln QA}$$

$$= \mu\frac{d\ln\int_0^{Q_A} P_A(Q)dQ}{d\ln QA}$$

Therefore, total log-differentiating equation (5') yields the following:

$$(7)\qquad d\ln(TR) = \gamma\left[d\ln\delta + \mu\frac{d\ln\int_0^{Q_A} P_A(Q)dQ}{d\ln Q_A}d\ln Q_A\right] + (1-\gamma)\left[\frac{d\ln\int_0^{\bar{L}-Q_A} P_N(Q)dQ}{d\ln Q_A}d\ln Q_A\right],$$

where $\gamma = \dfrac{\delta\cdot\tau_A f(\int_0^{Q_A} P_A(Q)dQ)}{\delta\cdot\tau_A f(\int_0^{Q_A} P_A(Q)dQ) + \tau_N\int_0^{\bar{L}-Q_A} P_N(Q)dQ} = \dfrac{\phi\tau_A}{\phi\tau_A + (1-\phi)\tau_N}$, is agriculture's tax revenue share, which can be expressed as a share of the weighted sum of both tax rates. Define $\phi = \dfrac{\delta f(\int_0^{Q_A} P_A(Q)dQ)}{\delta f(\int_0^{Q_A} P_A(Q)dQ) + \int_0^{\bar{L}-Q_A} P_N(Q)dQ}$ as agriculture's share of total assessed land value in a county. Differentiate the integrals in equation (7) and rearrange terms as follows:

$$(8)\qquad d\ln(TR) = \gamma\left[d\ln\delta + \mu\frac{P_A(Q_A)\cdot Q_A}{\int_0^{Q_A} P_A(Q)dQ}d\ln Q_A\right] + (1-\gamma)\left[\frac{-P_N(\bar{L}-Q_A)\cdot Q_A}{\int_0^{\bar{L}-Q_A} P_N(Q)dQ}d\ln Q_A\right]$$

Rearrange the denominator of each term and substitute (4) into (8):

$$(9)\qquad d\ln(TR)=\gamma\left[d\ln\delta+\frac{\mu P_A(Q_A)}{\tau_A\int_0^{Q_A}P_A(Q)dQ\Big/\tau_A Q_A}\left(\frac{-\eta_{AA}\eta_{AN}}{\eta_{AN}+\frac{\alpha}{1-\alpha}\eta_{AA}}\right)d\ln\delta\right]$$

$$+(1-\gamma)\left[\frac{-P_N(\bar{L}-Q_A)}{\left(\frac{\tau_N\int_0^{\bar{L}-Q_A}P_N(Q)dQ}{\tau_N Q_N}\cdot\frac{1-\alpha}{\alpha}\right)}\left(\frac{-\eta_{AA}\eta_{AN}}{\eta_{AN}+\frac{\alpha}{1-\alpha}\eta_{AA}}\right)d\ln\delta\right]$$

Defining the average values in the denominator of in terms of shares will allow for some simplification:

$$(10)\qquad d\ln(TR)=\gamma\left[d\ln\delta+\frac{\mu P_A(Q_A)}{\left(\frac{\gamma\cdot TR}{\tau_A\cdot\alpha\cdot\bar{L}}\right)}\left(\frac{-\eta_{AA}\eta_{AN}}{\eta_{AN}+\frac{\alpha}{1-\alpha}\eta_{AA}}\right)d\ln\delta\right]$$

$$+(1-\gamma)\left[\frac{-P_N(\bar{L}-Q_A)}{\left(\frac{(1-\gamma)\cdot TR}{\tau_N\cdot(1-\alpha)\cdot\bar{L}}\cdot\frac{1-\alpha}{\alpha}\right)}\left(\frac{-\eta_{AA}\eta_{AN}}{\eta_{AN}+\frac{\alpha}{1-\alpha}\eta_{AA}}\right)d\ln\delta\right]$$

At the margin, the price on the least productive parcel of land is defined as

$MV \equiv P_A(Q_A) = P_N(\bar{L} - Q_A)$. Factoring the common MV and elasticity terms yields:

$$(11) \qquad \frac{d\ln TR}{d\ln \delta} = \gamma + [\tau_N - \mu\tau_A]\left(\frac{MV}{TR/Q_A}\right)\left(\frac{-\eta_A\eta_N}{\eta_N + \frac{\alpha}{1-\alpha}\eta_A}\right)$$

Let $\frac{MV}{TR/Q_A} = \frac{P_A(Q_A)\cdot Q_A}{\tau_A f(\int_0^{Q_A} P_A(Q)dQ) + \tau_N \int_0^{\bar{L}-Q_A} P_N(Q)dQ} = \frac{P_A(Q_A)/\left(\frac{f(\int_0^{Q_A} P_A(Q)dQ)}{Q_A}\right)}{\tau_A + \tau_N\left(\frac{\int_0^{\bar{L}-Q_A} P_N(Q)dQ}{f(\int_0^{Q_A} P_A(Q)dQ)}\right)} = \frac{MV\ /\ AV_A}{\tau_A + \tau_N\left(\frac{1-\phi}{\phi}\right)}$,

where $\phi = \frac{\delta f(\int_0^{Q_A} P_A(Q)dQ)}{\delta f(\int_0^{Q_A} P_A(Q)dQ) + \int_0^{\bar{L}-Q_A} P_N(Q)dQ}$ is agriculture's share of total land value in a county.

Define the function $\overline{|\eta|} = \frac{1}{(1-\alpha)\frac{1}{|\eta_N|} + \alpha\frac{1}{|\eta_A|}}$ as the inverse of the weighted average of inverse elasticities. Therefore, the function $\overline{|\eta|}$ can be interpreted as an average demand elasticity for land in a county. Thus, the equation of interest, the elasticity of local property tax revenues with respect to the conservation easement subsidy, is as follows:

$$(12) \qquad \frac{d\ln TR}{d\ln \delta} = \frac{\phi}{\phi\tau_A + (1-\phi)\tau_N}\left[\tau_A - (\tau_N - \mu\tau_A)(1-\alpha)\left(\frac{MV}{AV_A}\right)\overline{|\eta|}\right]$$

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ANTITRUST AND POLITICS: PRESIDENTIAL PARTY CONTROL, CONGRESSIONAL OVERSIGHT, OR BUREAUCRATIC DISCRETION?[1]

I. Introduction

Politics seem to permeate the conduct of antitrust policy in the United States. The Department of Justice's (DOJ) Antitrust Division (hereinafter the Division) work actively with the executive branch through regulatory and legislative processes "to ensure that government action is pro-competitive or not unnecessarily anti-competitive." The Division also prepares reports for Congress and advises the President and other agencies in the executive branch about antitrust matters. Thus, antitrust activity in this country is connected to both the executive and legislative branches of the government. I outline these connections below.

The Division is headed by a presidential appointee who is confirmed by the Senate. The President has considerable discretion in nominating a Division head who is amenable to pursuing the President's agenda in antitrust enforcement. The Senate, which has the authority to confirm the appointment of the Division head, could accept or reject the President's nominee. Congressional oversight committees have the power to appropriate Division budgets, impel testimony by the head of the Division, and request hearings and reports from the Division. The following are Congressional committees with the greatest oversight for the

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Antitrust Division: House and Senate Appropriations Committees, House and Senate Committees on the Judiciary (especially the Senate Subcommittee on Antitrust, Competition, and Business Rights), and the Senate Committee on Commerce, Science, and Transportation.[2]

It seems reasonable to think that Democratic presidents differ from Republican presidents on many policy issues, including their preference for antitrust activism. Conventional wisdom states that Democratic presidents are more "activist" and prefer stronger antitrust enforcement. Similar arguments have been made about Democratic majorities in the House of Representatives and the Senate. These Democratic majorities translate into chairmanship and members' control of key oversight committees. Thus, the legislators' party affiliations indicate their preferences for different levels of antitrust activism.

Against this backdrop of presidential party control and congressional oversight, I examine the role of political affiliation in explaining a long time series of the Antitrust Division's case output. I measure political affiliation as the president's party and congressional oversight as the majority party in the House and the Senate. Political affiliation may affect the Antitrust Division's case output through the following three channels. First, does the party affiliation of the President signal his preference for a certain level of antitrust activism? Second, does the President appoint an Assistant Attorney General for Antitrust who reflects the President's policy agenda for antitrust enforcement? Third, does the majority party in the House and Senate (and resulting control over the House and

[2] See testimony listed on the Antitrust Division's website at http://www.usdoj.gov/atr/public/testimony/testimon.htm.

Senate Appropriations Committees) signal legislators' preferences for antitrust activism and their willingness to pay for it? If both presidential party control and congressional oversight do not influence antitrust enforcement patterns, then Division bureaucrats are largely independent of political pressure from the President and Congress. Bureaucratic discretion is the null hypothesis in explaining antitrust enforcement. While the alternative hypothesis is that the bureaucrats are not independent and that they bow to pressure from the President's party and congressional party affiliations.

The study of antitrust enforcement is particularly important because the Division has large off-budget effects on the economy in terms of the amount of fines collected and the number of prominent firms found guilty of antitrust violations.[3] See Table 2.1 below. From 1995 to 2005, the Division's appropriated budget (in real 2000 dollars) totaled $1.254 billion, while it collected $3.040 billion in fines, more than 2.4 times its budget appropriations. It is interesting to note that this period encompasses the three largest criminal antitrust fines ever collected: the $500 million fine against F. Hoffman-LaRoche and $225 million against BASF in the international vitamins price-fixing cartel in 1999 and the $300 million fine against Samsung for price-fixing in dynamic random access memory (DRAM) in 2005.

Previous studies find conflicting results on the effect of politics on antitrust activity because they examine different sub-periods and focus on each political entity in isolation. I model antitrust enforcement as the result of an

[3] I do not examine mergers in this paper and thus do not include the loss from unapproved mergers that result from DOJ investigations.

optimization problem among the President, legislators, and Division bureaucrats. I also employ a long time series of data, 1903-2005, and include the political affiliations of the President and Congressional majorities in my estimation.

Table 2.1 - The Antitrust Division's Annual Budget and Fines Collected (in Real 2000 Dollars), 1995-2005

Fiscal Year	Real Annual Budget ($'000)	Real Fines Imposed ($'000)
1995	82,359	38,164
1996	79,842	25,168
1997	88,204	195,760
1998	90,195	235,526
1999	99,475	951,431
2000	110,000	308,421
2001	123,738	279,344
2002	136,271	106,806
2003	141,667	68,339
2004	145,687	154,548
2005	156,441	676,946
	1,253,879	3,040,453

Sources: Appropriation Figures for the Antitrust Division
http://www.usdoj.gov/atr/public/10804a.htm
And Workload Statistics http://www.usdoj.gov/atr/public/workstats.htm

This paper is organized as follows: section II provides the institutional background and related public choice literature. Section III presents a model of antitrust and politics that generates predictions and testable hypotheses. Section IV discusses the data, estimation techniques, and results. Section V concludes.

II. Institutional background and related literature

The passing of the Sherman Act (1890) established the Department of Justice's power to prosecute criminal antitrust violations that involves restraint of trade (§1 prohibits price-fixing, bid-rigging, and allocation of customers) and monopolization (§2 outlaws attempts to suppress competition through predatory

acts). In 1903, thirteen years after the passing of the Sherman Act, the office of the Assistant to the Attorney General was established to administer antitrust laws.[4] This office receives funding separate from the rest of the Department of Justice.[5]

U.S. federal antitrust laws were further buttressed in 1914 by the passing of the Clayton Act and the Federal Trade Commission Act. The Clayton Act is a civil statute carrying no criminal penalties that prohibits anticompetitive mergers and acquisitions.[6] The Division scrutinizes all corporate mergers or acquisitions worth more than $10 million for potential anticompetitive effects. The Division can challenge or block a merger if the economic analysis shows significant competitive harm to consumers.

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[4] An excerpt from the Antitrust Division's website regarding its history: "The Division's organizational roots can be traced to the creation of an Assistant to the Attorney General in March 1903, to take charge of all suits under the antitrust and interstate commerce laws, and to assist the Attorney General and the Solicitor General in the conduct of the general executive work of the Department. The post was created under President Theodore Roosevelt and Attorney General Philander Knox. With the growth of the economy and of corporate enterprise, it became evident that the Department of Justice must have its own corps of specialists in antitrust law to cope with an increasingly complex enforcement situation. Consequently, in 1933, under the administration of President Franklin D. Roosevelt and Attorney General Homer S. Cummings, the Antitrust Division was established." Source: http://www.usdoj.gov/archive/mps/mission2000/mission.htm.

[5] The appropriation of $500,000 authorized for FY 1904 was used to fund the Assistant to the Attorney General for FYs 1903 through 1907. An average of $100,000 is imputed as the annual budget for each FY from 1903 to 1907 in my dataset. Source for budget data: http://www.usdoj.gov/atr/public/10804a.htm.

[6] An excerpt from the Antitrust Division's website regarding the recent change in criminal penalties: "The Department of Justice alone is empowered to bring criminal prosecutions under the Sherman Act. For offenses committed before June 22, 2004, individual violators can be fined up to $350,000 and sentenced to up to 3 years in federal prison for each offense, and corporations can be fined up to $10 million for each offense. For offenses committed on or after June 22, 2004, individual violators can be fined up to $1 million and sentenced to up to 10 years in federal prison for each offense, and corporations can be fined up to $100 million for each offense. Under some circumstances, the maximum fines can go even higher than the Sherman Act maximums to twice the gain or loss involved." Source: http://www.usdoj.gov/atr/public/div_stats/211491.htm.

The Federal Trade Commission (FTC) Act, also a civil statute without criminal penalties, created the sister agency to the Division that investigates unfair methods of competition. The Unites States is unique in having a dual-agency enforcement of antitrust laws but the Division and the FTC have gone through periods of competition and cooperation in antitrust enforcement. Since 1948, the Division and the FTC have cooperated on a formal liaison agreement to allocated antitrust investigations based on their different areas of expertise.[7] In this paper I focus only on the case output of the Antitrust Division and not the FTC because there have been numerous empirical studies on the FTC (see references cited), while the Division is not as widely researched. The FTC's five-Commissioner governance system (two Republicans, two Democrats, and one Independent, each with staggered tenure) complicates the inclusion of the presidential political party in the dataset.

I use modern public choice theory's empirical approach to model the regulator-politician's response to special interests. Empirical public choice studies have shown that regulator-politicians and bureaucrats do not act in the public interest, especially in antitrust policy. For example, Long, Schramm, and Tollison (1973) show that the Division does not initiate antitrust investigations based on the loss of consumer welfare during the period 1945-1970. The authors use Harberger's (1954) model for measuring welfare loss or resource

[7] Antitrust Division Manual, Chapter VII, Antitrust Division Relationships with Other Agencies and with the Public http://www.usdoj.gov/atr/foia/divisionmanual/ch7.htm#a. "Traditionally, duplication of investigations has been avoided in two areas. First, pursuant to a liaison agreement, the Department has referred all civil Robinson-Patman Act matters to the FTC for action, and, second, the FTC routinely refers possible criminal violations of the antitrust laws, such as price fixing, to the Division. The two agencies enforce the balance of the antitrust laws--particularly merger investigations (section 7 of the Clayton Act) and civil non-merger investigations (sections 1 and 2 of the Sherman Act)--concurrently."

misallocation resulting from a monopoly. They find that the welfare loss triangle and excess profit explain very little of the period's antitrust activity. In fact, the authors find that industry size, as measured by sales, is the most important explanatory variable for the Division's antitrust case-bringing activities. In another paper, Siegfried (1975) suggests that antitrust regulation is used to prop up the market prices charged by firms in regulated industries. Furthermore, Siegfried shows that the increase in the number of antitrust cases is associated with greater levels of excess profits in regulated industries and lower levels of welfare losses. Shughart (1997, 339) claims that antitrust bureaucrats "seem to use the discretion available to them to further their own interest rather than those of the public at large."

These studies provide the motivation for my use of Stigler's (1964) and Peltzman's (1976) models of regulation with special interests. I then test a principal-agent model within the context of this special interest model. I assume that Democrats and Republicans differ on their "taste" for antitrust enforcement and their willingness to "pay" for it. Democrats are perceived to be populist or consumer-oriented and more likely to transfer wealth from firms to consumers. Thus, Democrats have a greater preference for antitrust activism and are more willing to appropriate money to pay for it. The President appoints a party loyalist as the Assistant Attorney General for Antitrust who will carry out his party's agenda for antitrust enforcement. Since the Assistant Attorney General is a political appointee, he will have to be confirmed by the Senate. The Senate may subject the White House and the nominee to a difficult confirmation process

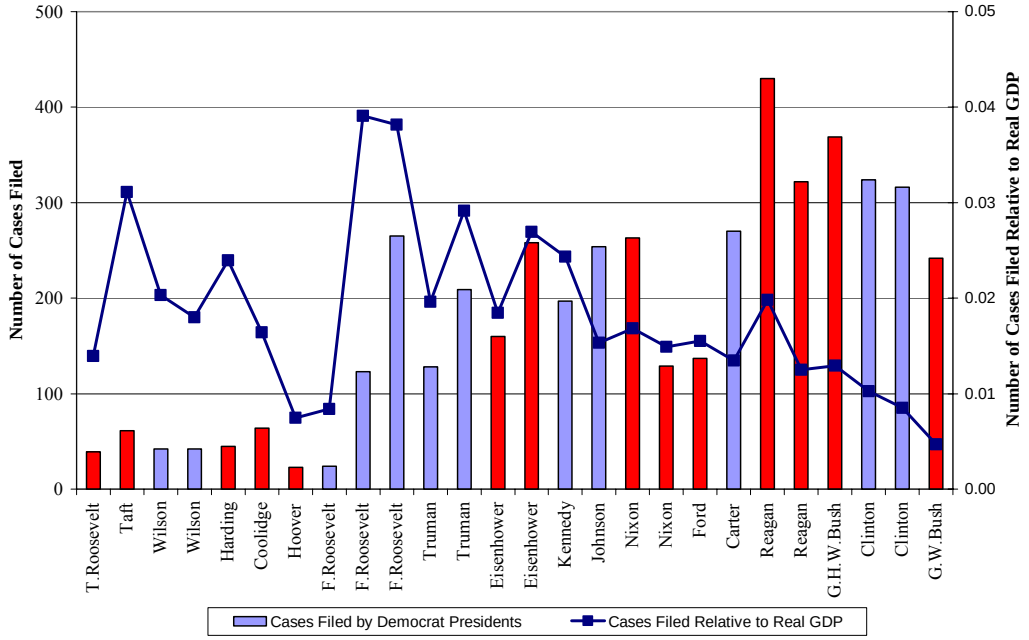
during periods when the party in control of the White House is different from the party in control of the Senate.

The evidence on the effect of the President's party on antitrust policy is mixed. Posner (1970) finds that antitrust activity is countercyclical but the President's party has no significant effect on the number of antitrust cases filed during the period 1890-1969. Posner's analysis does not use any econometric analysis, but he relies instead on computed averages of cases that Democrat and Republican presidents "should have" filed during each term. Yandle (1988) concludes that Republican Administrations tend to decrease Division budgets for the period 1951-1979. Yandle also finds that new Presidents increase the Division's budget in order to appoint more bureaucrats who are supportive of the President's antitrust policies. Moreover, Kwoka (1999) shows that Democratic presidents increase, on average, the DOJ's budget by nearly $14 million for the period 1970-1997. Kwoka claims (1999, 299), "It is commonly believed that the Democratic Party favors stronger antitrust policy, although some past evidence is equivocal on this issue."

Figure 2.1 shows the number of antitrust cases initiated by each presidential term for the period 1903-2005. The red columns represent Republican presidents, while the blue columns represent Democratic presidents. There does not appear to be any discernible pattern, except that the number of cases has trended upward from 1903 to reach its peak during Reagan's first term in office. A majority of the cases during Reagan's first term were filed by Assistant Attorney General William Baxter against highway construction firms

for bid-rigging violations. Since that peak, the number of antitrust cases has decreased steadily, even though the Division has collected greater amounts of criminal fines (See Table 2.1). One possible explanation may be a shift of Division resources to pursue fewer cases with greater perceived harm (thus, the large fines imposed on guilty firms) against consumers. Since the number of antitrust cases filed has increased along with the size of the economy, I also examine the number of cases filed relative to the real GDP, shown as the dark blue line below. Since the end of World War II, the number of cases filed relative to the real GDP has decreased steadily. Since Figure 2.1 suggests that individual presidential terms may affect the pattern of antitrust enforcement, I control for both political party effect and each individual president's effect in my data analysis in Section IV.

Figure 2.1 - Antitrust Cases Filed During Each Presidential Term 1903-2005



Congressional oversight is a possible explanatory variable for regulatory agency output because House and Senate appropriations committees control the budget appropriations for the Division. Lindsay (1976) and Rogowsky (1987) suggest that regulatory agencies and bureaucrats are evaluated on their "visible" output, even though their mission involves producing an "invisible" output. The original goals of antitrust policy include the promotion of competition and the protection of consumers from anticompetitive harm in the marketplace. Both of these goals are difficult to measure. Therefore, Congress estimates bureaucratic output through some crude observable proxies, such as investigations initiated and the number of cases won. The focus on visible output skews the bureaucrats' incentives and diverts resources from the production of invisible output—which are the original goals of the agency—to visible output such as initiating more investigations and winning more cases (particularly those that are smaller, easier to win, and do not take up a lot of resources).

Weingast and Moran (1983) offer further evidence for the congressional oversight hypotheses. They find that changing political majority and ideology of congressional oversight committees influence the case selection at the FTC for the period 1964-1976. They examine four categories of cases—credit, textiles, Robinson-Patman, and merger cases. Merger is the omitted category, since it has the most stable number of cases throughout the period. Weingast and Moran measure political ideology of individual committee members by their ADA scores and estimate the probability that a certain type of case would be filed based on the

ADA scores of the oversight committee chairman and members.[8] Appropriation committees controlled by the Democrats have a higher probability of opening more Robinson-Patman cases, but fewer credit and textile cases, relative to merger cases. For example, a ten-point increase in the Senate subcommittee chairman's ADA score increases the probability of opening a credit case by 2.4 percent, but decreases the probability of opening a textile case by 0.06 percent and a Robinson-Patman case by 0.13 percent.

Bureaucrats decide how many investigations and which cases to pursue, subject to their annual budget constraint. This is particularly true for rank-and-file Division bureaucrats who are not political appointees and thus are not affected by the identity of the President or the majority party in the Congress. Recall that bureaucratic discretion is the null hypothesis explaining antitrust enforcement, while presidential control and congressional oversight are the alternative hypotheses. The conclusion that bureaucrats are independent and have wide discretion over case selection is only valid if presidential control and congressional oversight are insignificant in explaining antitrust enforcement.

Katzmann (1980) and Weaver (1977) explain how the internal incentives of bureaucrats can affect agency output, case selection, budgetary appropriations, and personnel allocation. In models of bureaucratic discretion, Katzmann and Weaver assume that bureaucrats have complete discretion over the conduct of antitrust policy. At the Division, the incentives and preferences of the Assistant Attorney General for Antitrust govern the case selection and allocation of

[8] The ADA score is the Americans for Democratic Action's voting index, ranging from 0 (very conservative politician) to 100 (very liberal politician).

resources to specific cases or bureaucratic areas. Since the Assistant Attorney General is a lawyer, his decisions depend on whether he is a careerist attorney (professional government bureaucrat who will remain in public service) or an outsider (appointed from private practice, with the intention of leaving public service for private practice after his government tenure). A careerist attorney will select larger cases with longer gestation periods and cases with greater perceived harm to the economy. But as a career bureaucrat, he will balance his long-term goals with the need for producing "visible" output to demonstrate his productivity to Congress and the White House. If the Assistant Attorney General is an outsider who will return to private practice after his tenure, his incentives are skewed towards prosecuting smaller cases that will not take a long time to prosecute and will be easy to win. He wants to signal his productivity (with many successful prosecutions) to private law firms.[9]

It is widely understood that Division attorneys view their temporary tenure at the Department of Justice as training before entering private practice. Weaver (1977, 38-40) states, "Experience in the Antitrust Division became newly valuable to a young lawyer who wanted eventually to work in private practice." Katzmann (1980) further notes that "the ultimate career goal of most members of the FTC's legal staff is a job with a prestigious private law firm." He finds that the FTC's case selection is skewed towards smaller cases that are easily won.

[9] At the present time, I am unable to differentiate between small and large cases in my 1903-2005 dataset. I leave for future study, the examination of the bureaucratic productivity hypotheses using a detailed case-level dataset available for the period 1994-2006.

Thus, it is not inconceivable that Division attorneys initiate many investigations in order to increase their "visible" output to Congress.[10]

Eisner and Meier's (1990) study also provides support for the bureaucratic discretion hypothesis. The authors conclude that the antitrust enforcement record during 1959-1984 is due to bureaucratic policies initiated before the Reagan administration and not due to the influence of presidential or congressional politics, as is commonly thought. They cite Assistant Attorney General Thomas Kauper's 1972 initiative to increase the number of Ph.D. economists (as part of the Economic Policy Office) to serve as independent analysts on antirust cases. The authors claim that this bureaucratic initiative in 1972, and not the Reagan administration, led to the revolution in antitrust under Reagan's first term.

The preceding literature review outlines the three possible hypotheses—presidential control, congressional oversight or bureaucratic discretion—for explaining the role of politics in antitrust policy. The next section explicitly models the effect of the White House and Congress in influencing Division bureaucrats' case output.

III. A Demand and Supply Model of Antitrust Enforcement

The relationship between political influence and antitrust activity can be captured by a demand and supply model of antitrust enforcement. My model assumes that the executive branch and both chambers of the legislative branch (House of Representatives and Senate) have significant influences on the

[10] Unfortunately, I am unable to obtain data on bureaucrats' wages, post-DOJ employment, and GS ratings in order to directly examine the bureaucratic incentives hypothesis.

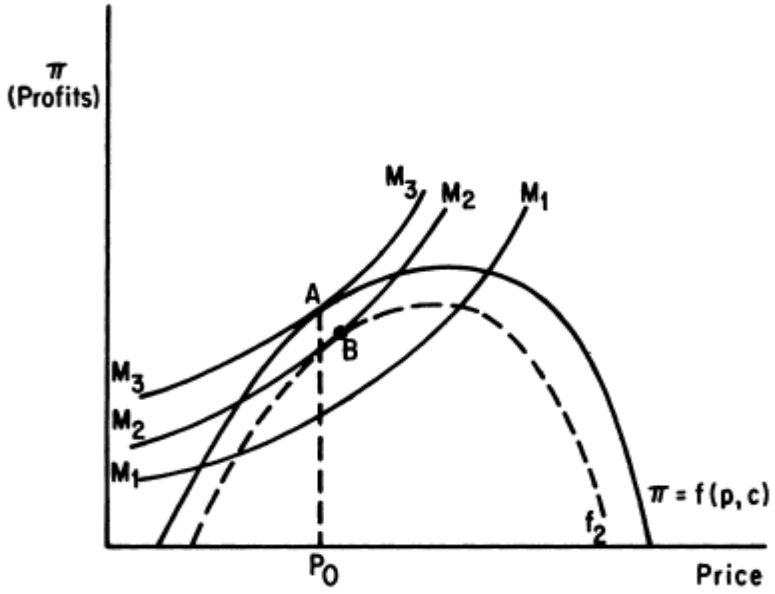
budgetary appropriations and case output of the Division. The demanders of antitrust cases are politicians who maximize their political majority subject to the competing interests of producers and consumers. In other words, politicians demand antitrust cases because their constituents value the wealth transfer generated by these antitrust cases. The suppliers are Division bureaucrats who "produce" antitrust investigations and case filings.

On the demand side, I follow Stigler's (1971) and Peltzman's (1976) models of the behavior of politicians in the market for regulation. These politicians are the U.S. Representative and Senators who sit on congressional appropriations committees and determine the Division's annual budget. In a special application of Peltzman's model, politicians supply price-entry regulation to satisfy their two main constituents: consumers who seek lower prices and producers who seek price controls and entry-limit regulation in order to increase their profits. I translate Peltzman's example of the politician's price-control regulation into the number of antitrust cases demanded in my model.

The politician maximizes her political payoff subject to the producers' profit function, which is directly related to price and inversely related to costs, depicted as the profit hill in Figure 2.2 below. Her political payoff is a function of lower prices and higher profits, which generates a series of iso-majority curves, M_iM_i in Figure 2.2 below. These iso-majority curves describe the politician's preferences or rate of tradeoff between higher profits for producers and lower prices for consumers. I assume that politicians of different parties have different preferences regarding their rate of tradeoff between pro-producer versus pro-

consumer regulation, characterized by the slope of their iso-majority curves. Conventional wisdom states that Democrat politicians have steeper iso-majority curves or a higher rate of tradeoff between consumer price cuts versus producer profits because they are viewed as populist politicians who protect consumers from Big Business. Conversely, Republican politicians have flatter iso-majority curves because they are pro-business. Therefore, the slope of the iso-majority curves represents a politician's taste for antitrust action and her willingness to allocate resources to the Division's budget.[11]

Figure 2.2 - Politician-Regulator's Iso-majority Curves Trading Off Lower Prices for the Consumers and Higher Profits for the Producers (Peltzman 1976, Figure II)



[11] The slope of the iso-majority curves could also depend on the size of the economy. Hirschleifer (1976) describes this result as sharing the pain with pro-producer regulation during economic downturns and sharing the gain with pro-consumer regulation during economic expansions. Therefore, I include the size of the economy (real GDP) in my regression analyses in Section IV.

Peltzman's solution to the politician's problem is the equalization of the marginal political product of a dollar of profits to producers and the marginal political product of a dollar price cut to consumers. The political equilibrium occurs at tangency A, shown on Figure 2.2 above, between the profit function and an iso-majority curve M_3M_3 and results in a politically optimal amount of regulation (regulated price of P_0) or the politically optimal number of antitrust cases in my model. Thus, the solution to the politician's problem results in her demand for antitrust cases. She is willing to demand a certain number of cases and also to appropriate a certain amount of tax revenues to pay for these cases. The demand curve for antitrust cases is inversely related to the demand price or "value" to politicians, arraying the highest-valued cases followed by lower-valued cases in the set of possible case investigations pursued by Division bureaucrats. Politicians rank-order antitrust cases by their demand intensity. For instance, the cases that are alleged to cause a great deal of anticompetitive harm to consumers may have a high value to politicians because of great public interest or great expected publicity. Thus, marginal benefit of additional antitrust cases declines because additional cases have smaller consumer harm, due to the rank-ordering of the cases.

On the supply side, I model Division bureaucrats' behavior in filing antitrust cases. For simplicity, I assume that each case costs the same amount of time and money to litigate. The annual number of cases filed makes up the "visible output" of the Antitrust Division (Lindsay 1976). The bureaucrats are assumed to choose their visible output to maximize their expected benefit

function subject to their appropriated budget constraint. The expected benefit function includes some combination of bureaucratic incentives along with how much bureaucrats care about consumer surplus and producer surplus. As the suppliers of antitrust cases, Division bureaucrats can rank-order their case load by the amount of anticompetitive harm inflicted by an antitrust violation combined with the probability of winning the case in court. The most egregious anticompetitive cases have a high probability of winning in court and are thus "cheaper" to produce. Therefore, the bureaucrats' supply function reflects increasing marginal cost of prosecuting additional cases.

Within a demand and supply framework, there is a strong assumption of price-taking behavior in a competitive model. Unfortunately, the market for antitrust action is not competitive. In fact, there are only two sellers (DOJ and FTC) and three aggregate buyers in a representative democracy (President, Senate, and House). In order to resolve this theoretical quandary, I follow Peltzman's (1976) assumption that sufficient competition exists for the politician's office and that each U.S. Representative or Senator constitutes an effective demander.

The market for antitrust cases has the politician moving first, followed by the Division bureaucrats. The politician determines her individual demand for cases and her willingness to appropriate a budget to pay for these cases. Then, the Division bureaucrats determine their caseload (quantity supplied of a "visible" output) subject to the politician's appropriated budget. Putting the politician's demand and the bureaucrats' supply together, we observe equilibrium price and

quantity of antitrust cases each year. In other words, the annual appropriated budget and number of cases filed result from the politician's and bureaucrats' optimizations.

Since we only observe the equilibrium price-quantity pair each year, I use a reduced form equation to estimate the effect of politics in shifting the equilibrium. Equation (1) below shows the equilibrium budget and caseload that are affected by demand and supply shifters such as political preference for antitrust and general economic conditions. The demand and supply shifters are binary dummy variables equal to one to indicate a Democratic White House, Democratic majorities in the Senate, Democratic majority in the House, and Democratic control in all three. The dummy variable All_Republican, however, takes on the value of one when the White House and both chambers of Congress are controlled by the Republican Party.

(1) $Cases_t = f(Real\ Budget_t, Real\ GDP_t, Democrat\_President_t,$
$Democrat\_House_t, Democrat\_Senate_t, Democrat\_Congress_t,$
$All\_Democrat_t, or\ All\_Republican_t)$

for t = 1903 to 2005.

My model yields two testable hypotheses regarding the effect of politics on antitrust policy changes. The first model prediction regarding presidential party control is an empirical test of conventional wisdom that Democratic politicians prefer more antitrust activism. The model predicts that a Democratic President will appoint Division bureaucrats who are activists in increasing the supply of antitrust cases, *ceteris paribus*. Thus, the average price of an antitrust

case falls and the quantity of antitrust cases increases. A positive and significant coefficient on the Democrat_President dummy variable is evidence in support of this first prediction. The second model prediction regarding congressional oversight states that Democratic majorities in the House and Senate, *ceteris paribus*, will increase the Division's budget appropriations and the demand for antitrust cases. Thus, the average price and the quantity of antitrust cases would increase. Positive and significant coefficients on the Democrat_House, Democrat_Senate, or Democrat_Congress dummy variables are supportive of this second prediction.

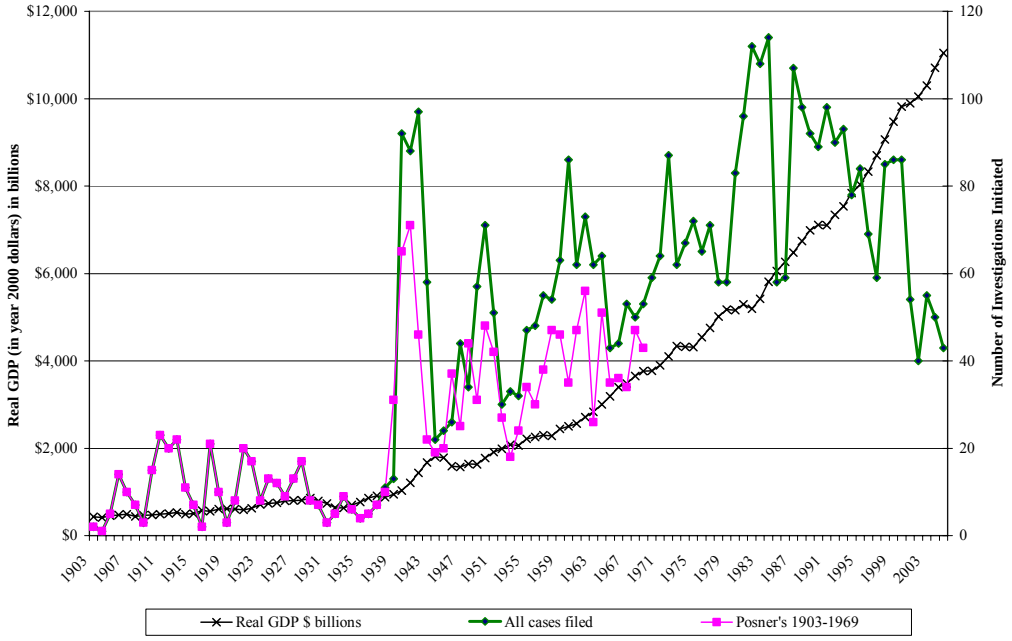
IV. Data, Estimation, and Results

I obtain time series data on Division case output in order to test the hypothesis that presidential party control and congressional control can explain antitrust activity. These data are from the Antitrust Division's Workload Statistics from 1938 to 2005.[12] The Division's annual budget figures are obtain from its website and start in 1903, the year the Office of the Assistant Attorney General in charge of Antitrust was created. For the period 1903-1937, I use Posner's (1970) data from his statistical study of antitrust enforcement from 1890 to 1969. See Figure 2.3 for the line graphs of Posner's data and the Division's Workload Statistics. Both time series for number of cases filed track each other quite consistently. The difference between the Workload Statistics data and Posner's data is due to Posner's consolidation into a single observation, the

[12] I thank Ms. Janie Ingalls of the Department of Justice's Antitrust Documents Group for providing me with hard copies of the Workload Statistics reports.

multiple case filings in a year that involve one firm.[13] I am able to analyze a longer time series from 1903 to 2005 by combining Posner's 1903-1937 data with the 1938-2005 Workload Statistics data.

Figure 2.3 - Department of Justice Antitrust Cases Filed and the Real GDP 1903-2005



See Table 2.2 for summary statistics of the data. Some of these data series cover different time periods due to changes in reporting format and data availability of the Division's Workload Statistics. For instance, the number of all cases filed covers 1903-2005, the number of cases filed (separated by statute: Sherman §1, Sherman §2, Clayton §7, and other) covers 1958-2005, and the number of investigations initiated (separated by statute: Sherman §1, Sherman §2, Clayton §7, and other) covers 1970-2005. In order to use the longest time series

[13] Posner (1970, 367) states, "The reason for this discrepancy is that, with trivial exceptions, every antitrust complaint, indictment, and information is assigned a separate [Commerce Clearing House] Bluebook number when it is filed, with the result that frequently what I consider a single proceeding is counted two or more times."

available, I focus on the natural log of the total cases filed relative to real GDP as the main dependent variable of my analysis. Recall from Figure 2.1 that as the number of antitrust cases filed by the Division increases over time, it has not increased as rapidly as the size of the economy. I deflated the total number of cases filed by the real GDP to gauge the impact of the antitrust caseload relative to the size of the economy.

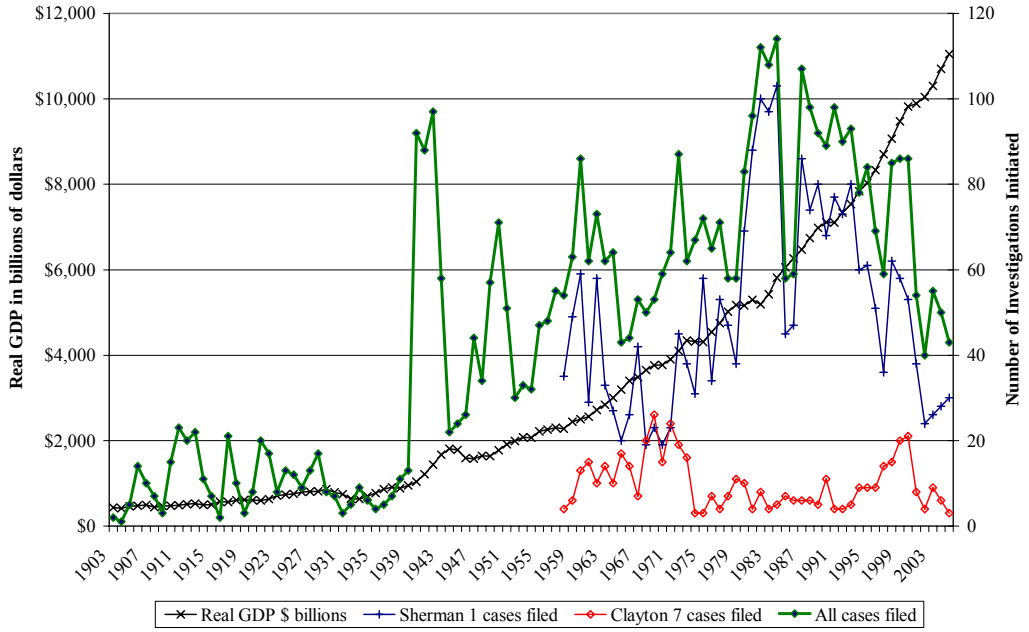
Table 2.2 - Summary Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Year	103	1954	29.88	1903	2005
Real total budget ($'000)	103	18564.61	36851.63	6.08	156441.40
Natural log of real total budget	103	6.56	3.25	1.81	11.96
Differenced real budget ($'000)	102	1533.68	3353.73	-2517.29	17261.02
Real GDP ($ billion)	103	3276.59	3012.40	413.60	11048.60
Natural log of real GDP	103	7.61	1.04	6.02	9.31
Differenced real GDP ($ billion)	102	104.12	124.26	-196.90	403.40
Total cases filed (civil and criminal)	103	45.98	32.80	1	114
Natural log of total cases filed relative to real GDP	103	-4.22	0.66	-6.02	-2.42
Natural log of total cases filed	103	3.39	1.12	0.00	4.74
Differenced total cases filed	102	0.40	16.06	-56	79
Posner's total cases filed	67	22.87	17.15	1	71
Sherman 1 cases filed	48	50.42	23.10	19	103
Sherman 2 cases filed	48	3.69	4.64	0	19
Clayton 7 cases filed	48	9.94	5.97	3	26
Other cases filed	48	10.15	7.10	1	34
Total civil cases filed	68	26.03	13.95	3	72
Total criminal cases filed	68	38.51	26.65	5	100

Sources: Posner (1970), budget appropriations at http://www.usdoj.gov/atr/public/10804a.htm, and workload statistics at http://www.usdoj.gov/atr/public/workstats.htm.

Figure 2.4 shows that the time series for Sherman §1 cases filed closely follows the trend of total cases filed. Merger challenges (Clayton §7) and cases for other statutes are rather small in number and do not significantly change my findings.

Figure 2.4 - Price-Fixing (Sherman 1) and Merger (Clayton 7) Cases Filed Relative to All Cases Filed and the Real GDP, 1903-2005



I include the real GDP (in 2000 dollars) in Figures 2.3 and 2.4 to illustrate the slightly procyclical pattern of the case filings, with a correlation coefficient of 0.6684, for the entire period of 1903-2005. This is in contrast to Posner's finding of a countercyclical pattern in antitrust filings since 1940, when the size of the economy increased significantly without an accompanying increase in antitrust filings. In fact, these correlation results are very sensitive to the particular sub-period chosen for analysis. See Table 2.3 for correlation coefficients between real GDP and number of case filings for different sub-periods.

Table 2.3 – The Correlation Coefficients Between the Real GDP and the Number of Case Filings for Different Sub-periods

Period	Correlation Coefficient	Period Description
1903-2005	0.6684	Entire sample period
1903-1929	0.1358	Beginning of period and before the Depression
1903-1939	0.3160	Beginning of period and after the Depression
1929-1939	0.4874	Great Depression
1940-1945	-0.8702	World War II
1940-1969	-0.1069	Posner's countercyclical period, including WWII
1940-2005	0.3013	My procyclical period, including WWII
1946-1969	0.3132	Posner's later period, excluding WWII
1946-2005	0.3540	My procyclical period, excluding WWII

Sources: Posner (1970) and Workload Statistics http://www.usdoj.gov/atr/public/workstats.htm and hard copies for 1938-2005.

For instance, the correlation between the size of the economy and antitrust activity is procyclical for the period from 1903 to 1939 but becomes countercyclical for the period 1940 to 1969 (corresponding to Posner's (1970) countercyclical findings). The countercyclical result, however, disappears when the sub-period is extended to 2005 because antitrust activity is procyclical from 1940 to 2005. Posner offers a plausible hypothesis for the procyclical result: as the economy expands, the incidence of antitrust violations and the resources appropriated to investigate cases are also increasing.

In contrast, Amacher, Higgins, Shughart and Tollison (1985) find a countercyclical result for the FTC's enforcement activity. Their dependent variables are FTC antitrust cases for the period 1915-1981 and Robinson-Patman cases for the period 1937-1981, while their independent variables include various measures of general economic conditions such as the real gross national product, the unemployment rate of the civilian labor force, the business failure rate per 10,000 firms, and the excess capacity rate. Their result supports Peltzman's

(1976) hypothesis that producer protection regulation increases in response to an economic downturn.

Recall that my model is an empirical test of conventional wisdom, which holds that a Democrat President would appoint Division bureaucrats who are likely to supply more antitrust cases, because Democratic Party loyalists have a stronger preference for antitrust activism and for transferring wealth from firms to consumers. My model also predicts that Democratic majorities in the House and Senate would increase the direct appropriations of the Division because elected Democratic politician-regulators will demand more antitrust cases in order to transfer wealth from firms to consumers. In the style of Peltzman's model, Democratic regulators in my model face a steeper set of iso-majority indifference curves, with different elasticities of substitution, than Republican regulators. My model's demand and supply of antitrust cases, influenced by politics, result in an equilibrium "price" and "quantity" that is estimated by the following reduced form regression equation.

(2) $\ln(Cases_t/GDP_t) = \beta_0 + \beta_1 Diff\_ln(Budget_t) + \beta_2 Democrat_{tk} + \beta_3 Time_t + \varepsilon_t$

for t = 1903 to 2005 and in different model specifications, for k = Democrat President, Democrat House, Democrat Senate, Democrat Congress (House*Senate), All Democrat (President, House, and Senate) and All Republican.

The reduced form estimation using time series data employs ordinary least squares (OLS) with robust standard errors, which accounts for heteroskedasticity in the residuals. Annual budget and GDP are deflated to real year 2000 dollars.

When dealing with time series data, one must be cautious of non-stationary data (where a unit root exists), which could result in spurious t-statistics and incorrect inferences. I use tests for unit root and first-differencing of the data to correct the non-stationarity problem. For the dependent variable, I deflate the number of cases filed by the real GDP to control for the effect suggested by Posner (1970) that the size of the economy influences the incidence of antitrust violations and also the resources appropriated to the Division. Since the time series of the real budget is non-stationary, I use the first-difference of the natural log of the real budget. The Phillips-Perron test for unit root and the Augmented Dickey-Fuller test both confirm that the dependent variable and the first-differenced natural log of real budget do not contain unit roots. Excluded variables that will affect the annual caseload are captured by the error term, ε_t. I include a linear time trend to model the rising budget appropriations, over time, for the Antitrust Division.

Table 2.4 presents the regression results for equation (2). The political dummies show mixed results in explaining the number of antitrust cases filed each year. The dummy variable for a Democrat President is not significant in explaining antitrust case-bringing by the Division in any of the eight specifications. One explanation offered by Powell, Shi, Smith, and Whaley (2005) is that presidential dummies can be highly persistent in time series data and thus, presidential regime differences can turn out to be insignificant in time series analysis.

The dummy variables indicating Democratic majorities in the House, Senate, and both are positively related to the number of antitrust cases filed. The

Congressional politics result is similar to the findings of Kwoka (1999). The statistical significance of these House, Senate, and Congress coefficients show that congressional oversight increases the Antitrust Division's number of cases filed relative to the real GDP by 0.378 percent to 0.586 percent. Over the 103-year time period, the average number of cases filed relative to real GDP is 14.03 cases per trillion dollar of real GDP. The impact of a Democratic House or Senate, evaluated at the mean, is an increase of 5.3 antitrust cases filed per trillion dollar of real GDP. The coefficient for the dummy variable All_Democrat in column (7), indicating a Democrat President and Democratic majorities in both chambers of Congress, is positive as predicted by theory but is not statistically significant.

The negative and significant coefficient for the All_Republican dummy variable in column (8) indicates that during years when the Republicans control the White House and both chambers of Congress, the Division filed 0.599 percent less antitrust cases relative to the real GDP. The impact of this Republican control, evaluated at the mean, is a decrease of 8.4 cases filed per trillion dollar of real GDP. This result is similar to Yandle's (1988) finding.

Table 2.4 - OLS Regressions with Robust Standard Errors

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Dependent variable: Log of Cases Filed Relative to Real GDP, 1903-2005							
Differenced Log of Real Budget	0.137	0.001	0.077	0.067	0.076	0.004	0.12	-0.03
	[0.271]	[0.245]	[0.261]	[0.258]	[0.257]	[0.245]	[0.259]	[0.293]
Democrat_President	0.086				-0.065	-0.025		
	[0.127]				[0.108]	[0.108]		
Democrat_House		0.545				0.586		
		[0.120]**				[0.171]**		
Democrat_Senate			0.378			-0.043		
			[0.123]**			[0.156]		
Democrat_Congress				0.379	0.404			
				[0.123]**	[0.109]**			
All_Democrat							0.178	
							[0.135]	
All_Republican								-0.599
								[0.160]**
Time Trend	-0.005	-0.007	-0.006	-0.006	-0.006	-0.007	-0.005	-0.009
	[0.002]*	[0.002]**	[0.002]**	[0.002]**	[0.002]**	[0.002]**	[0.002]*	[0.002]**
Constant	-3.987	-4.17	-4.112	-4.094	-4.073	-4.156	-4.021	-3.616
	[0.173]**	[0.165]**	[0.173]**	[0.170]**	[0.175]**	[0.168]**	[0.173]**	[0.200]**
Observations	102	102	102	102	102	102	102	102
R-squared	0.07	0.21	0.14	0.14	0.14	0.21	0.08	0.19

Robust standard errors in brackets
* significant at 5%; ** significant at 1%

An alternative estimation method to overcome the problem of the persistent Democrat presidential dummy variable is to use presidential fixed effects or dummy variables for each individual president. The results are presented in Table 2.5 below and none of the presidential dummy variables is significant in explaining the Division's case-bringing behavior.

Table 2.5 - OLS Regressions by Presidential Term and by President

	(1)		(2)
Dependent variable: Log of All Cases Filed at the Antitrust Division, 1903-2005			
	Presidential term fixed effect		Presidential fixed effect
Log of Real Budget	0.338	Log of Real Budget	0.666
	[0.480]		[0.371]
Log of Real GDP	-1.108	Log of Real GDP	0.642
	[1.189]		[0.771]
Taft	0.622	Taft	0.594
	[0.747]		[0.646]
Wilson 1st Term	-0.094	Wilson	-0.184
	[0.808]		[0.612]
Wilson 2nd Term	-0.044		
	[0.968]		
Harding	0.543	Harding	0.64
	[1.308]		[0.888]
Coolidge	0.327	Coolidge	0.172
	[1.492]		[0.875]
Hoover	-0.713	Hoover	-0.518
	[1.867]		[1.074]
F.Roosevelt 1st Term	-0.917	F.Roosevelt	-0.157
	[2.120]		[1.246]
F.Roosevelt 2nd Term	0.001		
	[2.254]		
F.Roosevelt 3rd Term	1.164		
	[2.333]		
Truman 1st Term	0.358	Truman	-0.74
	[2.581]		[1.362]
Truman 2nd Term	0.505		
	[2.715]		
Eisenhower 1st Term	0.273	Eisenhower	-0.911
	[3.057]		[1.637]
Eisenhower 2nd Term	0.603		
	[3.323]		
Kennedy	0.49	Kennedy	-1.024
	[3.524]		[1.792]

Table 2.5 - OLS Regression by Presidential Term and by President (Continued)

	(1)		(2)
Dependent variable: Log of All Cases Filed at the Antitrust Division, 1903-2005			
	Presidential term fixed effect		Presidential fixed effect
Johnson	0.183	Johnson	-1.572
	[3.830]		[1.946]
Nixon 1st Term	0.225	Nixon	-1.821
	[4.076]		[2.078]
Nixon 2nd Term	0.059		
	[4.224]		
Ford	-0.126	Ford	-2.327
	[4.244]		[2.129]
Carter	-0.389	Carter	-2.879
	[4.349]		[2.170]
Reagan 1st Term	-0.183	Reagan	-2.973
	[4.535]		[2.349]
Reagan 2nd Term	-0.539		
	[4.857]		
G.H.W.Bush	-0.509	G.H.W.Bush	-3.222
	[5.106]		[2.544]
Clinton 1st Term	-0.868	Clinton	-3.841
	[5.322]		[2.733]
Clinton 2nd Term	-1.011		
	[5.588]		
G.W.Bush	-1.687	G.W.Bush	-4.725
	[5.861]		[2.924]
Time Trend	0.043	Time Trend	-0.015
	[0.085]		[0.049]
Constant	7.469	Constant	-3.682
	[7.013]		[4.242]
Observations	103	Observations	103
Standard errors in brackets			
* significant at 5%; ** significant at 1%			

Another method to overcome the problem of the persistent Democrat presidential dummy variable is to use dummy variables for the year when the effect of a new president would be most pronounced. It is unlikely that a multi-term Democratic president such as Franklin D. Roosevelt could have affected the conduct of antitrust policy for all twelve years he was in office. It is more reasonable to think that a major antitrust reforms or change resulting from campaign promises would occur in the first or second year of a newly elected

president's term in office. Thus, I construct dummy variables for the first year, second year, and first two years of a president's administration. None of these dummy variables, however, turn out to be statistically significant suggesting that the first two years of a new president's administration do not affect the number of antitrust cases filed by the Division.

I also partition the data into three distinct time periods to reflect the major changes in antitrust policy in the country. The first period from 1903 to 1914 encompasses the Division's status is the sole enforcer of antitrust laws in this country. In other words, the Division is a monopolist supplying antitrust cases. The second period from 1915 to 1948 includes years of competition between the Division and its sister agency, the FTC. Finally, 1948 marks the beginning of a liaison agreement and a period of cooperation between the Division and the FTC. These two agencies currently allocated antitrust cases based on their different areas of expertise. Partitioning the data into these three periods and including political dummy variables do not show any statistically significant result. Neither does using period dummy variables along with the political dummy variables. I conclude that the pattern of antitrust enforcement over time is not related to these three time periods.

In a robust time series specification, I use the first-differenced of the logged data to estimate the effect of political party affiliations on the Division's caseload, controlling for the size of the economy and the Division's budget. The result of the Augmented Dickey-Fuller test for a unit root shows that the first-

differenced of these logged time series are stationary. The first-difference of logs regression equation is as follows:

$$(3) \quad \text{Diff\_ln}(\text{cases}_{t-(t-1)}) = \beta_0 + \beta_1 \text{Diff\_ln}(\text{budget}_{t-(t-1)}) + \beta_2 \text{Diff\_ln}(\text{GDP}_{t-(t-1)}) + \beta_3 \text{Democrat}_{tk} + \varepsilon_t$$

for t = 1903 to 2005 and in different model specifications, for k = Democrat President, Democrat House, Democrat Senate, Democrat Congress (House*Senate) and All Republican (President, House and Senate).

In Table 2.6's the first-differenced regression, none of the political variables is statistically significant, leading me to conclude that presidential control and congressional oversight do not affect bureaucratic behavior at the Division. The results show that the Antitrust Division is a bureaucratic agency that goes about its business and is insulated from political pressure. The behavior of Division bureaucrats is driven by its internal dynamics and incentives (Katzmann 1980 and Weaver 1977), which I am unable to study directly in this paper. Thus, I cannot reject the null hypothesis that Division bureaucrats are largely independent of presidential and congressional politics. This result makes intuitive sense if we consider that the rank and file bureaucrats, not the politically-appointed Division head, are the ones who carry out the Division's daily business of case selection, investigations, and litigation.

Table 2.6 – First-Differenced OLS Regressions with Robust Standard Errors

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent Variable: Differenced Log of Cases Filed at the Antitrust Division, 1903-2005								
Differenced Log Real Budget	-0.056	-0.05	-0.062	-0.054	-0.054	-0.043	-0.047	-0.06
	[0.312]	[0.309]	[0.312]	[0.309]	[0.311]	[0.315]	[0.310]	[0.313]
Differenced Log Real GDP	-1.398	-1.346	-1.454	-1.371	-1.378	-1.343	-1.258	-1.42
	[1.346]	[1.260]	[1.318]	[1.253]	[1.327]	[1.342]	[1.255]	[1.349]
Democrat_President	0				0.005	-0.026		
	[0.121]				[0.133]	[0.110]		
Democrat_House		-0.026				-0.124		
		[0.127]				[0.267]		
Democrat_Senate			0.029			0.131		
			[0.118]			[0.247]		
Democrat_Congress				-0.014	-0.015			
				[0.111]	[0.123]			
All_Democrat							-0.061	
							[0.108]	
All_Republican								-0.013
								[0.158]
Constant	0.08	0.094	0.066	0.087	0.085	0.092	0.096	0.084
	[0.079]	[0.125]	[0.099]	[0.110]	[0.105]	[0.122]	[0.087]	[0.093]
Observations	102	102	102	102	102	102	102	102
R-squared	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02

Robust standard errors in brackets

* significant at 5%; ** significant at 1%

NB: Adding a time trend does not change the signs and magnitudes of the estimates very much.

I also estimate an alternative model that takes into account the two-step process involved in congressional budget appropriations and bureaucratic case-bringing decision. Each year, the Division submits a budget proposal to congressional appropriations committees that are based on its previous year's budget request. Then, congressional politicians on the appropriations committee determine the Division's budget for the upcoming year based on its budget and caseload in the previous year. The previous year's caseload is a "visible" measure used by politicians to determine the Division's productivity and output. Once the budget is appropriated, Division bureaucrats make decisions about which cases and how many cases to pursue. Thus, I first estimate the Division's budget (with only House and Senate dummies because they are the ones who decide the budget) and predict the budget residuals. These predicted budget residuals are the unexplained part of the budget regression that is not related to congressional politics, the previous year's budget and caseload. Then, I include the budget residuals in the second-step estimation of the Division's caseload to see if the presidential dummy variable can explain the bureaucrat's case-selection decision. This two-step procedure to predict budget residuals that are purged of the congressional oversight effect is also used in Weingast and Moran (1987). The first-step regression equation is as follows:

$$(4) \quad \text{Diff\_ln}(\text{Budget}_t) = \beta_0 + \beta_1 \text{Diff\_ln}(\text{Budget}_{t-1}) + \beta_2 \text{Diff\_ln}(\text{Cases}_{t-1}) + \beta_3 \text{Diff\_ln}(\text{GDP}_{t-1}) + \beta_4 \text{Democrat\_House}_t + \beta_4 \text{Democrat\_Senate}_t + \varepsilon_t$$

for t = 1903 to 2005. After the first-step regressions, I predict $Budget\_Residual_t$ and include it in the second-step regression as follows:

(5) $Diff\_ln(Cases_t) = \gamma_0 + \gamma_1(Budget\_Residual_t) + \gamma_2 Democrat\_President_t + \delta_t.$

Table 2.7 presents the results from the above two-step regression. The first two columns include a linear time trend, while the third and fourth columns do not include a time trend. The exclusion of the linear time trend changes the sign and magnitude of the lagged differenced log of real budget and real GDP. However, none of the estimated coefficients are significant in this specification. These results lead me to conclude that congressional oversight does not affect the Division's budget appropriation process and presidential party control does not influence the Division's case selection decisions. In this econometric specification, I do not find any support for the hypotheses of presidential party control and congressional oversight. My results fail to reject the null hypothesis of an independent bureaucracy at the Antitrust Division.

Table 2.7 - Two-Step Budget and Caseload OLS Regressions with Robust Standard Errors

Dependent variables:	(1) Differenced Log of Real Budget	(2) Differenced Log of Cases Filed	(3) Differenced Log of Real Budget	(4) Differenced Log of Cases Filed
Lagged Differenced Log of Real Budget	-0.31		0.084	
	[0.191]		[0.622]	
Lagged Differenced Log of Cases Filed	-0.024		-0.025	
	[0.067]		[0.065]	
Lagged Differenced Log of Real GDP	0.084		-0.31	
	[0.626]		[0.191]	
Democrat_House	0.122		0.122	
	[0.064]		[0.068]	
Democrat_Senate	0.004		0.004	
	[0.064]		[0.062]	
Time Trend	0	-0.002		
	[0.001]	[0.002]		
Predicted Budget Residuals		-0.026		-0.027
		[0.343]		[0.346]
Democrat_President		-0.052		-0.048
		[0.113]		[0.112]
Constant	0.05	0.161	0.05	0.06
	[0.108]	[0.169]	[0.066]	[0.066]
Observations	101	101	101	101
R-squared	0.13	0.01	0.13	0
Robust standard errors in brackets				
* significant at 5%; ** significant at 1%				

V. Conclusion

This paper explores the relationship between the executive and legislative branches' political affiliations and antitrust enforcement activities. I present a demand and supply framework for antitrust cases that is based on Peltzman's (1976) model of the market for regulation. The demanders of antitrust cases are elected U.S. Representatives and Senators who sit on congressional appropriations committees, while the suppliers of antitrust cases are Division bureaucrats appointed by the President. This demand and supply model results in an equilibrium budget and number of cases that are observed each year. These

equilibrium budget and caseload data can be influenced by political variables such as the party affiliation of the president, majority party in the House and Senate, and whether the White House and both chambers of Congress are controlled by the same party.

I cite previous studies that have found significant results for presidential party control, individual president's effect, and congressional oversight. These studies, however, did not take into account the nonstationarity of the time series data and the time persistence of the binary presidential dummy variable. The nonstationarity of the data will result in spurious t-statistics. I employ time-series econometric analysis that corrects for the nonstationarity of these time series data by using a first-differencing technique. After this correction of the data, the statistical significance of the political variables disappears. Thus, I fail to support the hypotheses of presidential party control and congressional oversight in time-series regression analyses examining the relationship between political variables and the Division's antitrust activities. My findings support the hypothesis of an independent bureaucracy at the Antitrust Division.

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RELATIVE PRICES AND FAMILY VALUES: AN APPLICATION DURING WORLD WAR II[1]

I. Introduction

> "Black women have been handicapped by the increasing shortage of marriageable Black men."
>
> - Lynn Norment (1992)

The basic tenet of price theory is that relative prices matter. We explore this economic tenet in abstract settings such as the market for human sexual relations and marriage. In particular, we analyze the question of whether the exodus of young white males to fight in World War II affected the price of sexual relations. Since most sex acts are transacted in non-market settings without quid pro quo exchanges, we can only look at an instrument, namely illegitimate births. We show that the reduction in the number of available sex partners for women during the war reduced the price that remaining men had to pay for sex. One result of this lower price is an increase in the number of children born without married parents.[2] We draw further corollaries regarding the relative scarcity of men during this period by examining the differences in age, education attainment,

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[1] This essay is coauthored with Robert E. McCormick of Clemson University and Mason S. Gerety of Northern Arizona University. We thank Eric Bertonazzi and Jody Lipford for their help in earlier drafts of this paper. The usual caveat applies.

[2] Posner (1994) defines the effective sex ratio as "the ratio of males to *available* females." (p. 136) High effective sex ratios lead to more homosexual contacts and the use of prostitutes. Low effective sex ratios lead to an increase in illegitimate births. Posner focuses on urban black America for his supporting evidence, and claims that because the effective sex ratio for urban blacks is so low, "that with so favorable an effective sex ratio, black men (outside of prison) will be less likely than white men to engage in opportunistic homosexual behavior or patronize prostitutes but are more likely to have multiple sex partners, to be initiated into sex early, and to father illegitimate children." (p. 138).

and income between couples that married during the war. Large disparities in age, education, and income indicate that women are marrying less suitable men who are beneath their socioeconomic class.

The idea that the balance between the number of men and women in a society may be an important determinant of social mores and relationships is not new to either the sociology or cultural anthropology literature (Norment 1992). A psychologist, Harriette McAdoo, reports that there are between 35 to 45 black men available for every 100 black women, that is single men who are employed, out of jail, and non drug users. She also claims that for wealthy black women the ratio is even more lopsided, one per hundred. Aborampah (1989) discusses the effect of this low sex ratio on black women where "the low sex ratio puts black women at a disadvantage in mate selection. As a result of the black male shortage, there is intense competition for the available few." Staples (1978, 65) argues "to bargain effectively, the black woman must use the enticement of sex … Given the abundance of women around, he [the black male] does not have to wait too long, and her alternatives are limited because of the shortage of men." Again, Braithwaite (1981) claims that, "the insufficient supply of Black men pits Black women against each other in competition for the attention of this scarce resource." Guttentag and Secord (1983) find empirical evidence to support the assertion that this competition for men will lead to more illegitimate births. Using cross-sectional data from the National Center for Health Statistics, they find a strong negative correlation between the sex ratios for nonwhites and the proportion of nonwhite live births that were illegitimate [-0.76 in 1960 and -0.75 in 1970]. They

conclude that "there seems little doubt that sex ratios and illegitimacy are … very strongly correlated."

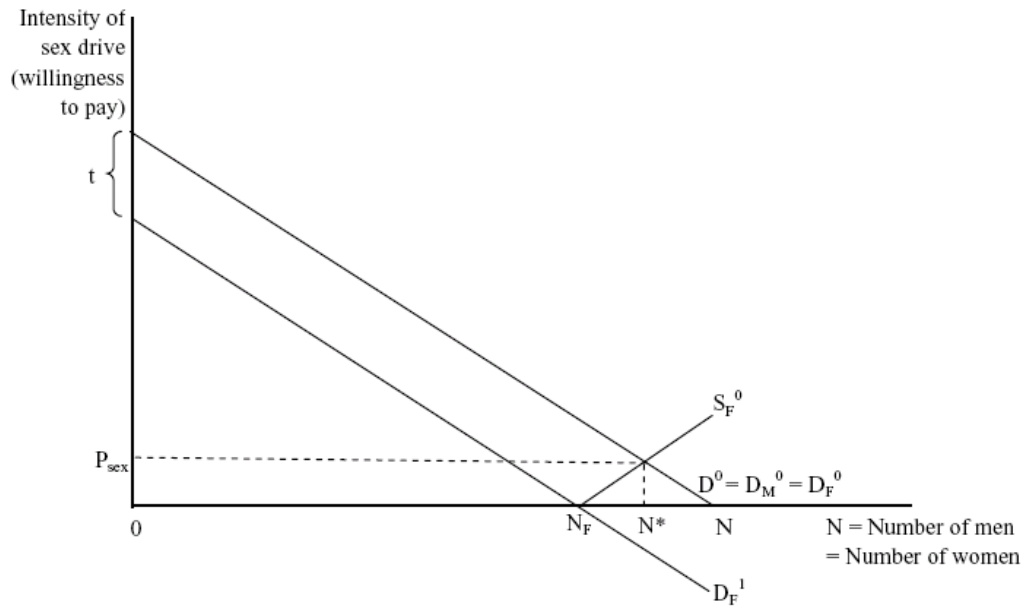
While these assertions and discussions are illuminating, they do not provide a controlled experimental setting. We wish to examine how the radical and unexpected changes in the sex ratio of males to females impact the incidence of illegitimate births. To accomplish this, we examine the American World War II experience, and confine our discussion to whites. The next section will present a model that allows for the changes in the sex ratio to affect the patterns of illegitimacy. We also present evidence about the types of matches that occur during periods of male scarcity.

II. A Model of Sexual Relations

We adopt a demand and supply framework to determine the "price" and quantity of matches that occur. In this non-market setting, the "price" is defined as some combination of marriage and fidelity promises, legal obligations from marriage, and wealth transfers–either pre- or post-marriage–from a male to a female. In Figure 3.1, the N number of males are arrayed according to the intensity of their demand for sex (or their willingness to pay for sex) along the demand curve D_M^0. The men are rank-ordered from left to right or highest demand intensity to lowest demand intensity. Similarly, there are N females in this population and they are also arrayed, from left to right, according to their intensity of demand for sex along the demand curve D_F^0. In a world where males and females are identical, except for their varying demand intensity for sex, the

male demand curve D_M^0 is exactly the same as the female demand curve D_F^0 and every male and female would be matched. In fact, sexual matches occur at every point along the demand curve. There are *N* matched couples in this world and no males or females remain unmatched.

Figure 3.1 - The Market for Sexual Relations Between Heterosexual Males and Females Prior to World War II



We observe, however, that females bear an expected cost "*t*" of possible pregnancy, which decreases their demand intensity for sex by the amount "*t*". The cost "*t*" includes the health risk of bearing a child and the time and monetary expense involved in raising a child. Thus, the females' demand curve for sexual relations is shifted down by "*t*" and results in the new curve D_F^1. Note that N-N_F women have a negative valuation for sexual relations. In fact, these women must be compensated in order to induce them to match with a man. The females who

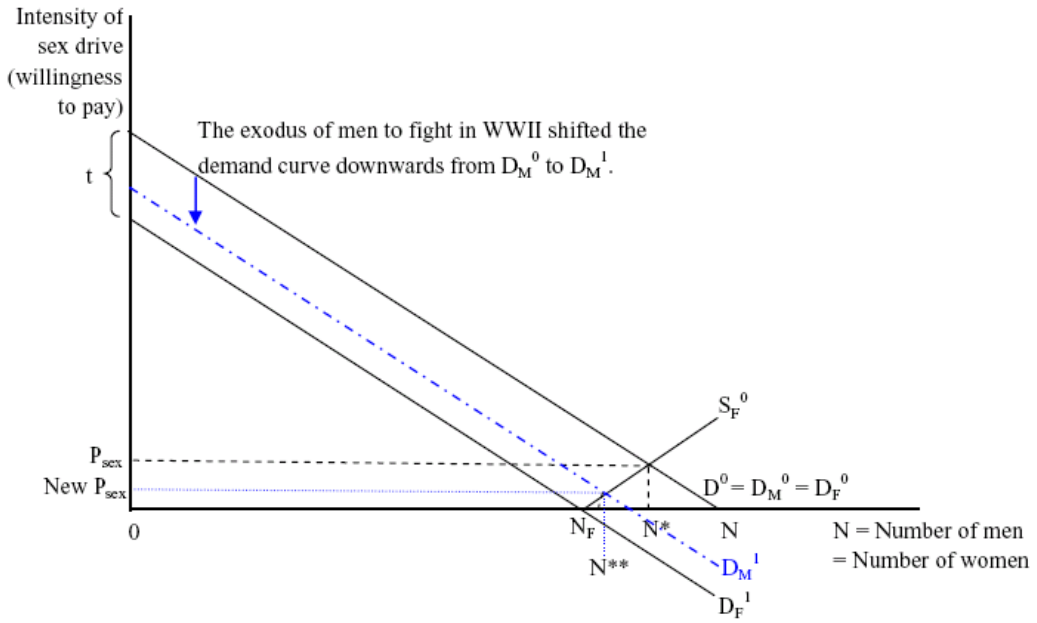
have smaller negative demand intensity for sex, are closer to the point N_F and they require less compensation than females who have large negative demand intensity for sex (those who are closer to the point N). The N-th female in this population, the one with the lowest demand intensity for sex, would demand the entire amount "t" as payment for matching with a male. The females who possess negative demand values for sex will match themselves to a male if he is willing to pay a "price"–like marriage, gifts, and monetary support–for them. These low sex drive females have become "suppliers" arrayed along the supply curve S_F^0. This supply curve is obtained by pivoting the negative portion of female demand curve, from N_F to D_F^1, to become S_F^0. Both S_F^0 and D_F^1 share the same horizontal intercept, N_F, and have the same slope (but with different signs, of course).

The equilibrium number of N^* matches occurs where the new supply curve S_F^0 intersects the male demand curve D_M^0. The resulting price, P_{sex}, is the wealth transfer–marriage obligations, gifts, and monetary support–extracted by all married women. Since a man cannot differentiate between high demand intensity women and low demand intensity women, he has to pay the price of P_{sex} to the woman that he marries. Thus, the high demand intensity females are price-protected by the low demand intensity females. There are, however, $2(N–N^*)$ men and women who do not match with a spouse.

This framework is useful to analyze our question of relative price because a decrease in the effective sex ratio can be modeled as a downward shift in the men's demand curve, shown in Figure 3.2 below. The exodus of men to fight in World War II shifted the males' demand curve for sex from D_M^0 to D_M^1. Due to

the relative scarcity of men, the remaining males pay a lower price, new P_{sex}, to their spouses. Also note that there are fewer couples, N^{**}, who are matched after the exodus of soldiers sent to fight abroad.

Figure 3.2 - The Market for Sexual Relations Between Heterosexual Males and Females During World War II



The new P_{sex} could be interpreted as a smaller wealth transfer that is extracted by the married females or the lack of a marriage bond prior to sexual relations. Females, who previously could expect a legal marriage contract from a man before engaging in sex, now have to accept a lower "price" for sexual relations. The relative scarcity of men induce women into competition for the remaining available men, including sexual competition where women would have sex with men without the benefit of marriage and without the use of birth control, thus resulting in illegitimate births. This situation describes an equilibrium where

the increased level of illegitimate births is determined by the decrease in the sex ratio.

Another implication from this model predicts the resulting matches as being different from the pre-War norm, that is, women are marrying less suitable men. The traditional ideal of male-female coupling suggests that women prefer to marry men who are a couple of years older than them, men who had more years of education than them, and men who earn higher wages than them. The matches that occurred during this period of male scarcity may include couples who are very different from each other or from different socioeconomic classes. For instance, a woman may have resorted to marrying a man who is much older or younger than her, a man who has considerably less education than her, or a man who makes less money than she does. The next section describes our data sources and provides some econometric evidence for the predictions of the model.

III. The Data and Some Evidence

In this section, we collect census data to directly test the prediction of the model regarding the effect of the change in the sex ratio on the illegitimate birth rate. In order to compute the sex ratio during the war, we start with the number of males and the number of females in each state as counted by the 1940 census. Then, we subtract from the male population in each month, the number of draftees called by the Selective Service, starting in December 1940. We then recomputed the sex ratio using the revised number of males relative to the number of females. At the end of the war, we allow the surviving males to return. Table 3.1 shows

the sex ratio for the United States (averaged for 42 states in our data set) for the period 1940-1945, except 1942. The highest ratio of men to women over this period occurs in Nevada in 1941 and the lowest ratio is found in the District of Columbia in 1945. The national sex ratio decreased dramatically throughout the war period, resulting in the lowest sex ratio in 1945 where there were only 80.9 males per 100 females in the country.

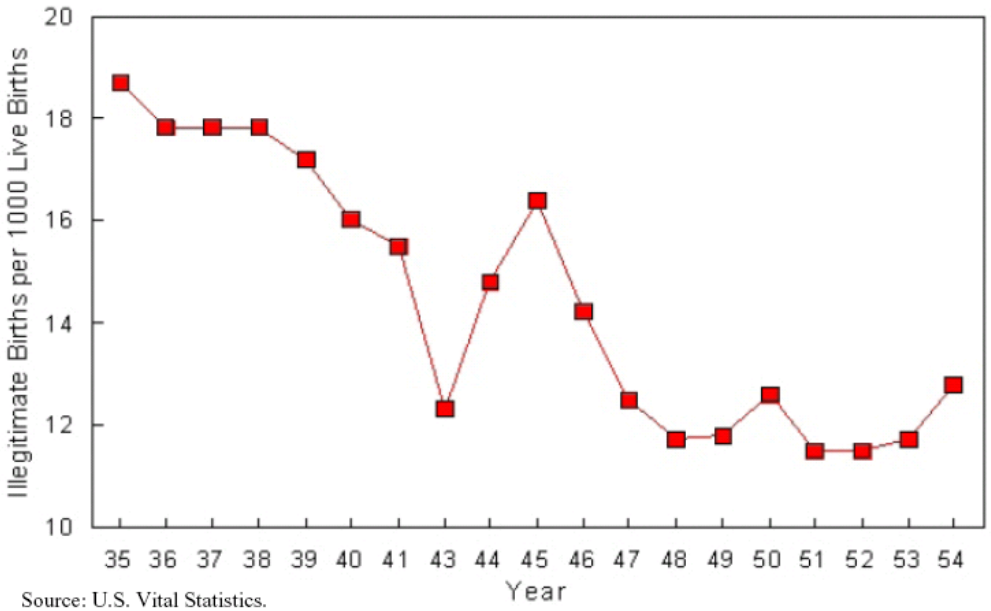
Table 3.1 - U.S. Average Male-Female Population Ratio for 42 States

Year	Male-Female Ratio (Computed)
1940	0.95
1941	0.895
1943	0.848
1944	0.824
1945	0.809

Source: U.S. Census Bureau

As predicted by our model, the decrease in the sex ratio is accompanied by a sharp increase in the illegitimate birth rate from 1943 to 1945, as depicted in Figure 3.3 below. We are unable to obtain data for 1942. The downward trend present prior to the war reverses itself during the war and appears to return to long-run trend levels after the war. The U.S. average (for whites) illegitimate birth rate over the war period is 19.3 per 1000 live births. The lowest incidence is found in Utah in 1943 at 6.1 and the highest is observed in Maine in 1945 at 50.5.

Figure 3.3 – U.S. Average Illegitimate Births per 1000 Live Births (Whites Only)



Source: U.S. Vital Statistics.
Note: Data for 1942 are missing.

We also present some econometric evidence for the relationship between the sex ratio and the illegitimate birth rate. The summary statistics of the data are presented in Table 3.2 below. Recall that we have data on 156 state-year observations that spans 1941-1945 (except 1942) and includes 42 states.[3] The dependent variable of interest is each state's illegitimate births per 1000 live births. We include the illegitimate birth rate in 1935 as a baseline control variable. We also control for each state's income per capita, median years of school, population density, four-firm church concentration ratio and church membership in 1950. The independent variable of interest is the sex ratio or the male to female ratio, either contemporaneous with the illegitimate births data or

[3] We only have one year's observation for Colorado, Connecticut, and New Mexico and 3 years' observations for Arizona, Idaho, and Nevada. The nine states not included in our data set are Alaska, California, Hawaii, Maryland, Massachusetts, Nebraska, New Hampshire, New York, and Wyoming.

lagged by one year. We lag the sex ratio by one year because any change in the price of sexual relations (especially out of wedlock sex) will only manifest itself after a nine-month gestation period.

Table 3.2 - Summary Statistics for 42 States During 1941-1945 (Except 1942)

Variable	Obs	Mean	Std. Dev.	Min	Max
Illegitimate Birth Rate in 1935	156	19.89	6.67	8.53	41.42
Illegitimate Births per 1000 Live Births	156	19.29	8.15	6.10	50.50
Income per Capita	156	540.23	187.10	242	1066
Median Years of Schooling	156	8.91	0.82	7.8	12.1
Population Density	156	194.97	749.76	0.94	4743.26
Military Draftees	156	30540.25	42041.11	1050	340012
Male/Female Ratio (contemporaneous)	156	0.93	0.08	0.76	1.24
Male/Female Ratio (lagged one year)	156	0.95	0.08	0.77	1.26
4-Firm Church Concentration Ratio	156	75.60	10.13	51.70	96.60
Church Membership in 1950	156	47.02	11.37	27.70	75.70
Percent Protestant in 1950	156	30.13	10.09	13.80	68.80
Percent Catholic in 1950	156	15.52	12.79	0.60	58.90
Percent Jewish in 1950	156	1.21	1.57	0	7.50

Source: U.S. Census Bureau and U.S. Vital Statistics

We use ordinary least squares (OLS) to estimate the following illegitimate births regression equation:

(1) $$\text{Illegitimate births}_{jt} = \beta_0 + \beta_1(\text{Illegitimate births in 1935})_j + \beta_2(\text{Median years of schooling})_j + \beta_3(\text{Income per capita})_j + \beta_4(\text{Population density})_j + \beta_5(\text{Male-female ratio})_{jt} + \beta_6(\text{4-firm church concentration ratio})_j + \beta_7(\text{Church membership in 1950})_j + \beta_8(\text{Year dummies})_t + \beta_9(\text{State dummies})_j + \varepsilon_{jt}$$

for j = 42 states and t = 1941, 1943, 1944, and 1945. Note that we use two different measures of the male-female ratio: contemporaneous and lagged by one year.

Table 3.3 - OLS Regressions for 42 States During 1941-1945 (Except 1942)

	(1)	(2)	(3)	(4)
Dependent variable: Illegitimate Births per 1000 Live Births				
Male/Female Ratio (contemporaneous)	-12.813		-18.306	
	[4.713]**		[5.402]**	
Male/Female Ratio (lagged one year)		-19.587		-29.876
		[5.057]**		[5.520]**
Illegitimate Birth Rate in 1935	1.109	1.104	1.175	1.178
	[0.074]**	[0.071]**	[0.096]**	[0.084]**
Median Years of Schooling	1.955	2.198	3.043	3.636
	[0.805]*	[0.782]**	[1.098]**	[0.963]**
Income per Capita	-0.008	-0.007	-0.001	0.003
	[0.002]**	[0.002]**	[0.005]	[0.004]
Population Density	0.0006	0.0003	-0.0014	-0.0024
	[0.0009]	[0.0009]	[0.0011]	[0.0010]*
4-Firm Church Concentration Ratio	-0.132	-0.137	-0.151	-0.141
	[0.038]**	[0.037]**	[0.054]**	[0.048]**
Church Membership in 1950	0.072	0.07	-0.021	-0.076
	[0.031]*	[0.032]*	[0.046]	[0.041]
Constant	2.199	7.498	-0.349	6.226
	[7.507]	[7.359]	[9.519]	[8.070]
State fixed effects?	No	No	Yes	Yes
Observations	156	156	156	156
R-squared	0.78	0.8	0.86	0.88
Robust standard errors in brackets				
* significant at 5%; ** significant at 1%				

The illegitimate births regression results are presented in Table 3.3. In columns (1) and (2) the independent variable of interest, the lagged and contemporaneous male-female ratio, is negative and statistically significant in explaining illegitimate birth rates during the war. A 10 percent decrease in the sex ratio (a reduction of 10 males per 100 females in the population) in a given year will result in an increase of 1.96 illegitimate births per 1000 live births in the following year. While a 10 percent decrease in the contemporaneous sex ratio will result in an increase of 1.28 illegitimate births per 1000 live births. We add state dummy variables in columns (3) and (4) to control for unobservable state-specific effects that could influence the illegitimate birth rate in each state. We

obtain larger positive and statistically significant coefficients for the contemporaneous and lagged sex ratio variables, indicating that the variation in the sex ratio is an important explanatory variable for the changes in the illegitimate birth rate during this period.

In all four specifications in Table 3.3, the baseline illegitimate birth rate in 1935 is positive and statistically significant in explaining the illegitimate birth rate during the war years. These positive coefficients show that the illegitimate birth rate during World War II was higher than in 1935. The coefficient for median years of schooling is positive and statistically significant, suggesting that states with better educated populations have higher illegitimate birth rates during the war. The median level of education in a state may be correlated with the levels of tolerance within a state. For instance, states with higher median years of schooling tend to be in the West and Northeast (morally liberal states), while states with lower median years of schooling tend to be in the South (morally conservative states where the social censure of illegitimacy is more severe).[4] Higher income states tend to have lower incidences of illegitimate births during the war. Population density, however, does not significantly affect the illegitimate birth rate in the states. The four-firm church concentration ratio, which measures the total market share (in terms of adherents) of the four largest religious institutions in each state, is negative and significant in explaining illegitimate birth rates during the war. States with a high religious concentration

[4] The top ten states with the highest median years of schooling are the District of Columbia, Utah, Nevada, Washington, Oregon, Maine, Arizona, Florida, Colorado, and Texas. The bottom ten states with the lowest median years of schooling are Kentucky, West Virginia, Tennessee, Arkansas, North Carolina, Alabama, Louisiana, New Mexico, Virginia, and Georgia.

ratio (such as Utah, with 96.6% of the population belonging to the four largest religious establishments within the state) may have a lower tolerance for illegitimacy.

The results in Table 3.3 suggest that the sharp decrease in the male-female population ratio increased the bargaining power of males relative to females. Thus, the remaining males do not have to pay as high a "price" to couple with females during the war and the decrease in the "price" of sexual relations resulted in increased births out of wedlock.

The decrease in the sex ratio also implies a corollary in the marriage market where women became willing to marry less suitable men. The women who married during the war may have husbands who are a lot older than them or younger. The husbands may also have less education, and a lower-paying job. In order to test these corollaries, we obtained data on 9,968 married couples from the Integrated Public Use Microdata Samples (IPUMS) database. These couples were married during the period 1936 to 1950. The demographic and economic information for these couples are observed during census years 1940, 1950, and 1960. The year of marriage and age at marriage are invariant with respect to time, but the data on education, occupation, and income are recorded with respect to the census year observed. See Table 3.4 for the differences between married couples in terms of their marriage ages, real incomes, real wages, occupational income score, socioeconomic index, and years of education.[5] These couples are listed by their year of marriage.

[5] The IPUMS's Duncan socioeconomic index is a measure of occupational status based upon the income level and educational attainment associated with each occupation in 1950.

In Table 3.5, we perform a difference-in-difference analysis of these 9,968 married couples in order to detect any changes in their ages at marriage and their economic status. The married couples are grouped in five-year intervals according to their year of marriage: period 1 for the pre-war years (1936-1940), period 2 for the war years (1941-1945), and period 3 for the post-war years (1946-1950). The average difference in age at marriage for the period before the war and the period during the war is -0.22 years for men and 0.11 years for women. Women who married during the war were, on average, older than women who married before or after the war, and these women married men who were, on average, younger than the men who married before the war. The net difference between male and female age at marriage between these two periods is -0.33 years, more than twice the -0.14 years net difference between the war period and post-war period. According to a t-test for means, these two numbers are statistically different from one another at the one percent level of significance.

Table 3.4 - Married Male-Female Differences By Year of Marriage, Observed During Census Years 1940, 1950, and 1960

Year married	1936	1937	1938	1939	1940	1941	1942	1943	1944	1945	1946	1947	1948	1949	1950
Number of couples	646	674	739	648	712	620	686	591	529	653	791	785	723	615	556
Average age of males at marriage	25.76	25.73	26.46	26.02	26.13	25.72	25.52	25.86	25.93	26.02	25.39	25.60	25.72	25.49	25.44
Average age of females at marriage	22.34	22.27	22.49	22.06	22.98	22.42	22.26	22.06	23.09	22.98	22.09	22.27	22.67	22.45	22.66
Average male-female age difference at marriage	3.83	3.83	4.06	4.17	3.27	3.37	3.47	3.73	3.20	3.57	3.56	3.03	3.43	3.23	3.37
Average real income of males*	4497.32	4580.36	4483.79	4847.11	4944.75	5660.96	5833.26	5742.27	5340.96	5393.91	5178.67	5492.77	5230.53	5524.71	5650.54
Average real income of females*	603.11	673.60	609.46	777.11	673.69	781.05	677.99	764.38	548.87	601.15	587.93	567.07	570.68	441.71	512.41
Average difference in male-female real income*	3894.21	3906.76	3874.33	4070.00	4271.06	4879.91	5155.27	4977.89	4792.10	4792.77	4590.74	4925.70	4659.86	5083.00	5138.13
Average real wage of males*	3679.11	3514.81	3346.23	3953.00	3837.12	4501.12	4573.75	4576.41	4247.49	4228.97	4142.61	4545.33	4293.05	4519.84	4380.90
Average real wage of females*	531.59	581.24	529.42	646.40	596.73	706.13	614.65	596.62	486.58	520.75	503.10	477.13	499.45	419.59	448.47
Average difference in male-female real wage*	3147.52	2933.56	2816.82	3306.59	3240.39	3795.00	3959.10	3879.80	3760.91	3708.21	3639.51	4068.20	3793.61	4100.25	3932.42
Average occupational score of males	26.62	27.52	26.40	26.38	27.17	27.92	28.19	27.19	26.87	26.81	26.84	26.77	27.17	27.40	27.78
Average occupational score of females	8.12	8.92	7.88	9.17	9.00	10.98	9.57	10.89	10.36	10.46	10.35	10.85	10.32	11.84	13.08
Average difference in male-female occupational score	18.50	18.60	18.53	17.21	18.17	16.95	18.62	16.30	16.50	16.35	16.49	15.92	16.85	15.56	14.70
Average Duncan socio-economic index o males	32.80	33.72	32.99	32.88	34.02	36.49	36.06	35.20	34.16	35.04	33.88	34.37	34.11	35.34	35.79
Average Duncan socio-economic index o females	12.86	14.81	12.91	15.73	15.34	18.33	16.38	18.77	18.74	18.38	17.77	19.23	18.26	20.15	23.68
Average difference in male-female Duncan socio-economic index	19.94	18.91	20.08	17.15	18.68	18.16	19.68	16.43	15.42	16.66	16.11	15.14	15.84	15.19	12.12
Average educational attainment of males	9.86	9.98	9.88	10.15	10.11	10.44	10.81	10.73	10.54	10.54	10.41	10.67	10.79	10.95	11.08
Average educational attainment of females**	10.11	10.31	10.25	10.44	10.49	10.7	10.97	10.87	10.89	10.78	10.92	10.91	10.97	11.20	11.10
Average difference in male-female educational attainment	-0.2519	-0.3485	-0.4034	-0.2453	-0.3077	-0.1730	-0.1203	-0.1790	-0.3383	-0.1056	-0.3512	-0.1697	-0.0894	-0.1972	0.0639

*real income or wage in constant 1960 dollars

**missing data for female educational attainment in 1950 census

Source: IPUMS 1% Census Samples for 1940, 1950, and 1960

Table 3.5 - Difference-in-Difference Analysis Between Married Males and Married Females Grouped By 5-Year Intervals of Marriage Year.

Period married	Period 2 1941-1945	Period 1 1936-1940	Period 1 - Period 2 Pre and During War	Period 3 1946-1950	Period 2 1941-1945	Period 2 - Period 3 During and Post War
Number of couples	3079	3419		3470	3079	
Average age of males at marriage	25.81	26.03	-0.22	25.53	25.81	-0.28
Average age of females at marriage	22.55	22.44	0.11	22.41	22.55	-0.14
Average male-female age difference at marriage	3.48	3.83	-0.33**	3.28	3.48	-0.14
Average real income of males[1]	5603.34	4670.24	933.1	5397.47	5603.34	-205.87
Average real income of females[1]	676.84	666.06	10.78	541.6	676.84	-135.24
Average difference in male-female real income[1]	4926.5	4004.18	922.32**	4855.87	4926.5	-70.63
Average real wage of males[1]	4430.46	3659.59	770.87	4370.1	4430.46	-60.36
Average real wage of females[1]	606.89	576.23	30.66	472.91	606.89	-133.98
Average difference in male-female real wage[1]	3823.57	3083.35	740.21**	3897.19	3823.57	73.62
Average occupational score of males	27.42	26.82	0.6	27.14	27.42	-0.28
Average occupational score of females	10.43	8.61	1.82	11.16	10.43	0.73
Average difference in male-female occupational score	16.99	18.21	-1.22**	15.99	16.99	-1.01**
Average Duncan socio-economic index of males	35.44	33.29	2.15	34.6	35.44	-0.84
Average Duncan socio-economic index of females	18.06	14.31	3.75	19.57	18.06	1.51
Average difference in male-female Duncan socio-economic index	17.38	18.98	-1.6*	15.03	17.38	-2.35**
Average educational attainment of males	10.62	9.99	0.63	10.75	10.62	0.13
Average educational attainment of females[2]	10.84	10.32	0.52	11.01	10.84	0.17
Average difference in male-female educational attainment	-0.1770	-0.3137	-0.11*	-0.1595	-0.1770	-0.04

[1] real income or wage in constant 1960 dollars

[2] missing data for female educational attainment in 1950

* difference is significant at 5%; ** difference is significant at 1%

Source: IPUMS 1% Census Samples for 1940, 1950, and 1960

We also observe statistically significant differences between married males and married females in the pre-, during, and post-war periods for the four economic variables and the education variable listed in Table 3.5. According to the net difference in real income and real wage, married males earned significantly more money than their wives, for pre-war and during war period, but these differences narrowed sharply after the war.

The increase in years of education before the war and during the war is 0.63 years for men and 0.52 years for women, resulting in a net difference of 0.11 years of education between married men and married women between these two periods. These increases in years of education slowed down after the war, such that the average married female has become better educated than her husband by a net difference of -0.04 years.

Another corollary predicted by our model is about the suitability of the spouses that married during the war. Our model predicts that women want to marry men who are similar in age to them, have not been previously married, are of the same race and birthplaces as their wives, have higher if not equal educational attainment, economic standing, and earning power compared to their wives. During the period of male scarcity, women are more likely to match up with the remaining available men, despite their age, previous marital status, race, birthplace, educational attainment, socioeconomic standing, and income.

To test the statistical significance of the corollary predicted by our model, we estimate the following system of eleven equations by Zellner's (1962) seemingly unrelated regression (SUR) method. The married male-female

differences in age, education, and income are highly collinear with each other, thus inflating the standard errors from the OLS regression and consequently, deflating the t-statistics of the estimates. The problem with including highly collinear explanatory variables in a single regression is the difficulty in interpreting how much of the dependent variable's variance is explained by each of the correlated independent variables. The SUR technique allows for the estimation of a system of equations with correlated error terms between equations. The eleven equations to be estimated are the differences between married couples (defined as the husband's variable minus his wife's variable), each explained by the state's male-female sex ratio and state fixed-effects.

$$(2) \quad (\text{Married male-female differences}_k)_i = \delta_0 + \delta_1(\text{Sex ratio})_{jt} + \delta_2(\text{State dummies})_j + \gamma_i$$

for i = 7,797 couples observed at census years 1940, 1950, or 1960; t = year of marriage from 1937 to 1950 (1936 is the omitted year); and j = 50 states (Alabama is the omitted category). The subscript k indexes the eleven equations with the following dependent variables: both married previously binary variable, husband previously married binary variable, wife previously married binary variable, different races binary variable, different birth place binary variable, difference in years of education, difference in socioeconomic index, difference in occupational income score, difference in real (1960 constant dollars) income, and difference in real (1960 constant dollars) wage.

It should be noted that our data set is not a panel structure. We do not observe the same couples in all three census years of 1940, 1950, and 1960.

These observations are stacked cross sections from the IPUMS's 1% census samples for 1940, 1950, and 1960. We originally have 9,968 couples in our sample, but only 7,797 of them had complete educational information for our analysis. Our sample size is further reduced to 3,197 couples when we include the contemporaneous male-female ratio for each state and each year. To control for the 9-month gestation period of a pregnancy (our outcome variable of interest), we use lagged male-female ratios for each state and lagged year, resulting in a regression with 2,812 couples.

Table 6 presents the results for the SUR estimates of equation (2). Panel A uses the contemporaneous sex ratio in the state that an individual couple resides. Panel B uses the previous year's sex ratio in the state that an individual couple resides. *A priori*, as the sex ratio decreases due to the exodus of men fighting in the war, we ought to see more women marry less suitable men who are older, who may have been previously married, who may be of a different race or birthplace. These less desirable men may have less education than their spouses or earn less money than their spouses. Since the dependent variables in columns (7) through (11) are in terms of the male-female difference, we expect to see positive coefficients to denote a direct relationship between the state's sex ratio decreasing during the war and the accompanying smaller income differences between married men and their spouses. For the previous marital status, race and birthplace binary variables in columns (2) through (6), we expect to see negative coefficients to describe the inverse relationship between the state's sex ratio decreasing during the war and the accompanying increases in marriages for men

who have been previously married, interracial marriages, and marriages between people born in different states.

Out of the eleven equations estimated in Panel A, there are only three statistically significant differences in columns (4), (6), and (11). In column (4), the decrease in the sex ratio during the war increases the incidence of marriages between women who have been previously married and men who are married once. The result in column (6) is consistent with our model's prediction that the decrease in each state's sex ratio during the war increases the number of women who married men born in states different from their wives. This is not a conclusive result as some differences are not as striking as others. For example, the difference in the birthplace of North Carolina for the husband versus South Carolina for the wife is not as remarkable the difference in the birthplace of Wyoming for the husband versus Alabama for the wife. Even then, the birthplace may not be indicative of the state where each individual grew up. In column (11), the statistically significant but negative coefficient on the difference in real wages between married men and their spouses during the war indicate that a decrease in the sex ratio increased women's real wages relative to their husbands' and resulted in a smaller wage differential. This is certainly true if we consider the influx of women into the labor market during the war and the increase in women's wages (compared to their previous unpaid status as a homemaker).

In Panel B's SUR estimates using each state's lagged sex ratio, there are only two statistically significant differences in column (15) and (16). The negative coefficient on previously married wives is similar to the result in column

(4) of Panel A. The positive coefficient on interracial marriages is not compatible with our model's prediction. We expect to see more interracial marriages during the war, for instance between white women and non-white men. However, the coefficient suggests that a decrease in a state's sex ratio also decreased the incidence of interracial marriages. There are only 34 interracial couples in our IPUMS dataset of 9,969 married couples. The minuscule percentage of interracial marriages during the 1936 to 1950 time period suggests that interracial marriages are quite uncommon and perhaps not socially acceptable. Thus, we must interpret with care the statistically significant coefficient on interracial marriages in Table 3.6.

Table 3.6 - Seemingly Unrelated Regressions for Male-Female Differences in Couples Married During 1936-1950

Panel A - Contemporaneous Male/Female Sex Ratio in Each State

	(1) Age difference	(2) Both previously married	(3) Husband previously married	(4) Wife previously married	(5) Different races	(6) Different birthplaces	(7) Education difference	(8) Socioeconomic index difference	(9) Occupational income score difference	(10) Real income difference	(11) Real wage difference
Contemporaneous Sex Ratio in the State	-0.566	0.059	-0.038	-0.094	-0.001	-0.296	0.107	-1.457	1.483	-1,183.07	-1,519.37
	[1.001]	[0.045]	[0.039]	[0.038]*	[0.010]	[0.080]**	[0.482]	[5.135]	[2.650]	[743.376]	[686.303]*
Constant	5.913	0.083	0.159	0.164	0.001	0.538	-0.962	18.682	14.724	5,260.45	4,366.54
	[1.186]**	[0.054]	[0.047]**	[0.045]**	[0.012]	[0.095]**	[0.571]	[6.085]**	[3.140]**	[880.880]**	[813.250]**
State fixed effect?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3197	3197	3197	3197	3197	3197	3197	3197	3197	3197	3197

Panel B - Lagged (Previous Year's) Male/Female Sex Ratio in Each State

	(12) Age difference	(13) Both previously married	(14) Husband previously married	(15) Wife previously married	(16) Different races	(17) Different birthplaces	(18) Education difference	(19) Socioeconomic index difference	(20) Occupational income score difference	(21) Real income difference	(22) Real wage difference
Lagged Sex Ratio in the State	-0.098	0.033	-0.002	-0.183	0.026	-0.155	-0.843	0.972	1.273	-784.019	-142.953
	[0.960]	[0.044]	[0.041]	[0.043]**	[0.010]**	[0.083]	[0.503]	[5.338]	[2.770]	[765.357]	[697.895]
Constant	5.026	0.082	0.115	0.266	-0.024	0.418	-0.235	16.276	16.191	4,859.60	2,659.57
	[1.126]**	[0.052]	[0.048]*	[0.050]**	[0.012]*	[0.097]**	[0.590]	[6.262]**	[3.249]**	[897.864]**	[818.723]**
State fixed effect?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2812	2812	2812	2812	2812	2812	2812	2812	2812	2812	2812

Standard errors in brackets
* significant at 5%; ** significant at 1%

IV. Alternative Explanations

The argument may be made that the observed increase in the illegitimate birthrate is due to alternative phenomena. In this section we address the possibility of what we loosely call the horizon problem. One dimension in which people pay for behavior is the opportunity cost of time. When one's expected time horizon is short, costly behavior becomes relatively less expensive. An extreme example is that of war. Just as Vietnam era veterans consumed more heroin during their tour of duty than they did before or after their service, so too may be the case among wartime women consuming more illegitimate sex, with its accompanying consequences. The social stigma of the bastard child is conceivably less severe during war. The whispers of the neighbors pale in comparison to the wrath of the Blitzkrieg. We therefore have an alternative hypothesis with testable implications.

If there indeed existed genuine fear as to the future of the United States, then under the time horizon hypothesis we would expect various other time-dependant series to be affected. Foremost, in the case of world war, one would expect observed interest rates to reflect a sudden shift in time preferences. Moreover, one cannot imagine a steeper yield curve than one in which both the issuer and holders of long-term debt may not exist in the near future. We therefore obtained data on short and long rates during the WWII period. Unfortunately, interest rates were controlled by the Federal Government during most of this period. For example, from the middle of 1943 through 1947, the rate on three-month T-bills was pegged at 0.375 percent. Indeed most other rates were

virtually constant during this period. Thus we see no real chance to test the theory on this margin.

In a second attempt, we looked at life insurance policies. Again, the same reasoning applies. A casual interpretation of the data show a steady increase in the number of policies in force and coverage per family when in fact the theory predicts a decline. When your world may be coming to an end, there is little reason to pay for a policy that none of your loved ones can collect on. What is especially interesting about these data is that they relate only to what is referred to as legal reserve life insurance companies. These are companies operating under insurance laws specifying the minimum basis for the reserves a company must maintain on its policies. Veterans life insurance policies issued by the federal government to members of the Armed Forces during this period are not included. Therefore the rise in policies cannot be attributed to the millions of military personnel at high risk of dying. We suggest a possible interpretation of these data is that indeed the horizon problem was not substantial. In fact, the simultaneous rise in the number of policies and fall in the average size of policies, we suggest, may be a result of more, not fewer, less wealthy (relative to men) women purchasing policies. Thus this interpretation is not consistent with the horizon problem theory.

V. Conclusion

The issue of illegitimate births is serious. This problem is particularly keen among black American. Men are net demanders of sexual activity. While

both men and women enjoy the physical act of sexual contact and relations, women bear a larger expected cost and are therefore, net suppliers. Women negotiate for the supply of sex via a commitment from men to assist in the rearing of any issue that might ensue from a random sex act. Women shift part of the cost of pregnancy to men by requiring a long-run commitment in order to supply their portion of the sex act. Competition between women for a shrinking number of men erases the ability of many women to sustain the commitment demand. The result is an increasing number of sex acts outside the bounds of marriage or a commitment to marriage. When the number of men relative to the number of women decreases, the prices tilt in favor of men, and they are less regularly required to make the long-term commitment of marriage in order to enjoy regular sexual relations. When females are plentiful, competition between women reduces the request on their part that the man make a long-term commitment. This problem has the potential for social degeneration and moral decay. To recapitulate, we find some evidence that the sex ratio affects the price of sexual relations, namely the number of illegitimate births. We also find some suggestive evidence that the decrease in the sex ratio affects the married male-female differences in terms of age, previous marital status, education, and socioeconomic standing.

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CONCLUSIONS

The first essay of my dissertation presents a two-sector model of land use in a county for the purpose of analyzing the effect of conservation easements on local property tax revenues. I assume that the tax deductibility of conservation easements increases the demand for agricultural land. In instances when local property tax revenues decline due to the income tax deductibility of conservation easements, the decline depends, *ceteris paribus*, on the following four conditions. First, the decline is larger when the demand for land is more elastic. Second, the decline is larger when the proportion of non-agricultural land in the county is larger. Third, the decline is larger when the agricultural tax benefit is larger. Counties that have a large difference between the property tax rate on non-agricultural land and the property tax rate on agricultural land will experience a decrease in their property tax revenues. Fourth, the decline is larger when there is less Ricardian rent on agricultural land or a lower cost for farming closer to the city center.

In the second essay of my dissertation, I examine the role of presidential party control and congressional oversight on the pattern of antitrust enforcement by the Antitrust Division from 1903 to 2005. In one econometric specification, I find some evidence congruent with my model's prediction that Democratic majorities in the House and the Senate increase the number of antitrust cases filed. Individual presidents and the president's political party, however, cannot explain the Division's caseload over this time period. Additionally, in a first-differenced

time series specification, none of the political variables is statistically significant. Thus, I am unable to reject the hypotheses of bureaucratic discretion. The rank and file bureaucrats at the Division are the ones conducting the Division's daily business and they are largely independent of political pressure from the White House and the Congress.

My third essay analyzes the effect of a change in the sex ratio of males to females on the price of sexual relations as measured by an instrument, namely illegitimate births. The deployment of young men to fight overseas during World War II resulted in a dramatic decrease in the sex ratio. The reduction in the number of available sex partners for women during the war decreased the price that the remaining men had to pay for sex. One result of this lower price is the increase in the number of children born out of wedlock during the war. State-level data from 1941 to 1945 (except 1942 where no data are available) show that the decline in the sex ratio increased the illegitimate birth rate during this period. The male scarcity also resulted in females marrying less suitable males who were too old or too young to serve in the Armed Forces and those who were not acceptable for military service due to 4F deferments. The difference-in-difference analysis using micro-level census data of couples who married during 1936 to 1950 shows significant changes in pre-war and post-war differences between husbands and wives in terms of their ages at marriage, educational attainment, and socioeconomic status.