On 'The Causes of Slavery or Serfdom' and the Roads to Agrarian Capitalism: Domar's Hypothesis Revisited

Jonathan Conning*

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Abstract

I propose a simple general equilibrium formalization of Domar's famous hypothesis on the causes of slavery or serfdom that emphasizes the interactions between factor endowments, the nature of the production technologies, and the initial distribution of property rights over land. The model provides a framework within which to understand the choice between slavery, serfdom, and free labor and tenancy equilibria with or without bonded labor-service obligations. The model also sheds light on the 'Agrarian Question' regarding why some otherwise similar regions transitioned to free-labor agrarian capitalism via an 'American road' dominated by independent family farms while others followed a 'Junker road' with production dominated by large estates surrounded by small semi-proletarianized peasant households. The model is built around an otherwise canonical general equilibrium trade model adapted to allow for the endogenous emergence of land oligopoly and labor oligopsony power distortions that shape the pattern of agrarian production organization.

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1 Introduction

> "[I]n the context of universal history, free labour, wage labour, is the peculiar institution (historian Moses Finley, 1976)."

Coerced labor arrangements or 'voluntary' but servile labor forms of one form or another have played an important and often central role in the organization of production for the better part of human civilization and in almost all known human societies. Despite the historical ubiquity of such labor arrangements, economists have devoted comparatively little attention to formal model explanations for their rise or fall, or the nature of the transition to competitive labor and tenancy markets.

To be sure, economic historians have studied slavery and serfdom closely and, especially following the work of Conrad and Meyer (1958), American Southern slavery has been examined in great empirical detail (e.g. Fogel and Engerman, 1989; Wright, 1978). Yet, with a few exceptions[1], most theoretical examinations of the economics of unfree labor have remained verbal or partial equilibrium in focus. Most of the available formal theoretical treatments have mainly analyzed slaves' work incentives (Findlay, 1975; Chwe, 1990), or have been competitive general equilibrium treatments that do not attempt to explain the origin of these labor practices in comparative perspective (Bergstrom, 1971). Relatively more has been written on voluntary bonded labor and 'interlinked' labor contracts in developing country agriculture, usually by appealing to information asymmetries and credit market imperfections (Srinivasan, 1989; Genicot, 2002; Bhaduri, 1973), but again the focus has mostly been on partial equilibrium and these theories typically do not account for why such information asymmetries should have such persistent influences over time or what explains why they might have varied so systematically across regions.

To economists the best known analytic narrative explanation is Evsy Domar's 1970 essay 'On the Causes of Slavery or Serfdom: A Hypothesis.' Echoing arguments earlier put forth by Nieboer (1910) and others, Domar conjectured that coerced labor arrangements were more likely to emerge in economies where labor was scarce relative to land for the simple reason that thats where the marginal value product of labor would be larger and hence higher incomes would accrue to those that controlled labor rather than land. Building on accounts of seventeenth century Russia by historian V.O. Kliuchevsky, Domar noted that as "the central areas of the state became depopulated because of peasant migration into the newly conquered areas in the east and southeast," serfdom emerged "under the pressure of the serving [landlord]

[1] For instance the work of Lundahl (1992) on the economics of apartheid. A recent paper by Lagerlof (2006) explores the rise and fall of slavery and the transformation of property rights over land in response to changing population pressures in a dynamic growth model, and is perhaps the most similar in approach to that explored in this paper. Our two papers are complementary – for instance his paper emphasizes a further dynamic perspective by endogenizing population growth, whereas this paper offers somewhat more micro-economic detail on the nature of equilibrium contracting patterns and other tradeoffs.

class...[as] the government gradually restricted the freedom of peasants ... to move."

Domar argued in familiar neoclassical terms, starting from a simple description of a competitive free labor market equilibrium. In the first part of this paper I present a simple formalization of Domar's reasoning. In a model with constant or decreasing returns to scale, all else equal, competitively determined land rents fall relative to wages as the land-labor ratio rises threatening the livelihood of any 'servitor class' that might try to live primarily off land rents and it also therefore increases the attractiveness of 'enslaving' a portion of the peasant population to expropriate part of the rising returns to labor.

Domar's paper did not make a clear distinction between chattel slavery and serfdom even though the Russian case he most frequently references was very evidently a case of Russian servitors lobbying the Tsar to establish more draconian limits on the mobility of peasants who already cultivated fields as tenants and debt-bonded workers on lands attached to the servitors estates. These peasants became serfs who continued to owe tribute and labor service just as before, and generally not slave laborers. By incorporating a few more assumptions into Domar's basic model to allow for landlord market power and for an important role for non-traded production factors such as farming skills or the ability to mobilize and motivate family labor we arrive at rich new predictions that help clarify distinctions and a framework within which the choice between cultivating land with free laborers, voluntary and involuntary serfs, or slaves can be more fully understood.

I analyze and compare the range of feasible equilibria under three different institutional scenarios. The first benchmark scenario is a standard efficient equilibrium under competitive factor markets. Land and labor markets are competitive and the equilibrium distribution of operational farm sizes is determined uniquely by the distribution of non-traded farming skills in the economy in a manner similar to Lucas' (1978) "span of control" model. This plus the initial distribution of property rights over land and labor then determines the equilibrium pattern of trading on land and labor markets.

The second scenario is that of a simple competitive slave economy. Landlords are assumedto able to, at a cost, enslave a portion of the labor force. In effect they expropriate the full value of an enslaved laborer's marginal product of labor net of the cost of reproduction and subsistence costs. If property claims remain secured[2], landlords can buy or sell slave labor and resources and marginal products will be equalized across farms. Enslavement reduces cost at which the landlord-cum-slaveowner hires some or all of its labor force. However in certain economic environments a slave-owner may earn more by freeing slaves and rehiring them as free tenants or serfs. The reason is that although wages paid to slaves are low free tenants or serfs may have better incentive to apply non-traded farming ability and skills in production and landlords appropriate part of the return to these skills via

[2]See Conning and Robinson (2007) for an analysis of the pattern of production organization in a model with contested property rights

higher land rents.

Domar's principal hypothesis, that the net return to enslaving a portion of the population rises with the land-to-labor ratio, is easily derived by comparing these two scenarios under the assumption of constant returns to scale or – equivalently in this model – when the non-traded factors owned by the laboring population are relatively not important in production. Interesting qualifications to Domar's Hypothesis emerge however when the technology and patterns of non-traded asset ownership gives some advantages to tenancy and family farming. All else equal, establishing 'slavery' is now less likely in economies with land concentration because larger landlords will now have less to lose, or more to gain, from turning slaves into tenants compared to maintaing cultivation of large *demesne* farm lands using wage or slave labor. More generally, larger landlords' may have less need to resort to extra-economic coercion to establish limits on peasant mobility (such as was used to establish legal serfdom) for the simple reason that they may have other ways to extract rents by virtue of their larger control over land. Historical evidence suggests that large and smaller Russian nobility in fact often diverged on the issue of serfs. The state-enforced limits on peasant mobility that established Russian serfdom in the seventeenth century were granted primarily as a political concession to the *pomeshchik* or small gentry class[3] while the *boyar* magnates, who had vastly larger estates, often fought the strict restrictions (Anderson, 1979).[4]

The third and most interesting scenario, also embedded in a canonical general equilibrium trade model, allows for endogenous market power distortions to transform the equilibrium pattern of production organization. If land ownership becomes sufficiently concentrated landlords in any one area landlords may try to exercise market power by witholding land from the market to artificially drive up land rents. This is just as in any partial equilibrium setting, but in a general equilibrium setting there is an additional motivation to restrict peasant access to land because witholding land also drives down the marginal product of labor on peasant farms, thereby increasing peasant labor supply to landlord farms and hence the scope for capturing monopsony rents from labor. To highlight this interaction between land monopoly and labor monopsony effects I sometimes refer to landlords as having '*mononpoly*' power, formed by joining the greek base terms *mono* (one), *on* (buyer), and *poly* (seller).[5]

[3] This new servitor class was created at a time when the Tsars still lacked both the financial resources to adequately compensate military servitors, or a state apparatus effective enough to raise such funds through direct taxes. From the sixteenth century land grants were given out in exchange for military service. Since the land was without much value without labor, and because the servitors were often away on military campaigns, this new gentry then lobbied to tie peasants to the their land (Anderson, 1979; Byres, 1996; Moon, 2001).

[4] Perry Anderson writes 'the gentry thus clamored ravenously for the abrogation of all restrictions on the recovery of fugitive peasants, while the magnates maneovered successfully to maintain the legal time-limits after which forcible recuperation was no longer possible (1979:336).'

[5] TI would like to thank Robert Thornton for suggesting this term. In an earlier version of this paper I had used the term 'monopsoly' which combined elements from the words monopoly

Depending on the initial distribution of land and non-traded assets and on the nature of the production technology, *latifundia-minifundia* type arrangements may arise where landlords withold large amounts of land in order to operate inefficiently large estates. Interestingly, starting from some equilibria, it may take only a small increase in land concentration, or perhaps a small rise in the relative price of the landlord crop to precipitate seemingly dramatic transformations in equilibrium agrarian production structures.

Extending the analysis further to allow landlords the ability to price-discriminate demonstrates how some production efficiency can be restored at the expense of peasant incomes. I argue that the equilibrium contracts required to sustain such price-discrimination equilibria *must* involve labor-service obligations under which a peasant receives access to a tenancy on condition that they fulfill an obligation to provide regular labor services to the landlord. Labor service tenants in Russia, and the serfs they became once additional mobility restrictions had been added, labored under precisely this type of arrangement. The model makes evident how restrictions on serf mobility facilitate such price discrimination, but also how it might be sustained in a voluntary exchange economy without resort to that form of extra-economic coercion.

The model's comparative statics are rich and help to make sense of several important historical puzzles. For example, I demonstrate how a rise in the relative price of a landlord crop or an improvement in landlords' technology might lead to the increase of 'mononpoly' power effects, which can lead to a decline in the size of peasant plots, an increase in labor-service obligations and a fall in real wages in circumstances in situations where the more conventional competitive model without market power distortions would have predicted far different effects. This may provide microfoundations for an explanation as to why regions that appear to have very similar factor endowments but different initial distribution of property rights could experience such different institutional transformations in response to a common external stimulus such as a population crash or an export boom.

The rest of the paper is organized as follows. The following section points to how the model's framework relates to previous literature and may offer microfoundations for a reinterpretation of several classic debates on economic growth and institutional transformation such. The following section introduces the model and base scenario where I analyze competitive equilibria with and without slavery, formalizing ideas similar to those argued by Domar. The next section analyzes conditions under which endogenous market power effects may arise and comparative statics of the distorted 'mononpoly' equilibria that may emerge. An appendix demonstrates how the model can be readily generalized to the more general case of landlords interacting as non-cooperative multi-factor market 'oligonpolists.'[6] I characterize equilibria

and monopsony. The problem with this term is that, like the term 'monopsony,' it contains the Greek base term *ops*, meaning "fish" or "meat" (Thornton, 2004) which obviously is not part of the intended meaning.

[6] Landlords act strategically and non-cooperatively on multiple factor markets in a manner similar

for a broad class of homogenous production functions and illustrate by simulating equilibrium agrarian structures in a Cobb-Douglas economy. The next section extends the analysis by studying how price-discriminating mononpolists would implement tenancy with labor-service obligations as an optimal contract to limit competition and improve on the earlier analyzed outcome. Next I carry out some comparative static exercises to show how equilibrium production structures and factor incomes would respond to changes in relative product prices, endowments and technology, and how outside interventions to ban certain forms of labor tying may increase peasant welfare even while reducing overall economic activity. I illustrate with historical examples. A final section analyzes how landlords might try to further influence equilibrium allocations via land grabs and other political interventions. A conclusion is followed by appendices that offer proofs of the paper's main propositions and.explain how to extend the model to allow for strategic non-cooperative 'oligonpoly' behavior amongst landlords.

1.1 Relation to other literature

One critique of neo-classical factor-endowment based theories of institutional change has been that while economists like Domar have argued that an increase in relative labor scarcity helps to explain the rise of serfdom in Eastern Europe and Russia, similar economic reasoning has been used by other neoclassical economic writers including Postan (1937) and North and Thomas (1973) to explain the *fall* of serfdom in Western Europe. According to this second narrative the population collapse that followed the ravages of the 14th century Black Plague increased competition for labor by landlords leading to an eventual increase in the relative 'wage' and bargaining position of peasants, and the eventual collapse of legal serfdom.

This apparent contradiction was pointed out perhaps most famously by Robert Brenner who argued that neoclassical approaches that simply interpreted "the response of the agrarian economy to economic pressures ... as occurring more or less automatically, in a direction economically determined by the 'law of supply and demand' (Brenner, 1976: 10)" could not account for the wide divergence of institutional responses observed in practice on either side of the river Elbe. The framework failed, he argued, because it ignored 'social or class structure.' His critique led to a series of pointed exchanges and rebuttals between historians and economists that came to be known as the "Brenner Debates" (Aston and Philpin, 1985). By allowing for the analysis of 'power' issues within an otherwise neoclassical framework and the possibility of divergent equilibrium agrarian trajectories, the model considered here contain elements for a synthesis, or at least a better understanding, of aspects of this important debate.

In the contex of the model, legal serfdom may be interpreted as a situation in

to that analyzed by Bulow, Geanakoplos and Klemperer (1985) in the context of inter-related product markets, but here on multiple factor markets.

which landlords have succeeded in enforcing extra-economic limitations on peasant mobility. This strengthens landlords' bargaining position in establishing labor-service tenancy arrangements and act as more efficient and effective price-discriminating mononpolists. Interestingly, the model demonstrates that the removal of legal barriers to labor mobility (associated with either the abolition of slavery or serfdom) can lead to a *fall* in overall output. In the case of the ending of serfdom it may lead to enclosures and encroachment and a decrease in the size of peasant plots as landlords fall back onto more distortionary second-best mononpoly strategies to extract rents. So long as landlords control enough land to exercise market power, labor-service arrangements may persist in the new equilibrium (or emerge for the first time, following the abolition of slavery).

The model therefore also helps to shed light on the 'Agrarian Question' that other important debate on the nature of production relationships in the transition to agrarian capitalism. Political economists including Kausky and Lenin pointed to a marked contrast between an 'American road,' or 'capitalism from below' in which agricultural production came to be dominated by efficient capitalist family and a 'Junker Road' or 'capitalism from above' such as was followed in Prussia, Russia and several Latin American countries where large landed estates continued to dominate production usually surrounded by a fringe of small 'semi-proletarianized' peasant producers on small plots selling labor to much larger estates (Kautsky,1899; Lenin,1899, Byres, 1996; Anderson, 1979; de Janvry,1981).[7] Similar themes have been echoed in writings about the emergence and persistence of the so called *Latifundia-minifundia* complex in parts of Latin America (de Janvry, 1981; Engerman and Sokoloff, 200l) and in debates over the relative size of landlords' *demesne* compared to *villein* peasants' lands under manoralism (North and Thomas, 1973; Fenoltea, 1975).

The precise distinction between 'coerced' and 'voluntary' contractual forms of labor obligation has in fact often been difficult to clearly delineate. Kliuchevsky's own descriptions of Russia in the centuries prior to the introduction of legal serfdom is replete with accounts of the many forms of 'voluntary' bondage and 'self-pledging' (1968: 174-199). Serfdom was introduced not by a single decree that suddenly allowed landlords to pin down peasants but rather as the introduction of a range of increasingly restrictive new legal mechanisms and re-interpretations of existing law that over many years made it more and more difficult for peasants to terminate the supposedly 'voluntary' labor-service obligations that they or their parents had contracted into.

Likewise, the abolition of serfdom and other forms of labor compulsion has rarely immediately lead to anything resembling the textbook model of a competitive labor market. After the formal abolition of serfdom in 19th century Russia, labor-service obligations persisted. In *The Development of Capitalism in Russia* Lenin wrote at

[7] The Junker road refers to the pattern of agricultural organization that prevailed in regions of present day Germany, from Brandenburg eastward and especially Pruserania, where practically all land was farmed on great estates using mostly landless, wage-earning agricultural laborers. The landed estate owners were the Junkers.

length about these arrangements arguing at first that they were transitional forms that would be soon eliminated by the advance of capitalism. Years later he was forced to admit that these institutions were proving far more resilient than he had thought.

Labor-service tenancy arangements have been found throughout history. Morner (1970) catalogs and explores the similarities across a large number of such institutional arrangements all of which lasted into the early twentieth century including the *Statartorpare* (Sweden), *Robota* (Czech regions), *Husemenne* (Norway), *Instleuete* and *Heurerlinge* (North East Germany) and the *Tamalia* system (Egypt). In Latin America servile workers and tenants with labor-service obligations have been known, depending on the region, by terms such as *inquilinos*, *yanaconas*, *peones encasillados*, *huasipungueros* and *colonos camaradas*.

Trade theorists may recognize a similarity between the formal structure of main model in the paper and trade models with monopsony distortions as analyzed by Feenstra (1980) and others.[8] Two key differences allow for wider applications and richer predictions. Depending on parameter values, Feenstra's equilibrium and the standard competitive Hecksher-Ohlin equilibrium emerge are special cases. The most important difference is that whereas these earlier trade models worked under the standard neoclassical assumption of widely dispersed factor ownership, land ownership is concentrated, and this changes the objective function of the larger farm enterprises. A second important difference is that whereas these other models assumed constant returns to scale and exogenous barriers of entry giving market power to a single large firm, in this paper the size distribution of operational firm sizes is determined endogenously, shaped in part by the nature of the crop production technology. Despite these important differences the model shares enough of the structure of standard trade models to be applied to demonstrate how classic theorems such as the Stolper-Samuelson Theorem may be modified.

Finally, the model also yields predictions about landlords returns from meddling with politics to affect property rights over land and labor mobility, and how these predictions vary depending on initial land concentration and other variables. This leads to a brief discussion of the comparative politics of land grabs and frontier policies, technological and educational investments, labor market discrimination and apartheid .

2 Model

The economy has $\overline{T}$ units of cultivable land of "uniform quality and location (Domar 1970:19)" and there are $\overline{L}$ households with one unit labor each. The economy-wide land-to-labor ratio will be indicated as $\bar{t} = \overline{T}/\overline{L}$. The $\overline{L}$ households are sub-divided

[8] See in particular also Bishop (1966), McCulloch and Yellen (1980) and Markusen and Robson (1980). An excellent concise review of this earlier literature is presented in chapter 24 of Bhagwati, Panagariya and Srinivasan (1998).

into an integer number $m\overline{L}$ of landlord households and $n\overline{L}$ 'peasant' households. Landlords as a class own fraction θ of the overall land endowment or $\overline{t_r} = \theta\overline{t}/m$ per landlord household. The $n\overline{L}$ peasant households consist of $n_0\overline{L}$ landless peasant households that own no land but may cultivate land as tenants ($\overline{t_{p0}} = 0$ per household) and $n_1\overline{L}$ 'yeoman' households who possess the remaining land ($\overline{t_{p1}} = (1-\theta)\overline{t}/n_1$ per household). The subscript $g \in \{r, p_0, p_1\}$ will be used to indicate variables that correspond to landlord, landless peasant and yeoman peasant households respectively. Since the land Gini can be calculated as a simple linear function $Gini = (m+n_1)\theta + (n_0 - m)$, in what follows below I shall simply use θ as a measure of inequality.

All households have access to the same crop production technology $\widehat{F}(T, L, S)$ which is linear homogenous in its three arguments, land, labor, and a non-traded production factor S. This last factor may be thought of as the household's farming skill or management ability, or its labor supervision capacity. The assumption that S is non-traded is a simple way to capture the well grounded assumption that transaction costs and information asymmetries pertaining to labor supervision end up creating farm-level diseconomies of scale which can be used to explain the widespread prevalence of family farming in many crops throughout the world (Hayami and Otsuka, 1993; Binswanger and Deinenger, 1995). This formulation is essentially similar to Lucas' (1978) "span of control" model except that whereas Lucas assumes that an individual must choose between becoming either a full-time enterprise manager or a worker, I allow all households with $S > 0$ to operate a farm enterprise so that some households may at the same time operate a small family farm and at the same time sell their (unskilled) labor to others.

If we normalize each peasant's holding of the non-traded factor to $\overline{S_p} = 1$ the peasant household production function can be written $F(T, L) = \widehat{F}(T, L, 1)$ which is homogenous of degree $k \leq 1$ in its two arguments. A lower k indicates that non-traded skills or labor supervision activities are more important in production and therefore that diseconomies of scale in the restricted production function are more pronounced.[9] For the moment landlords are assumed to have access to *the same* production technology $\widehat{F}$ but they may possess higher levels of the non-traded asset $\overline{S_r}$. The landlord's restricted production function can then be represented as $G(T, L) = AF(T, L)$ where $A = (\overline{S_r}/\overline{S_p})^k$. Landlords and peasants can be thought of as producing the same crop using the same production technology with possibly different levels of managerial talent or skill.[10]

Material balance in each factor market requires that

$$mT_r + nT_p \leq \overline{t} \tag{1}$$

$$mL_r + nL_p \leq 1 \tag{2}$$

[9] For example, for a Cobb-Douglass production function of the form $\widehat{F}(T, L, S) = T^\alpha L^\beta S^{1-\alpha-\beta}$ the restricted production function is $F(T, L) = T^\alpha L^\beta$ is homogenous of degree $k = \alpha + \beta < 1$.

[10] The more general case where G is a relatively more land (or labor) -intensive production technology is considered later.

where (T_p, L_p) and (T_r, L_r) are, respectively, factor uses on the n peasant farms and the m landlord farms.

2.1 Competitive Equilibria

In describing Russia prior to the establishment of serfdom, Domar leads his readers to imagine something resembling a competitive free-labor and land tenancy market equilibrium where marginal factor products would be equalized across farms, so "the country will consist of family-size farms ...[where] the wage of a hired man or the income of a tenant will have to be at least equal to what he can make on his own farm." He also assumed, initially, that "land of uniform quality and location is ubiquitous" implying that "hired labor in any form, will be either unavailable or unprofitable: the wage of a hired man or the income of a tenant will have to be at least equal to what he can make on his own farm (p.19)."

Suppose that $k < 1$ but that all households possess non-traded factor S in equal amounts ($A = 1$). If all output is sold at a unit price fixed on the world market[11] each household will choose factor inputs to maximize the value of farm sales plus net factor sales, or equivalently, to maximize the value of profits plus the market value of their labor and land endowment:

$$V_g^c(\overline{t}, \theta) = \max_{T_g \ ,L_g} \quad [F(T_g, L_g) - rT_g - wL_g] + r\overline{t_g} + w \tag{3}$$

where $g \in \{r, p_1, p_0\}$ indicates landlord, yeoman peasant, or landless peasant households respectively. In an efficient competitive equilibrium marginal products would be equalized across all farm types, so $F_L = w = G_L$ and $F_T = r = G_T$ and, because they each have the same level of non-traded S, all households would operate farms of identical efficient operational size $T_g = \overline{t}$ and $L_g = 1$. Every household will be exactly self-sufficient in labor and each landlord household would lease out all land owned in excess of the efficient farm size, or $\theta\overline{t}/m - \overline{t} > 0$ units of land to the market.

Equilibrium operational farm size is fixed by each household's holding of S, independently of its ownership of traded factors, so a higher level of land inequality θ would simply result in more land being leased from landlords to the peasant sector. Each farm produces $F(\overline{t}, 1)$ and economy-wide output is $\overline{L}F(\overline{t}, 1)$ irrespective of θ.

Domar realized of course that if some households held larger stocks of the non-traded factor, for instance by holding land "in areas of unusually good (in fertility and/or in location) land, or specializing in activities requiring higher than average capital intensity, or skillful management (p.20)" this would lead to larger farms using hired labor. Given the assumed properties of the economy, households with higher S will operate larger farms by employing proportionately more land and labor, but all farms will continue to employ the same factor proportions.Specifically, the efficient

[11] This was not an extreme assumption in Domar's analysis given the importance of grain export markets in seventeenth century Russia.

allocation is $T_p = \phi\bar{t}$ and $L_p = \phi$ and $T_r = A^{\frac{1}{1-k}}\phi\bar{t}$ and $L_r = A^{\frac{1}{1-k}}\phi$, where $\phi = 1/(mA^{(1/1-k)} + n)$.[12]

2.2 Competitive Equilibria with Slavery

A very simple way to model the introduction of slavery is to assume that the landlord class can, at a cost, collude to enslave a fraction σ of the free landless peasant population. By assumption enslaved households can be forced to surrender all of their labor time to the landlord who must only pay a subsistence wage $\underline{w}$. For simplicity, enslaved workers are assumed to be initially allocated evenly across landlord-cum-slaveowner farms, so that each landlord receives $\sigma n_o/m$ units of slave labor. The fraction of the landless σ that may be potentially enslaved is taken to be exogenously given. In practice, this might for example be the fraction of a population that is of a different ethnicity or linguistic group to reflect the frequently observed fact that slaves have almost always been easily identifiable 'outsiders' (Engerman, 1999). Hard-to-conceal traits such as skin color or language made it difficult for slaves to flee or hide amongst the free. Landlords will be able to buy and sell or lease slaves in a new competitive equilibrium, to or from other landlords or to the remaining free farming peasant households.

Domar did not distinguish clearly between slavery and serfdom in his paper. I distinguish between them here by assuming that a slave can be forced to supply unskilled labor when supervised by a farm operator but he cannot be forced to surrender his non-traded skills. In short, it is possible to have slave laborers but not slave tenants. This is meant to capture the idea that a slave cannot be made a residual claimant without also giving them a substantial degree of independent control over how he would allocate labor time between their own tenancy and labor services to the landlord.[13] A slave owes labor service in return for nothing other than a subsistence wage, whereas a serf was typically a peasant farmer that maintained access to land in exchange for payment to a landlord which may or not have included a significant labor-service obligation. The potential dilemma for landlords will be this: should they prefer to enslave their laborers, in which case they appropriate the full value of the marginal product from each slave less subsistence costs, or should they prefer to instead set them free and then hire them back as tenants in which case they may be able to appropriate higher rents from the land they own than they could by farming it themselves with slave because tenancy provides better incentives for households to put non-traded skills to use.

To examine this question in this section I compare landlords' earnings with or without slavery assuming labor and tenancy markets would be competitive. In later

[12] Note that in the CRS case ($k = 1$), A *must* then equal unity in the one crop model, otherwise landlord farms would have uniformly lower costs and dominate all production.

[13] Note however that, depending on their outside opportunities, we will show that a tenant-serf or even a free-tenant may not have much higher welfare than a slave.

sections I will compare outcomes to tenancy equilibria in which landlords may be able to exercise significant market power, and where serf-like tenancy arrangements with labor-service obligations will emerge.

Rather than specify an ad-hoc functional form to represent the costs of capturing and supervising and coercing slaves, which might vary with the size of the slave population, the number and cohesion level of landlords, and other parameters, in the analyis below, like Domar, I focus only on how the *benefits* that accrues to each landlord is likely to vary across economic settings. This provides an idea of the maximum expense that each landlord would be willing pay to participate in the system.

In a slave economy there will be $\sigma n_0 \overline{L}$ slaves which leaves $[n - \sigma n_0]\,\overline{L}$ free farming households. Equilibrium in factor markets now requires:

$$\begin{aligned} mT_r^s + T_p^s\,[n - \sigma n_0] &= \bar{t} \\ mL_r^s + L_p^s\,[n - \sigma n_0] &= 1 \end{aligned}$$

The landlord pays slave labor employed on his own farm a subsistence wage $\underline{w}$ but can sell or rent out any surplus slave labor to the yeoman sector (or to other landlords) at the free labor market rate w. This is the same rate he would have to pay to hire free or slave labor from the market. This matches descriptions of the operation of several known slave economies. Fogel and Engerman (1989; p53) for instance provide evidence that "there was an extremely active rental market for slaves" in the antebellum US South. Conrad and Meyer (1958) and others have also argued that slave prices reflected present values and the marginal return to slave use was equalized across farms.

The slave-owning landlord's problem, not including slave supervision and coercion costs F, can be stated as choosing labor and land allocations to maximize:

$$V_r^s(\bar{t}, \theta, \sigma) = \max_{T_r^s\ ,L_r^s} \quad [G(T_r^s, L_r^s) - rT_r^s - wL_r^s] + r\theta\bar{t}/m + (w - \underline{w})\sigma n_o/m \qquad (4)$$

The last term is the value of slave exploitation rents: the market value of slave labor net of the costs of paying for slave subsistence. The first-order conditions for this problem are again $G_T = F_T = r$ and $G_L = F_L = w$ so slave and free labor will be allocated efficiently across farms. The number of peasant farming households has been reduced from $n\overline{L}$ to $(n - \sigma n_0)\overline{L}$. A price-taking landlord will support the enslavement of fraction σ of the free peasant population so long as the gross private benefits $B(\bar{t}, \theta, \sigma) = V_r^s(\bar{t}, \theta, \sigma) - V_r^c(\bar{t}, \theta)$ per landlord exceed his share of slave coercion and supervision costs $F > 0$, where V_r^s is the landlord's earnings in a slave economy and V_r^c is what the same landlord earns in the no-slavery free market equilibrium (given earlier by expression (3)). Clearly, at $\sigma = 0$ we must have $B(\bar{t}, \theta, \sigma) < F$ since $V_r^s = V_r^c$. By the Envelope Theorem, $\frac{\partial B}{\partial \sigma} = (w - \underline{w})n_0/m > 0$, .so

the benefits of slavery to landlords are increasing with σ. Therefore, if $\underline{w}$ is sufficiently low and slavery enforcement costs F are not too large, slavery will be preferred by landlords for a high enough value of σ.

Define $\widehat{\sigma}_c(F)$ to be the minimum fraction of the landless that must be enslaved for slavery to just become profitable, or $B(\overline{t}, \theta, \widehat{\sigma}_c) = F$.If we assume parameters such that an interior solution $0 < \widehat{\sigma}_c < 1$ exists, then it is easily shown that for the constant returns to scale case ($k = 1$) that $\widehat{\sigma}_c$ is increasing with the size of F or $\underline{w}$, and decreasing in anything that increases w such as an increase in the relative scarcity of labor or an increase in the price of the landlords' crop. This points to a confirmation of Domar's hypothesis that in a labor-scarce economy it was "the ownership of peasants and not of land that could yield an income to the servitors or to any non-working landowning class (p.19)" since:

Proposition 1 *Assuming constant returns to scale ($k = 1$), the threshold fraction of the population $\widehat{\sigma}_c$ falls with $\overline{t}$. Slavery is more likely in economies with a higher land to labor ratio.*

To see this note that in general (for any k) gross benefits can be written:

$$\begin{aligned} B(\overline{t}, \theta, \sigma) &= V_r^s(\overline{t}, \theta, \sigma) - V_r^c(\overline{t}, \theta) \\ &= \Delta\Pi + (w^s - \underline{w})\sigma n_o/m + (r^s - r^c)\theta\overline{t}/m \end{aligned} \tag{5}$$

where $\Delta\Pi$ is the change in farm profits on landlord farms following the transition from free labor to a slave economy and the other two terms are the 'exploitation rents' earned by the landlord and any possible change in the value of land due to changes in equilibrium rental prices.

If non-traded skills are not necessary in production so the restricted production becomes constant returns to scale in land and labor inputs ($k = 1$), under competitive markets the initial distribution of operational farm sizes is indeterminate and in any case irrelevant to the determination of relative factor prices and real allocations. In such an environment enslavement would amount to a simple transfer of property over peasant labor to landlords. Landlord earnings would increase because of the transfer of rents $(w^s - \underline{w})\sigma n_0/m$ but this would not affect real allocations or equilibrium factor prices.[14]

Things are more interesting when non-traded assets play a role in production ($k < 1$) since enslavement of $\sigma n_0 \overline{L}$ households removes a similar number of farms units from production. The land and labor that these households would have used must now be reallocated to the remaining $(1 - \sigma n_0)\overline{L}$ farms resulting in fewer, larger, farms. Equilibrium wage and rental rates must fall ($w^s < w^c$ and $r^s < r^c$) proportionately because slaves non-traded skills are no longer being used. Profits on the remaining

[14] Bergstrom (1971) provides a model with slavery along these lines in an Arrow-Debreu framework. Real allocations will be affected of course by the fact that coercion and supervision generates real costs and distortions.

farms must increase in response to this change of factor prices (a simple property of any well-behaved profit function), so $\Delta\Pi > 0$. When $k < 1$ the first two terms of (5) are therefore positive but the last term $(r^s - r^c)\theta t/m$ is negative. This leads to the following simple but interesting qualifications to Domar's hypothesis:

Corollary 2 *Ceteris paribus, $\widehat{\sigma}_c$ increases with k and decreases with A, so that slavery is less likely in economies where technology is subject to diseconomies of scale and/or where peasant ownership of non-traded productive assets is more similar to landlords.*

Corollary 3 *When $k < 1$, $\widehat{\sigma}_c$ increases with θ, suggesting that, ceteris paribus, slavery is less likely in economies with high concentration of land.*

Consider the second result first. Each new slaveowner-landlord earns additional 'exploitation rents' $(w - \underline{w})\sigma n_o/m$ but the fall in rentals r lowers the market value of any land the landlord might still lease out. A landlord with large amounts of land under lease will therefore be more reluctant to enslave his tenants. Or stated differently, a slave-owner is more likely to agree to convert his slaves into tenants the more land that he will be in a position to lease out. For similar reasons, tenancy (or as analyzed below, serfdom) is the more attractive option for landlords the more productive is land organized around family farm tenancies compared to large landlord estates.

These results are consistent with the often made observation that slavery was more likely in staple or plantation crops where economies of scale were supposedly derived from gang labor applied to the execution of repetitive and easily monitored tasks by unskilled labor (Fogel and Engerman, 1974). The result here demonstrates that strictly positive economies of scale are not necessary. Slavery is less likely in crops where the opportunity cost of running a large farm (i.e. not using tenants) is not too high. A higher A can also be interpreted as a higher relative price for 'landlord' export crops favoring slavery.

The first corollary result suggests that slave owners are more likely to transition to tenancy (or serfdom as described below) without a fight in economies where there is a greater initial concentration of land. The next section demonstrates that this conclusion is strengthened further if land concentration increases landlords' ability to exercise market power and manipulate factor market prices. In such cases tenancies with labor-service obligations, very much characteristic of arrangements under many types of both voluntary and involuntary serfdom, emerge as attractive alternatives to slave labor.

2.3 Equilibria with market power distortions

Throughout history economic power has been associated as much with control over land as it has been with control over man. Even in Western Europe the end of

serfdom most economies continued to be dominated by "servile' but now voluntary' bonded labor contracts, and tenancy arrangements with labor service obligations. To see why this might have been the case, the following sections extend the model to situations where land concentration can lead to market power over the land market and how landlords would reshape the pattern of agrarian organization to their favor. Peasants are now free to hire in land and lease out labor to any landlord at market-determined, but possibly distorted factor prices.

Consider first the simplest case where landlords are assumed to be able to coordinate production decisions as would a perfect non-price discriminating landlord cartel.[15] Peasant households, which are small relative to the market, take factor prices as given and lease-in or lease-out land and labor up to the point where the marginal revenue product equals a given factor price, or $F_T(T_p, L_p) = r$ and $F_L(T_p, L_p) = w$. The landlord cartel's problem is now to choose land and labor use on each landlord's farm, T_r and L_r, to maximize the value of farm profits plus the market value of landlords' land and labor endowment, taking into account peasant sector reactions:

$$\begin{aligned} V_r^m(\bar{t}, \theta) = \max_{T_r\ ,L_r} \quad & AG(T_r, L_r) - F_T(T_p, L_p)T_r - F_L(T_p, L_p)L_r \\ & + F_L(T_p, L_p) + F_T(T_p, L_p)\theta\bar{t}/m \end{aligned} \tag{6}$$

Since in equilibrium total demand for any given factor must equal total supply, using (1)-(2) we can substitute for T_p and L_p using:

$$\begin{aligned} T_p &= \frac{\bar{t} - mT_r}{n} \\ L_p &= \frac{1 - mL_r}{n} \end{aligned}$$

This way of stating the landlords' objective function (6) highlights a key difference between the present analysis and a prior literature on monopsony factor market distortions in general equilibrium trade models (see Feenstra, 1980, Bhagwati et al, 1998 and the references cited therein). In this earlier literature, *exogenously* specified barriers to entry led to *de facto* monopsony power over both factor markets by one large firm (or firms) in one sector of the economy. This concentrated sector then exercised market power to maximize sectoral profits (i.e. the first line of (6) above) but was *not* concerned with how production decisions affect the value of its shareholders' factor endowments (i.e. the second line of (6). This was because these models made the conventional simplifying assumptions that factor ownership was widely dispersed and also that production technology was constant returns to scale.

By contrast in the present analysis there are no assumed exogenous barriers to entry. Indeed there are always $n\overline{L}$ peasant farms competing with the $m\overline{L}$ landlords in

[15] The appendix extends the model to allow strategic non-cooperative behavior amongst landlords, and a later section considers price-discrimination.

the same sector. Furthermore, the assumption of diseconomies of scale in production ($k < 1$) explicitly penalizes large farm units. Hence, if we restricted landlords to maximize only farm profits rather than also the value of land rents, equilibrium allocations would be hardly different from the efficient competitive outcome.

Our focus is instead on the endogenous market power distortions that may emerge when land ownership becomes sufficiently concentrated. From (1) and (2) we have $\frac{\partial T_p}{\partial T_r} = \frac{\partial L_p}{\partial L_r} = -\frac{m}{n}$. Suppressing arguments, the first-order necessary conditions for a maximum to (6) are:

$$AG_T = F_T \left[1 - \frac{m}{n}\frac{F_{TT}}{F_T}\left(T_r - \theta\bar{t}/m\right) - \frac{m}{n}\frac{F_{LT}}{F_T}\left(L_r - 1\right)\right] \tag{7}$$

$$AG_L = F_L \left[1 - \frac{m}{n}\frac{F_{TL}}{F_L}\left(T_r - \theta\bar{t}/m\right) - \frac{m}{n}\frac{F_{LL}}{F_L}(L_r - 1)\right] \tag{8}$$

The first expression (7) can be seen to be a modified version of the land monopolist's pricing rule for hiring out land until marginal revenue equals marginal cost. The direct marginal cost of leasing out an additional unit is measured in terms of foregone output on the landlord estate G_T. Marginal revenue is given by the rental rate $r = F_T$ at which that unit is hired out plus the usual negative effect on rental earnings of having to lower the rental rate on inframarginal leases $-\frac{m}{n}F_{TT}(T_r - \theta\bar{t}/m)$, since $\frac{\partial r}{\partial T_p}\frac{\partial T_p}{\partial T_r} = -\frac{m}{n}F_{TT}$. Finally, there is an additional impact on the cost of hiring free wage labor $-\frac{m}{n}\frac{F_{LT}}{F_T}\left(L_r - 1\right)$ that results as leasing out more land raises the marginal product of labor on peasant farms. A similar interpretation can be given to first-order condition (8) as a modified version of the labor monoponist's markdown pricing rule.

Given our homogeneity assumptions ($k < 1$), equations (7)-(8) can be solved for a unique set of landlord T_r, L_r. In general, the system is highly non-linear and closed form solutions for T_r and L_r will not be possible even for rather standard production functions. However, substantial insight into the properties and structure of this economy can still be deduced. Dividing (8) by (7) and rearranging yields the more compact expression:

$$\frac{G_L}{G_T} = \frac{F_L}{F_T}\,\Gamma \tag{9}$$

$$\text{where } \Gamma = \frac{\left[n - m\frac{F_{TL}}{F_L}\left(T_r - \theta\bar{t}/m\right) - m\frac{F_{LL}}{F_L}(L_r - 1)\right]}{\left[n - m\frac{F_{TT}}{F_T}\left(T_r - \theta\bar{t}/m\right) - m\frac{F_{LT}}{F_T}\left(L_r - 1\right)\right]}$$

Expression $\frac{G_L}{G_T}$ and $\frac{F_L}{F_T}$ are, respectively, shadow wage-rental factor price ratios on landlord and peasant farms. Efficiency in production would of course require production along the efficient locus given by $\frac{G_L}{G_T} = \frac{F_L}{F_T}$. If we continue to assume that

landlords and peasants produce only one crop using the same general production function, but allowing for the possibility that landlords have a higher level of non-traded skills (i.e. we can write $G = AF$ with $A \geq 1$), the efficiency locus will be a single point along a straight line of slope equal to the economy-wide land to labor ratio $\bar{t}$. However, from (9) it is clear that in the distorted economy $\frac{G_L}{G_T} \gtreqless \frac{F_L}{F_T}$ as $\Gamma \gtreqless 1$. Since landlords' concentrated ownership of land makes them net sellers on a competitive land market, they exercise market power by withholding land from the lease market. This makes them use everywhere more land-intensive production techniques and to operate larger farms:

Proposition 4 *If landlord and peasant farms produce the same crop and have access to the same general production technology, with $G = AF$ where $A \geq 1$. Then $\Gamma > 1$ and therefore $\frac{G_L}{G_T} > \frac{F_L}{F_T}$. Landlord (peasant) farms will use inefficiently large (small) and land-intensive (labor-intensive) techniques and the economy displays an inverse farm-size productivity relationship.*

Consider first the case where $A = 1$. Then all farms are of equal operational farm size and by the definition of what it means to be a landlord ($\theta > m$) landlords would be leasing out land and be self-sufficient in labor in a competitive equilibrium. The larger is θ the larger the amount of land leased out in a competitive equilibrium, but the greater also is a landlord cartel's ability to pursue monopoly land rents by withholding land from the lease market. This is as would be predicted by a partial equilibrium analysis. In a general equilibrium setting however, reduced access to land on peasant farms reduces the marginal product of labor on peasant farms which also increases peasant labor supply to landlord farms and hence the scope for landlords to capture monopsony rents from labor. I call this the 'mononpoly' market power case to highlight this interaction and to distinguish it from the pure 'size monopsony' effects of the earlier literature. Landlords clearly stand to gain by depressing the wage-rental ratio[16]. Hence in a distorted equilibrium production techniques on peasant farms must become relatively more labor-intensive and the shadow wage rental on landlord farms will exceed that on peasant farms $\frac{G_L}{G_T} > \frac{w}{r} = \frac{F_L}{F_T}$. The distorted equilibrium allocation must lie above the diagonal efficiency locus in an isoquant Edgeworth box. For landlords to be able to exercise market power requires only that peasant demand for land be downward sloping ($F_{TT} < 0$) and that the exercise of monopsony power on the labor requires only that peasant labor supply have positive slope ($F_{LL} < 0$).There will be interaction effects so long as land and labor are Edgeworth complements ($F_{LT} > 0$).Since the 'efficiency cost' of being large

Note that it is possible that landlord estates might expand to such an extent as to begin to encroach on peasant lands and end up hiring in both labor *and* land from the

[16]Raising it would obviously be suboptimal, unless the landlord crop were in a technological sense much more land-intensive than the peasant crop. This is ruled out by assumption here, but I consider this consideration below.

peasant sector. This last 'reverse-tenancy' scenario is not as improbable as it might seem: if land is sufficiently concentrated in landlords' hands, and if the efficiency costs of becoming larger than the efficient scale are not too large (i.e. if k is close to one and hence diseconomies of scale are not too pronounced), then landlords may want to withhold all their land from the market or even turn to buying or leasing-in any remaining land so as to squeeze out peasant tenancy entirely in an all-out effort to further depress wages.

The analysis can be extended to more general situations where landlords have higher non-traded skills ($A > 1$) or where landlords produce a different crop using a more land- or labor-intensive production technology. The key question is always whether landlords choose to increase or decrease the wage-rental ratio relative to competitive allocation. Any departure from the efficient ratio (i.e. a point off the efficiency locus) entails efficiency losses but may allow landlords to capture land monopoly and/or labor monopsony rents. The case Feenstra (1980) and others in effect analyzed was that of a (exogenously) monopolized sector producing a relatively more land-intensive production technology but where the firm was *not* concerned about rentals from the ownership of factors. The monopoly firm, which by assumption was large, only hired factors and therefore exercised monopsony power by reducing the hiring of both land and labor. The firm cut back relatively more on its hiring of land to reduce the price of the factor that it uses relatively more intensively in production. Their models predict that monopoly firms should make their sector *smaller* and more labor-intensive than in the competitive setting. This pure 'size monopsony' equilibrium for a firm using a land-intensive technology is indicated in Figure 2.

If however the owners of agricultural firms also own land a higher θ leads landlords to become larger net suppliers of land relative to labor in a competitive equilibrium. If θ is high enough landlords will prefer to depress the wage-rental ratio even if the land crop is land-intensive. Figure 2 indicates how distorted equilibria are matched to different initial levels of θ.

Summarizing, we can state the following loosely worded proposition, discussed in more depth in the appendix:

Proposition 5 *If landlords have a more land-intensive production technology, then if k is not too low, and for high enough θ, we will have $\Gamma > 1$ and therefore $\frac{G_L}{G_T} > \frac{F_L}{F_T}$.*

If k is low, production is subject to strong diseconomies of scale which favors small-peasant production. Landlords will have little ability to distort the economy away from the efficient allocation. As k gets closer to unity (and or A gets larger) landlords can distort production allocations at lower efficiency cost. If land concentration θ is high enough and a large enough fraction of landlord income is derived from land rents, they will have incentive to try to lower the wage-rental ratio by restricting peasant access to land.

2.3.1 Equilibrium agrarian structures: a Cobb-Douglas example

It is interesting to illustrate the possibilities by considering a standard Cobb-Douglas production technology $F(T, L) = G(T, L) = T^{\alpha}L^{\beta}$, where $\alpha + \beta < 1$ and $A = 1$. For the base case I assume an economy with $\overline{L} = 100$, $\overline{T} = 100$ and $m = 0.01$, so there is one landlord household ($m\overline{L} = 1$) and $n\overline{L} = 99$ peasants. Production efficiency would require 100 farms of equal operational size each employing $\overline{t}$ units of land and one unit of labor. All peasant households operate farms, regardless of the initial distribution of land.

Figures 2 to 4 show equilibrium inputs, outputs and incomes at different initial levels of land inequality θ. I have set $\alpha = 0.49$ and $\beta = 0.49$. This choice makes the production homogenous of degree $k = 0.98$, which is relatively close to constant returns to scale. This last assumption implies that the opportunity cost of expanding wage labor production onto larger than first-best efficient scale farms will be positive but not too large. Smaller values of k would raise the opportunity cost of operating larger scale wage-labor farms as smaller subtenancies or family-operated farms become relatively more efficient. Much lower degrees of production homogeneity k can also sustain the rather strong market power distortions illustrated below if landlords are allowed to have better technology or more skills than peasant farmers (i.e. if A is large enough).

Figure 2 shows equilibrium net factor supplies at different initial levels of land inequality θ. Under the efficient competitive equilibrium benchmark net total supply of land from the landlords sector $(\theta\overline{t} - m\overline{t})\overline{L}$ rises linearly with θ.[17] Net peasant labor supply would remain zero at every level of θ since each household's labor demand exactly equals its own labor endowment. At relatively low levels of land inequality 'mononpoly' equilibrium factor supplies closely match the efficient competitive allocations since the landlord sector does not yet have enough land to exercise much market power. At higher levels of inequality however landlords are able to exercise increasing amounts of market power by withholding larger and larger amounts of land from the market. As landlord farms become larger, monopoly power over land translates into monopsony power over labor since higher equilibrium land rents pushes peasant households to demand and employ less land, shifting out peasant net labor supply to the market. Peasant labor supply to the landlord sector $n(\overline{L} - L_p)$ is seen to be increasing with θ.

A very interesting shift of regimes occurs around the vicinity of $\theta \approx 0.7$ on the graph. As θ was increased up to that point, landlords had become ever more aggressive at exercising market power and withholding land. At around $\theta \approx 0.7$, landlords' supply of land actually falls to zero, and at yet higher levels of θ landlords actually encroach on peasant farms by *leasing in* land. What is happening is that at relatively lower levels of land inequality landlords earn the bulk of their rents from land and

[17] The figure indicates this as peasant sector net supply (=landlord sector net demand) falling linearly with θ.

not much from the monopsony rents because they are not yet hiring many workers. But at sufficiently high levels of inequality the landlord estate becomes sufficiently large that monopsony rents come to dominate the landlords' strategy. At about $\theta \approx 0.7$ landlords earn all rents from labor monopsony, and at higher θ landlords are actually prepared to pay costly land rents to buy or lease up peasant lands so as to push more cheap labor onto the landlord estates. In sharp contrast to a partial equilibrium setting where labor monopsony rents are created by withholding labor demand relative to the efficient optimum, here landlords *increase* their demand for labor by sharply limiting peasant's access to land on the lease market.

Figures 3 and 4 show how output and land-labor ratios change with θ on landlord and peasant farms. Despite the fact that landlords enjoy no special skills or technological advantage over peasant farmers ($A = 1$) and would in a competitive equilibrium produce only fraction m of economywide output, landlords come to almost completely dominate production in the distorted equilibrium at high enough levels of θ. Peasant output contracts commensurately as θ is increased while economy wide output falls relative to the efficient optimum.

These results speak directly to the 'Agrarian Question' regarding the nature of the transition to agrarian capitalism. Low θ economies will follow the 'American Road' model where largely efficient family farms and free tenancies dominate production, while at higher θ the economy follows an inefficient 'Junker Road' with inefficiently large landlord estates or *Latifundia* dominating production whilst being surrounded by a fringe of poor peasant farms or *minifundia* scratching out a living producing on inefficiently small farms and tenancies and by selling labor to the landlords. Although the high θ economy generates a Junker road, the model also suggests a reason why Lenin and Kautsky could have been led to the erroneous conclusion that the 'peasant' populations had to become increasingly 'proletarianized' because of some inherent technological advantage of 'capitalist' farming. Here peasant farmers do become 'proletarianized' but not because of any lack of skills or technology.[18]

As θ rises landlords withhold ever greater amounts of land from the market, leading the land to labor ratio to fall on peasant farms and at first rise on landlord farms. Land-labor ratios cannot continue to rise with θ on landlord farms however since in the limit a landlord estate the size of the entire economy must by definition employ the economywide land-labor ratio $\overline{t}$. So somewhere before $\theta \approx 7$, we start to see the land-to labor ratio on landlord farms tapering off and after that falling back. Even though landlords are still aggressively hoarding land, and eventually possibly

[18] Both thinkers recognized the possibility of an 'American' or 'farmer' road, but even for this case they predicted a process of internal differentiation within the peasant sector leading to an inevitable polarization between proletarianized peasants and a rising rural bourgeoisie (de Janvry 1980: 98-99). The 'American' road of the model predicted here instead features the emergence and persistence of successful family farms without any process of proletarianization.

Lenin's 'interpretation' would have tragically huge consequences as the Communists' pessimism regarding the productive potential of the peasant sector would later be used to justify the forced collectivization of Soviet agriculture under Stalin.

hiring in peasant land, labor hiring on landlord farms starts to expand at faster rate at higher θ as peasant farms find themselves with less and less land.

How pronounced market power distortions will be depends in general not only on land concentration but also on the nature of the production technology and parameters describing the relative profitability of landlord versus peasant crops.

2.4 Labor-service obligations and serfdom

Commenting on a long tradition of scholarship before him, historian Jerome Blum notes that the term "serf" had been used at various times and in different contexts to describe people ranging from "whose condition could scarcely be distinguished from that of chattel slaves to men who were nearly free (Blum 1957: 808)." After considering several alternative definitions and synthesizing controversies over the matter, Blum proposes recognizing a peasant "as unfree if he was bound to the will of his lord by ties that were degrading and socially incapacitating and that (as Struve puts it) were institutional rather than contractual." This definition puts the emphasis on the landlords' ability to place demands upon the peasant's time beyond that already expected that the peasant would dedicate to his own tenancy and which seemed designed, at least in part, to limit the peasant's outside opportunities.

The most obvious example of this type of imposition was the widespread use of labor-service requirements which obligated peasants to provide labor services to the landlord in exchange access to tenancy, and in addition to land rents or tribute. The distinction between free and unfree peasants was very often in fact a distinction of degree rather than of kind, since whether or not serfs had juridically restricted mobility the extent to which a peasant was 'free' depended in part on how arbitrarily landlords could impose demands on their labor time and how incapacitating those demands became. Hence after the 14th century the peasants of Western Europe were considered more 'free' than the peasants of Eastern Europe, not mainly because they faced fewer restrictions on their mobility (sometimes they did not), but also because Western Europe saw the emergence of stronger absolutist states that (in exchange for the ability to tax) intervened often to regulate and constrain the ability of local lords to impose crippling labor service obligations or to restrict peasant access to land.

In the previous section we saw how distortions create by a non price discriminating 'mononpolist' raised landlords' incomes by reducing economic efficiency. If the landlord cartel could act as a price-discriminating monopolist, it would want to maximize total output via efficient subtenancies but then find ways to extract all the gains to trade via take-it-or-leave-it contracts offered to each individual peasant household. The optimal way to do this, it turns out, is by using labor-service tenancy arrangements.

Formally the price-discriminating landlord cartel's contract design problem can be seen as choosing land and labor input and a lump-sum transfer payment for each peasant household to maximize income from production on the landlord farm plus

the value of total lump-sum rental/wage payments, subject only to the constraint that each peasant household earn at least as much as their autarky reservation payoff. Optimal contracts will be tailored to each peasant household's level of asset ownership since the landless can be pressed down against a lower reservation utility than those with land. Contracts to each of the $n_0\overline{L}$ landless peasants households will specify land and labor use T^d_{p0}, L^d_{p0} and a fixed payment R_0. Contracts to each of the $n_1\overline{L}$ peasant households with land will be summarized by the contract T^d_{p1}, L^d_{p1}, R_1. The cartel now chooses the terms of these contracts to maximize

$$\begin{aligned} V^d_r(\overline{t},\theta) = \max \quad & G\left(T^d_r, L^d_r\right) + n_0 R_0/m + n_1 R_1/m \\ \text{s.t.} \quad & F\left(T^d_{p1}, L^d_{p1}\right) - R_1 \geq F\left((1-\theta)\overline{t}/n_1, 1\right) \\ & F\left(T^d_{p0}, L^d_{p0}\right) - R_0 \geq F\left(0,1\right) \end{aligned} \tag{10}$$

where $mT^d_r = \overline{t} - n_0 T^d_{p0} - n_1 T^d_{p1}$ and $mL^d_r = 1 - n_0 L^d_{p0} - n_1 L^d_{p1}$.

The peasant participation constraints obviously must bind, as otherwise landlords could increase their earnings by raising R_0 or R_1. These binding constraints yield expressions for R_1 and R_0. Substituting these into the objective function, and differentiating with respect to the T^d and L^d leads to first-order conditions that, not surprisingly, are exactly the first-order conditions for the efficient competitive case analyzed earlier. Production will be organized efficiently, except that payoffs now sharply favor the landlord:

$$V^d_{p1}(\theta) = F\left((1-\theta)\overline{t}/n_1, 1\right) \tag{11}$$

$$V^d_{p0}(\theta) = F\left(0,1\right) \tag{12}$$

$$V^d_r(\theta) = G(\overline{t},1) + nF(\overline{t},1)/m - n\left[\lambda V^d_{p0}(\theta) + (1-\lambda)V^d_{p1}(\theta)\right]/m \tag{13}$$

Each landlord receives the value of production on his own farm plus his share of rental income from subtenancies. Rental income is set at the value of peasant production less tenants' autarky reservation payoffs or to $R_1 = F(\overline{t},1) - F\left((1-\theta)\overline{t}/n_1, 1\right)$ for each of the $n_1\overline{L}$ tenants with land and to $R_0 = F(\overline{t},1) - F\left(0,1\right)$ for landless tenants.

Optimal price discrimination contracts will in general be characterized by non-linear tariff pricing and tied labor-service obligations, features that resemble the defining characteristics of labor-service tenancy arrangements and the contractual relationships under serfdom. The rental payment rate must be tied to the peasant household's factor endowment in a non-linear way because landless peasants can be charged higher rentals per unit land because they have less attractive fall-back options. Contracts *must* also involve control over labor in the form of labor-service obligations tied to tenancy. To see this more clearly assume that the landlord starts with a better technology or skills (i.e. $A > 1$) so that an efficient allocation would requires some peasant ;labor on the landlords' demesne. Then if the tenancy contract did not specify and enforce a labor obligation, tenants would obviously not work on

the landlords' demesne unless he was willing to pay them a wage proportional to the marginal product of their time on peasant farms cum tenancies.[19]

Descriptions of labor service tenancy in 19th century Russia support the interpretations presented here. For example, Lenin obviously seemed to recognize landlords' efforts to price-discriminate by tailoring contracts to peasants' outside opportunities when he noted that "rent in kind is developed to the greatest degree among the poorest groups of peasants ... well-to-do peasants do what they can to pay rent in money...to escape bonded hire (Lenin, 1956; Chapter 3, paragraph 3)." He also noted that "[t]he data from various sources are at one in testifying to the fact that the payment of labour where it is hired on a labour-service and bonded basis is always lower than under capitalist "free" hire."

Depending on the historical time period and setting, landlords might not be able to always tailor the terms of their contracts to peasant household's outside opportunities exactly because of legal impediments, peasant resistance, or because asymmetric information makes it difficult to condition contracts upon peasant's outside opportunities and actions. Intermediate agrarian structures, somewhere in between the mononpoly and the pure price discrimination scenarios described here are likely to have emerged.

Outside enforcement mechanisms would have helped landlords to better approximate the perfect-price discrimination case. As already mentioned, the rise of serfdom in Russia took place through the slow conversion of 'free' bonded labor relations into perpetual labor service obligations over time. Kliuchevsky writes that where formerly "a peasant contracting for a plot of land and a loan wrote in his promissory note that if he left without fulfilling his obligations, the landowner was to take his possessions as payment," by the early seventeenth century additional clauses were being added to contracts, for example one that stated that "the landowner, his master, 'was free to take him back from wherever he may be,' and 'in the future I, So-and-So, am to live as a peasant on the same plot and pay taxes or live as a peasant under my master for the rest of my life and not run away anywhere.' (Kliuchevsky 1968:184)."

The type of land-labor market power interactions I have highlighted in this section would seem to provide a more compelling explanation for the genesis of serfdom, bonded labor contracts and other constraints on labor mobility and land access, than explanations such as that given by North and Thomas (1973) who in *The Rise of the Western World,* argued that labor-service obligations on the European manor arose primarily where "there was no organized market for goods and services (p.20)."[20]

[19] Sadoulet (1992) analyzes labor-service contracts within a principal-agent model. When peasants face limited liability, landlords restrict the size of tenancy plots for reasons similar to why a lender limits loan sizes and labor service obligation is a way to monitor/control peasant moral hazard.

[20] North and Thomas are aware of factors that seem to indicate the role of market power when they note that only "where the lords could effectively collude rather than compete for labor, as in Eastern Europe, could they thwart the changing status (and income) of their former vassals... To the extent that lords avoided competition for labor, they could prevent a rise in real wages, but collusion over an area large enough to be effective would require centralized political coercion. (1973:

Some authors, including Srinivasan (1989) and Genicot (2003) have interpreted bonded labor contracts as credit contracts, with landlords advancing workers sizeable loans in exchange for a bondage pledge by workers. As mentioned before, Kliuchevsky described most of the voluntary labor bondage contracts that pre-date serfdom in Russia as being set up in these terms, with peasants signing promissory notes. The model of this section is consistent with this interpretation, but also shows how transactions in the land market will be bundled into the contract. Peasants obtain access to landlords's land in exchange for the promise to repay with labor service and/or a fixed transfer payment. I modeled a situation in a one period setting but the same type of real allocations and contractual terms could be made consistent with 'loan advance' and repayments in an multi-period setting.

An interesting implication of the above analysis is that even though each individual contract is voluntary, and the perfect price discrimination equilibrium is Pareto efficient, efforts to legislate against labor service or other forms of labor bonding – for instance by legislating that laborers must be paid a uniform hourly agricultural wage – might reduce area under tenancy and total agricultural output (by returning the economy to the distorted mononpoly equilibrium) *yet* still raise equilibrium peasant wages and welfare. Some evidence lends support to this possibility. For example, de Janvry (1981) attributes most of the sharp mid 20th-century decline in Chile's labor-service tenants, or *inquilinos* to the passage of new laws requiring the payment of uniform minimum agricultural cash wages.

Much more speculatively, it is not implausible to interpret Perry Anderson's and other accounts of the coincident decline of serfdom and the rise of Absolutist states in Western Europe in terms of the model. We can think of serfdom as mapping onto a mononpoly equilibrium of the sort we have described, but made more effective by controls over peasant mobility and collusion amongst landlords which leads to equilibria more similar to the more efficient price-discrimination scenarios. Plagues and wars in the 14th century could have easily disrupted these equlibria leading to more competition amongst landlords and a sliding toward the type of equilibria associated with non-price discriminating 'mononpoly'.

Although historians are in general agreement that the rise of Absolutist states is closely tied to changing military technologies and the need to raise and maintain large armies (Anderson, 1979; Moon, 2001), the model suggests that absolutist states may also have emerged, at least in part, as a sort of 'encompassing monopolist.' In Western Europe states increasingly intervened on the side of peasants, providing them with greater mobility, better guarantees of access to land and justice and relief from arbitrary demands from local lords. Greater mobility and freedom from arbitrary extractions would have led to more efficiently organized peasant production, upon which a central authority could then impose its own new tribute obligations, enforceable now with its new military coercive apparatus.

A Seigneurial reaction to re-impose serfdom might have been an option in the

24)."

West, as it was in the East but the rising strength and vitality of towns (to which escape serfs could run) and perhaps also the inability of Western landlords to collude as effectively as their Eastern counterparts, made it harder for the feudal lords and the king to impose that option. So the Kings chose to do away with serfdom and in its place create new tax obligations that fell directly on their now more independent peasant producers and subjects. Local lords' estate incomes declined as wages rose and feudal rents declined,.but many of them found new roles and incomes in the growing state bureaucracy, or perhaps as entrepreneurs in the expanding towns or (in England) dynamized agriculture.

In parts of Eastern Europe and Russia powerful absolutist rulers also emerged but, at least initially, they lacked the financial resources to pay salaries of the military servitors it needed to raise armies. They did not yet have the bureaucratic apparatus to impose direct taxes on peasants, in part because they were moving into newly conquered territories. Starting in the sixteenth century the Russian state paid its military servitors with land grants (Moon, 2001). The *pomeshchik* class of military servitors was created this way. Since land was of little value however without labor in a land abundant region, and especially because these servitors spent so much of their time as absentee landlords because of their prolonged military duties, the servitors pressed to have the state tie their peasants to the land as permanent serfs. Over time, as the independent bureaucratic ability of the state grew, the state came to introduce new taxes imposed directly on the peasants. In 1718-24 for example, Peter the Great introduced internal passports to monitor and control the movements of all tax payers. The interests of the state and the gentry thus began to conflict and, eventually, as in Western Europe, the state finally asserted its dominance by abolishing serfdom in 1861 (Moon, 2001).

2.5 The effect of changes in Technology and Prices

Historical accounts of peasants being supposedly immizerized or disposed by the introduction of new export crop technologies or a commodity export boom abound in the economic history texts, as well as claims that landlords have sought to block peasant access to land, new technologies or skill accumulation (Binswanger et al,. 1995; Bhaduri, 1973). This point of view may even have had an influence in shaping Arthur Lewis' view that manufacturing represented the 'dynamic sector' while agriculture remained backward:

> "[T]he owners of plantations have no interest in seeing knowledge of new techniques or new seeds conveyed to the peasants ... [nor will they] support proposals for land settlement, and are often instead to be found engaged in turning the peasants off their lands." (Arthur W. Lewis, Economic Development with Unlimited Supplies of Labour, 1954: 149)

To many contemporary economists these accounts appear puzzling, if not logically incoherent. Why would a rational landlord object to peasants acquiring new skills or technologies when this would only seem to increase the productivity of land cultivated by peasants, and therefore the land rents that landlords stand to capture via tenancy leases? Why would peasant labor be immizerized by a commodity export boom when a very likely consequence would seem to be an increased demand for labor which would almost surely translate into higher, not lower, equilibrium wages and incomes?

Many of these seemingly puzzling historical accounts can make sense however if one allows for 'mononpoly' power effects within this otherwise canonical general equilibrium trade model. Immiserizing growth results are always and everywhere an application of the theory of the second best: where equilibrium allocations are already distorted by market power effects, improving the relative quality of technology or non-traded skills on the landlord farm, or increasing the relative price of a landlord crop, can help to deepen equilibrium allocation distortions. Conversely, improving peasant technology or prices can raise total incomes and peasant sector output but lower landlord returns if it simultaneously undermines or weakens landlords' ability to exercise market power.

Proposition 6 *Assume landlord and peasant farms produce the same crop and have access to the same general production technology, $G = AF$, with initial $A \geq 1$. An increase from A to $A' > A$ lowers real wages, raises real land rents, and may be immiserizing.*

To see this, consider the competitive market scenario benchmark. A rise in the profitability of landlord production would lead landlord farms to operate on a new larger efficient scale.[21] Since the efficiency locus is a straight diagonal line with slope $\overline{t}$, land-labor ratios are unchanged and equilibrium wage and rental rates both rise to reflect greater demand for both factors on landlord farms. The welfare impact on the peasant sector is ambiguous, and depends on their ownership of land, as they gain from higher wages but now pay higher land rents for leases.

Now consider the mononpoly case. Raising A to A' raises landlord output and his demand for both factors. By Proposition 1 we know that in a distorted equilibrium the land-to-labor ratio on landlord farms exceeds that of peasant farms. If this initial set of distorted factor prices were to remain unchanged as landlord farms expand, for each unit of land reallocated from the peasant sector to the landlord sector, the peasant sector would release more labor than the landlord sector needs to absorb. This must create an incipient excess demand for land and an excess supply of labor that can only be eliminated by a fall in wages and a rise in land rents.

The main constraint on the exercise of market power in this model are farm-level diseconomies of scale due to the role of non-traded assets which impose costs on

[21] As noted earlier, landlord land and labor use will be $A'^{\frac{1}{1-k}}$ times greater than on peasant farms.

landlords who try to operate on too large of a scale. An increase in landlords' A lowers the opportunity cost of being large and by increasing labor demand increases the scope for earning monopsony rents over wage labor. This is illustrated in figure 5. The lower and upper solid lines reproduce, respectively the net supply of land from the landlord to the peasant sector and the total net peasant labor supply to the landlord's estate from the earlier mononpoly analysis. The dashed lines in the figure show how each of these net factor supply curves change as a consequence of an increase in the landlord's total factor productivity from $A = 1$ to $A' = 1.033$.

Given that this represents a relatively small change in the productivity of a single farm one might expect only a small effect on real allocations. Figure 5 shows indeed that landlord net land supply changes only slightly under competitive markets, as indicated by the small vertical rise in the lower diagonal line. With mononpoly power effects however, the result is a very sharp decrease in the net supply of landlord land to peasant farms, an increase in equilibrium supply of peasant labor to landlord estates, and (not shown) a *fall* in equilibrium wages.

This discussion suggests why the emergence of strong market power effects does not just hinge on the earlier assumption of approximately constant returns to scale in $F(T, L)$. Anything that helps raise the *relative* productivity of landlord farms, including a rise in relative total factor productivity or landlord skills, an increase in the relative price of landlord crops, or agricultural subsidies or policies biased against small farms will facilitate the exercise of market power and multiply its economic impact.

It is surprisingly easy to find historical evidence of episodes where an increase in the relative profitability of landlord crops seems to have been followed by a period where the size of peasant tenancies was reduced at the same time as landlords were imposing an increase in labor service obligations.

Blum (1957: 828-830), commenting on Russia and Eastern Europe in the century before the re-imposition of legal serfdom notes that soon after

> "[a]gricultural prices rose sharply ... in the second quarter of the sixteenth century," landlords responded by increasing demesne production "[i]n the East German lands, where labor services, when required, had originally been three to four and, rarely, six days a year ... by the end of the century in Mecklenbuq three days a week had become standard. In the early seventeenth century in Brandenburg and Pomerania-Stettin it was ordered that peasants were to be liable to unlimited labor service. ... [I]n Eastern Germany, Livonia, Poland, Silesia, Bohemia, and Hungary...[i]ncreased labor dues and immobilization of the peasant labor force were inevitable corollaries of expanded demesne farming...Moreover, as the decades went by ... with the increase in demesne and in peasant population the holdings kept getting smaller."

Perhaps an even more compelling case can be made by looking at historical transformations in South American agriculture. Arnold Bauer (1971, 1975) has chronicled the rise and consolidation of Chile's large landlord estates and the associated system of *inquilinaje* labor service tenancy, over the second half of the nineteenth century. His analysis helped to put to rest the common myth of inefficient landlords more preoccupied with status than profit, by demonstrating that estate production in responded very flexibly to the new opportunities created by new wheat export markets and falling transport costs.

During the period between 1850 and 1870.the area under wheat cultivation more than tripled and labor demand boomed. In neighboring Argentina where landownership was considerably less concentrated and labor more scarce, as conventional theory might have predicted a similar agricultural boom led to rising wages, increased mechanization and more open immigration policies. Yet, according to Bauer, in Chile the outcome was considerably different as "the information that is available suggests that real wages stayed constant and may have decreased slightly (p.1079)" over the same thirty year period. Rather than raise wages, landlords satisfied their demand for labor by "tightening of the screws on the service tenants (p. 1074)" and by radically restructuring their estates to bring in more labor service tenants[22] while reducing average tenants' plot sizes while increasing labor service obligations. According to Bauer labor service obligations doubled or tripled in some regions tenants' .

Bauer's account of this period would certainly appear puzzling to standard economic theory, yet the observed pattern is readily reconciled to the model in this paper. As argued previously, under conditions of sufficient land concentration, an increase in labor demand on landlord farms can lead to an increase in landlords' ability to exercise market power, to a reduction in the area under tenancy even if peasants could grow the same crop more efficiently, and may lead to declining or stagnant equilibrium wages.

2.6 Slavery when landlords have market power

Now that we have seen that a richer set of contractual alternatives may be available to landlords as an alternative to competitive free labor and free tenancy markets, let's return to Domar's question regarding when a landlord class might choose to enslave (or liberate) its peasants.

We now allow for the possibility of slavery alongside other contract forms in a 'mononpoly' distorted economy. Landlords who act collectively to enslave a fraction σ of the landless would then be placed in an economy where they would choose to operate farms using a combination of slave and non-slave labor to maximize

[22] Bauer (1975) calculates that approximately 35,000 inquilinos and permanent workers and 125,000 day laborers worked on estates in 1865. The next comparable data from the 1930 agricultural census shows inquilinos and permanent workers nearly doubling to 67,000 while the number of day laborers stood at 133,000. Note that these figures count only inquilino heads of households.

$$V_r^s(\bar{t},\theta) = \max_{T_r^s, L_r^s} \; G(T_r^s, L_r^s) - F_T(T_p^s, L_p^s)T_r^s - F_L(T_p^s, L_p^s)L_r^s \tag{14}$$
$$+F_L(T_p^s, L_p^s)(1+\sigma n_o/m) - \underline{w}\sigma n_o/m + F_T(T_p^s, L_p^s)\theta\bar{t}/m$$

where T_p^s and L_p^s are defined as in (1) and (2). The possibilities now become considerably more interesting and complex, and for this reason predictions are also now somewhat less clear cut. Here I will only briefly summarize some of the trade-offs faced.

Note that enslavement now not only offers a direct source of cheap wage labor, it also eliminates peasant farm competitors. This is bad for landlords in so far as it reduces land rents to be earned from this group, but it might be good for landlords in so far as it also eliminates a potential source of competing labor demand, thereby further lowering the wages of free laborers as well.

If the fraction of the population that is enslaved is high and slaveownership is concentrated then we have the interesting possibility that landlords could have potential market selling power on both the market for land and for slaves. These two forms of market power may work at cross-purposes because a landowner who owns no slaves will withhold a lot of land in an effort to depress the market wage rate and earn monopsony rents in the hiring of free labor. But a landlord who is also a large slaveowner wouldn't want to depress the market wage rate as much because this is also the wage at which he leases out his slaves. Hence, paradoxically perhaps, economies where landowners concentrate both land and slaves are less likely to distort the market for free labor compared to landlords who control just the land market.

This last possibility is illustrated in figure 6. The model is parameterized as in the earlier simulations. Fifty percent of peasants are landless and enslavement makes 50 percent of these households slaves. In other words, the slave economy will have 25 slave households and 50 free laborer households (50 with land, 25 landless). At midrange levels of θ total output in the slave economy with mononpoly power is actually higher than in the mononpoly equilibria in the absence of slavery. The reason is that, for these parameters, slavery has turned the landlords into slave traders, selling or leasing out slave labor to the other independent farms. Obviously the landless peasants who have been enslaved have been expropriated and deprived of their freedom, but independent farmers with land gain from the fall in rents and wages. Landless labor households who remain free experience a fall in wage income, but at lower θ at least, may gain increased access to land. Hence landlord estates are less large, and independent farms which now hire some slave labor operate at a more efficient scale, at least as compared to the mononpoly equilibria without slavery. At very high θ however the landlords return to their old ways, and the efficiency gains are lost as we see the emergence of Latifundia, now with slaves.

2.7 Property Rights conflicts

> "So one of the hacendados' principal strategies for acquiring workers was, precisely, to seize the lands of the Indian communities." (Enrique Florescano, *The Hacienda in New Spain*, 1987: 267)

So far we have treated the initial distribution of property rights over land as given and secure. Throughout history property rights are however frequently contested, and landlords and peasants both have incentives to invest in private and collective efforts to reshape property rights in their favor. Landlords have at times employed violence and/or legal manipulation to encroach upon peasant lands including commons via land grabs and evictions. Peasants also at times contest landlords' property rights by mobilizing in support of land or tenancy reform or by squatting. Frontier land policies have also at times varied markedly across regions. In marked contrast to the United States where frontier lands were distributed massively and in a highly egalitarian fashion to hundreds of thousands of settlers or squatters, landlords wielded more power in Latin America and often shaped the evolution of land policies sharply in their favor, denying rural lower classes access to the vast available areas of frontier lands (de Soto, 2000). Similar policies to expropriate or otherwise severely limit independent peasant farming and access to land have been carried out via legal or extra-legal mechanisms throughout history (Binswanger et al., 1995) and have often been closely linked to efforts to also limit labor mobility for an underprivileged class. Examples include the imposition of legal limitations on black farmers access to land and Apartheid laws to limit mobility in Southern Africa (Lundahl, 1992), limits on ownership of land in other areas of Western Africa (Cooper, 1980), 'Black-Codes' and other discriminatory policies that limited access to land and forest resources to freed-slaves in the post-bellum United States South (Ransom and Sutch, 2001).

This paper will not attempt to explicitly model property rights conflicts, but the model already suggests when property rights conflicts are most likely. To see note that a redistribution of property rights is equivalent to a change in θ. Under competitive markets no agent is willing to pay more than the fixed market rental rate to obtain or protect another unit of land. For given factor endowments, the marginal product of land remains constant at $F_T(\overline{t}, 1)$ independently of the value of θ. However, when landlords can exercise market power the private marginal return to land is increasing in θ for both landlords and peasants. To see this differentiate expressions (3) and (10) to obtain:

$$\frac{\partial V_r^d}{\partial \theta} = \frac{\overline{t}}{m} F_T\left(\frac{(1-\theta)}{n}\overline{t}, 1\right) > \frac{\partial V_r^c}{\partial \theta} = \frac{\overline{t}}{m} F_T(\overline{t}, 1) > 0$$

These expressions state that the marginal impact of an increase in θ on landlord income is always higher when the landlord has full market power compared to a

competitive allocation. Furthermore, this difference is increasing in θ since

$$\frac{\partial V_r^{2d}}{\partial \theta^2} = -\frac{\bar{t}}{nm} F_{TT}\left(\frac{(1-\theta)}{n}\bar{t}, 1\right) > 0 = \frac{\partial V_r^{2c}}{\partial \theta^2}$$

The *marginal* incentive to challenge property rights rises with the initial level of land inequality in the market power case. This suggests that latent or actual property rights conflicts are more likely to arise in economies where higher initial inequality allows landlords to exercise market power.

2.8 Related Literature

While the institution of slavery, particularly in the US South, has been discussed and analyzed at length empirically since the seminal work of Conrad and Meyer (1958), there have been very few theoretical analyses that explicitly attempt to explain slavery or serfdom in a general equilibrium context, and much less its rise or demise.[23] Beginning in the 1970s a large literature developed on tenancy and interlinked transactions explained by the theory of incentives and asymmetric information (Bardhan, 1989). Within this tradition, Srinivasan (1989) and Genicot (2002) for example model bonded labor as a solution to a credit market imperfection.

This literature has provided essential new insights, but the analysis has tended to be partial-equilibrium in nature, a shortcoming that often drives results (contract terms in one market are shaped by the assumed absence of other markets and would often disappear if that market were opened). It also is hard to believe that asymmetric information problems could explain such large and persistent differences in agrarian trajectories over such very long periods of time. It seems unlikely that we could explain serfdom or the persistence of the Latifundia-minifundia complex over hundreds of years across entire continents mainly because of credit market imperfections or information asymmetries. Surely a few hundred years would be enough for tenant or family farmers dynasties to save enough to get around a credit constraint?

3 Conclusion

Although coerced labor arrangements have been widely used to organize production for the better part of human history and in virtually all known societies, economists have to date devoted remarkably little theoretical attention to building analytic frameworks that might explain the rise or fall of slavery, serfdom or other mechanisms.

[23] There is a literature on the incentives for motivating slave effort in partial equilibrium settings (e.g. Chwe, 1990, Findlay, 1975). Bergstrom (1971) analyses slavery, or ownership of labor, in a competitive Arrow-Debreu general equilibrium model, but has little to say about its emergence or profitability in non-competitive settings. An interesting recent paper by Lagerlof (2004) explains the rise and fall of slavery, but in a model without a market for land or tenancies.

The classic political economists from Smith to Marx to Marshall wrote at length on how the character of agrarian organization in a given society shaped the nature of subsequent political and economic transformations, and the topic has spawned important debates ever since. Writing in 1969, Sir John Hicks paused to footnote his discussion of rise of serfdom in East Europe and its contrast to free labor in the West by noting that it was "no coincidence that the frontier which so long separated these agricultural systems has so striking a resemblance to the [Iron] Curtain which is dividing Europe at the present day."

More recently, and in somewhat less sweeping terms, economic writers such as Engerman and Sokoloff (2000) have helped to refocus historical and empirical interest on the hypothesis that initial land inequality can have profoundly negative impacts on the evolution of political and economic institutions and the quality and rate of future economic growth in Latin America and other regions.

Several other stylized features of what has at times been dubbed the 'backward' agrarian economy emerge as equilibrium features of this simple agrarian economy with endogenous levels of market power. Where the ability to price discriminate is limited, landlords become willing to carry out production on an inefficiently large scale and an inverse farm size-productivity relationship emerges as yield per hectare on smaller, more labor intensive farms exceeds that measured on larger landlord farms. Although landlords' ability to price discriminate helped to restore efficiency, it do so at the expense of peasant welfare, and the contracts that they would employ resembled the sort of labor service-tenancy contract that have historically found to be widely prevalent in many parts of the world.

As Domar hypothesized, the model predicts that slavery as an institution is more likely to emerge and be maintained in economies with high land to labor ratios, and where high-value staple crops can be grown. But the model also predicts that, all else equal, slavery is more likely to give way to tenancy (be it serfdom or free tenancy) in economies where landownership is concentrated. This is an hypothesis that could be tested empirically. Certainly at first impression, the concentration of landownership amongst landlords appears to have been lower in the US South and the Caribbean islands than in many parts of Latin America where Indian slavery was abolished very early in the days of the colony.

The conditions that most likely led to the emergence and persistence of inefficient production organization consistent with serfdom or labor-service tenancy included high initial land inequality, the ability of landlords to collude, a production technology that was approximately constant returns to scale in land and labor inputs. This last assumption was associated with a production technology where non-traded farming skills or labor supervision abilities that might have strongly favored small farm production did not play a big role. More generally, anything in the production environment that gives an advantage to being large can strengthen the exercise of market power. This helps to explain the historical observation that many of Latin America's large Latifundia become consolidated during periods of export growth and

technological change.

While economic historians have attributed the rise of the latifundia in Latin America to conditions of labor scarcity, this paper has argued that the effect of population growth on agrarian organization depends in important ways on the nature of the production technology, and on whether or not new arrivals into the labor force possess non-traded skills or other factors of production.

While most of the paper has focused on scenarios where property rights over land were secure and involuntary labor service could not be compelled, the model predicts that agent's incentive to resort to extra-legal mechanisms to encroach upon the property rights of others (or to defend against others' encroachment) will be most pronounced in precisely the same situations where the potential for capturing mononpoly rents is highest. The principle at work is quite general: landlords who withhold land from the market raise the price of land access to levels well above the social marginal product of land. Agents are therefore much more likely to spend resources to encroach upon the property of others, and/or to defend their own property compared to a competitive factor market where no agent would ever be willing to pay more than the social marginal product of land (the equilibrium market price) for access to an additional unit of land.

A longer time horizon and a land sales market does not undo the observed inefficiencies in the economy for precisely the same reason that the land rental market operates at less than the efficient level in the one period case: a higher volume of land sales would only dilute landlords' market power. Since the problem is not due to the absence of a credit market, so called 'market-assisted' land reforms – where the government or some other intermediary helps finance peasant land purchases – will not help improve efficiency unless the government can compel landlords to sell land at truly competitive market prices rather than at manipulated market prices.

4 Appendices

4.1 Landlords as multi-market 'oligonpolists'

The main text assumed a perfect landlord cartel, but the model can be generalized to strategic non-cooperative 'oligonpoly.' To fix ideas, consider the case of non-cooperative competition in Cournot style amongst the $m\overline{L}$ landlords (assumed an integer number). This can be modeled adapting the multi-market oligopoly framework of Bulow, Geanakoplos and Klemperer (1985).

In a symmetric Nash equilibrium in pure strategies, landlord i decides on his best 'strategy' of land and labor use (T_r^i, L_r^i), taking the symmetric choices (or conjectures about) every other landlord (T_r, L_r) as given to maximize.

$$\max \quad AG\left(T_r^i, L_r^i\right) - F_T\left(T_p, L_p\right)\left(T_r^i - \theta\overline{t}/m\right) - F_L\left(T_p, L_p\right)\left(L_r^i - \sigma n_0/m\right) \qquad (15)$$

where from the factor market balance equations we must have

$$\begin{aligned} T_p &= \frac{\left[\overline{T} - (m\overline{L} - 1)T_r - T_r^i\right]}{(n - \sigma n_0)\overline{L}} \\ L_p &= \frac{\left[\overline{L} - (m\overline{L} - 1)L_r - L_r^i\right]}{(n - \sigma n_0)\overline{L}} \end{aligned}$$

Differentiation of (15) with respect to T_r^i, L_r^i yields a set of first-order conditions for each landlord that are analogous to (7)-(8)

$$\begin{aligned} AG_T &= F_T\left[1 - \frac{1}{(n - \sigma n_o)m\overline{L}}\frac{F_{TT}}{F_T}\left(mT_r - \theta\overline{t}\right) - \frac{1}{(n - \sigma n_o)m\overline{L}}\frac{F_{LT}}{F_T}\left(mL_r - 1\right)\right] \\ AG_L &= F_L\left[1 - \frac{1}{(n - \sigma n_o)m\overline{L}}\frac{F_{TL}}{F_L}\left(mT_r - \theta\overline{t}\right) - \frac{1}{(n - \sigma n_o)m\overline{L}}\frac{F_{LL}}{F_L}(mL_r - 1)\right] \end{aligned}$$

When $m\overline{L} = 1$ the conditions collapse to the previously derived conditions (7)-(8) for a single mononpoly cartel. When there are two or more oligonpolists, each oligopolist now faces a more elastic set of peasant (net) factor demands and hence produces less of an impact on wages or rentals from restricting land supply or labor demand. As the number of landlords $m\overline{L}$ rises, the two last terms on the right-hand side of each equation vanish and the first-order conditions approaches those of the efficient competitive solution. It is evident that the perfect mononpoly and perfect competition equilibria bracket the possible outcomes of the oligopoly case.[24]

4.2 Proposition Proofs

The following Claim will be useful in the proof of Proposition 4:

Claim 7 $\frac{T_p}{L_p} = \frac{F_{TL}F_L - F_{LL}F_T}{F_{LT}F_T - F_{TT}F_L}$.

Proof. As $F_T(T, L)$ is homogenous of degree $k - 1$,by Euler's Theorem,
$(k-1)F_T = F_{TT}T_p + F_{TL}L_p$
$(k-1)F_L = F_{LT}T_p + F_{LL}L_p$
Multiplying the first expression by F_T and the second by F_L gives:
$(k-1)F_TF_L = F_{TT}F_LT_p + F_{TL}F_LL_p$
$(k-1)F_LF_T = F_{LT}F_TT_p + F_{LL}F_TL_p$
and since the two left hand sides are the same,
$F_{TT}F_L\frac{T_p}{L_p} + F_{TL}F_L = F_{LT}F_T\frac{T_p}{L_p} + F_{LL}F_T$
which upon rearranging delivers the desired result. ■

[24] In future work I hope to model transaction costs or threshold barriers to labor movement which would bring non-cooperative 'oligopsoly'equilibria closer to the cartel equilibria described in this paper. The size of these barriers or transaction costs might be subject to political control. When barriers are high we would expect equilibria resembling serfdom or bonded labor.

4.2.1 Proof of Proposition 1:

Proof. We need to show that $\Gamma > 1$ as if $\theta > m$. Now $\Gamma > 1$ as

$$\frac{F_{TT}}{F_T}(T_r - \frac{\theta}{m}\bar{t}) + \frac{F_{LT}}{F_T}(L_r - 1) < \frac{F_{TL}}{F_L}(T_r - \frac{\theta}{m}\bar{t}) + \frac{F_{LL}}{F_L}(L_r - 1)$$

Collecting terms and rearranging yields

$$\begin{aligned} \frac{(\frac{\theta}{m}\bar{t} - T_r)}{(1 - L_r)} &< \frac{F_{LL}F_T - F_{LT}F_L}{F_{TT}F_L - F_{TL}F_T} \\ \frac{(\theta\bar{t} - mT_r)}{(m - mL_r)} &< \frac{F_{LT}F_L - F_{LL}F_T}{F_{TL}F_T - F_{TT}F_L} = \frac{T_p}{L_p} \end{aligned} \tag{16}$$

where the last equality follows from the previous claim. Note that in Feenstra (1980) firms own no factors, in which case $\theta = 0$ and landlords own no labor, so the above becomes simply $\frac{T_r}{L_r} = \frac{T_p}{L_p} = \bar{t}$ and hence $\Gamma = 1$.Landlords would exercise monopsony power by operating proportionately smaller than efficient farms (i.e $T_r < T_p$ and $L_R < L_p$) since this lowers both F_L and F_T. Here, the inequality is satisfied as long as landlord farms lease in labor and lease out land which will occur if $\theta > m$ and $A \geq 1$.[to be further completed] ■

1.0

References

Anderson, Perry (1974). *Lineages of the absolutist state.* Verso Books, London.

Anderson, Perry (1974). *Passages from antiquity to feudalism*, Verso Books, London.

Aston T.H. and Philpin C.H.E (1987). *The Brenner debate: agrarian class structure and economic development in pre-industrial Europe*, Cambridge University Press: Cambridge ; New York

Bardhan, P. E. (1989). *The economic theory of agrarian institutions.* Oxford; New York; Toronto and Melbourne, Oxford University Press.

Bhaduri, A. (1973). "A Study in Agricultural Backwardness under Semi-Feudalism." *Economic Journal* 83(329): 120-37.

Bauer, A. J. (1971). Chilean Rural Labor in the Nineteenth Century. *American Historical Review* 76(4): 1059-83.

Bergstrom, T. (1971). "On the Existence and Optimality of Competitive Equilibrium for a Slave Economy." *Review of Economic Studies* 38(113): 23-36.

Bhagwati J.N., Panagariya A, Srinivasan T.N. (1998). *Lectures on international Trade,* second edition, MIT Press: Cambridge, Mass.

Binswanger, H. , K. Deininger, and G. Feder (1995). Power, Distortions, Revolt and Reform in Agricultural Land Relations in *Handbook of Development Economics*,Volume III. edited by J. Behrman and T. N. Srinivasan. Amsterdam, North Holland.

Blum, J. (1957). "The Rise of Serfdom in Eastern Europe." *American Historical Review* 62: 807-36.

Brenner, R. (1976). "Agrarian Class Structure and Economic Development in Pre-Industrial Europe." *Past and Present* 70: 30-74.

Byres, T. J. (1996). *Capitalism from above and capitalism from below: An essay in comparative political economy.* New York & London, St. Martin's Press.

Bulow, J., J. Geanakoplos, P. Klemperer (1985). "Multiproduct Oligopoly: Strategic Substitutes and Complements." *Journal of Political Economy* 93(3): 488-511.

Chwe, M. S.-Y. (1990). "Why Were Workers Whipped? Pain in a Principal-Agent Model." *The Economic Journal.*

Conrad, A. H. and J. Meyer (1958). "The Economics of slavery in the Antebellum South." *Journal of Political Economy* 66: 95-130.

de Janvry, A. (1981): *The Agrarian Question and Reformism in Latin America.* Baltimore: Johns Hopkins University Press.

de Soto, H. (2000). *The Mystery of Capital: Why Capitalism Succeeds in the West and fails almost everywhere else*, New York: Basic Books.

Deininger, K. and H. P. Binswanger (1995). "Rent seeking and the development of large-scale agriculture in Kenya, South Africa, and Zimbabwe." *Economic Development & Cultural Change* 43(3): 493-523.

Domar, Evsy (1970) The Causes of Slavery or Serfdom: A Hypothesis, *Economic History Review* 30:1 (March), pp. 18-32.

Eswaran, M. and A. Kotwal (1986). Access to Capital and Agrarian Production Organization. *Economic Journal* 96: 482-498.

Feenstra, R. C. 1980. Monopsony Distortions in an Open Economy: A Theoretical Analysis. *Journal of International Economics* 10(2): 213-235.

Fenoltea, S. (1975). "Authority, Efficiency, and Agricultural Organization in Medieval England and Beyond: A Hypothesis." *The Journal of Economic History* 35(4): 693-718.

Findlay, R. (1975). "Slavery, incentives, and manumission: A theoretical model." *Journal of Political Economy* 83: 923-933.

Fogel, R. W. and Stanley Engerman (1989). *Time on The Cross; The Economics of American Negro slavery.* New York, Norton.

Genicot, G. (2002). "Bonded Labor and Serfdom: A Paradox of Voluntary Choice." *Journal of Development Economics* 67(1): 101-127.

George, Henry (1879), *Progress and Poverty.*

Kautsky., K. (1988) [1899] *The Agrarian Question.* London, Winchester, MA.

Lehmann, D. (1982). After Chayanov and Lenin: New paths of agrarian capitalism. *Journal of Development Economics*, 11(2), 133-161.

Kliuchevsky, V.O. (1968), *A course in Russian History,* Chicago, Quadrangle books,

Lagerlof, N.-P. (2006). "Slavery and other Property Rights," Department of Economics working paper, Concordia University, Canada.

Lenin, Vladimir. I. (1956). *The development of capitalism in Russia; the process of the formation of a home market for large-scale industry.* Moscow, Foreign Languages Pub. House.

Lewis, W. Arthur (1954) "Economic Development with Unlimited Supplies of Labour," *The Manchester School*, pp. 139-191.

Markusen, J. R. and A. J. Robson (1980). "Simple General Equilibrium and Trade with a Monopsonized Sector," *Canadian Journal of Economics* 13(4): 668-82.

McCulloch, R. and J. L. Yellen (1980). "Factor Market Monopsony and the Allocation of Resources." *Journal of International Economics* 10(2): 237-47.

Moon, David (2001) *The Abolition of Serfdom in Russia, 1762-1907.*Pearson Longman, London.

Morner, Magnus (1970) "A Comparative Study of Tenant Labor in Parts of Europe, Africa and Latin America 1700-1900: A Premilinary report of a resarch project in Social History," *Latin American Research Review*, 5(2), 3-15.

Nieboer, H. J. (1910). *Slavery as an industrial system*; *ethnological researches.* The Hague,, M. Nijhoff.

North, D. and R. Thomas (1973). *The Rise of the Western World: A New Economic History.* Cambridge, Cambridge University Press.

Pastore, M. (1990). "La hipotesis de Domar sobre las causas de la servidumbre o la esclavitud en una colonia Hispanoamericana: Contraste y Reformulacion." *Revista de Historia Economica,* VIII(3).

Postan, M. M. (1937). "The Chronology of Labour Services." *Transactions of the Royal Historical Society* 20.

Roemer, J. E. (1982). "Origins of exploitation and class: Value theory of pre-capitalist economy." *Econometrica* 50: 163-192.

Sadoulet, E. (1992): "Labor-Service Tenancy Contracts in a Latin American Context," *American Economic Review*, 82, 1031-1042.

Sokoloff, K. and S. Engerman (2000). "Institutions, Factor Endowments, and Paths of Development in the New World." *Journal of Economic Perspectives* 14(3).

Srinivasan, T. N. (1989). "On Choice Among Creditors and Bonded Labour Contracts." in Bardhan, P. (ed) *The economic theory of agrarian institutions.* Oxford; New York; Toronto and Melbourne, Oxford University Press: vi, 408.

Thornton, R. J. (2004). "Retrospectives: How Joan Robinson and B. L. Hallward Named Monopsony." *Journal of Economic Perspectives* 18(2): 257-61.

Wright, G. (1978). *The political economy of the cotton South : households, markets, and wealth in the nineteenth century.* New York, Norton.

Isoquant Edgeworth Box (landlord technology more land-intensive)

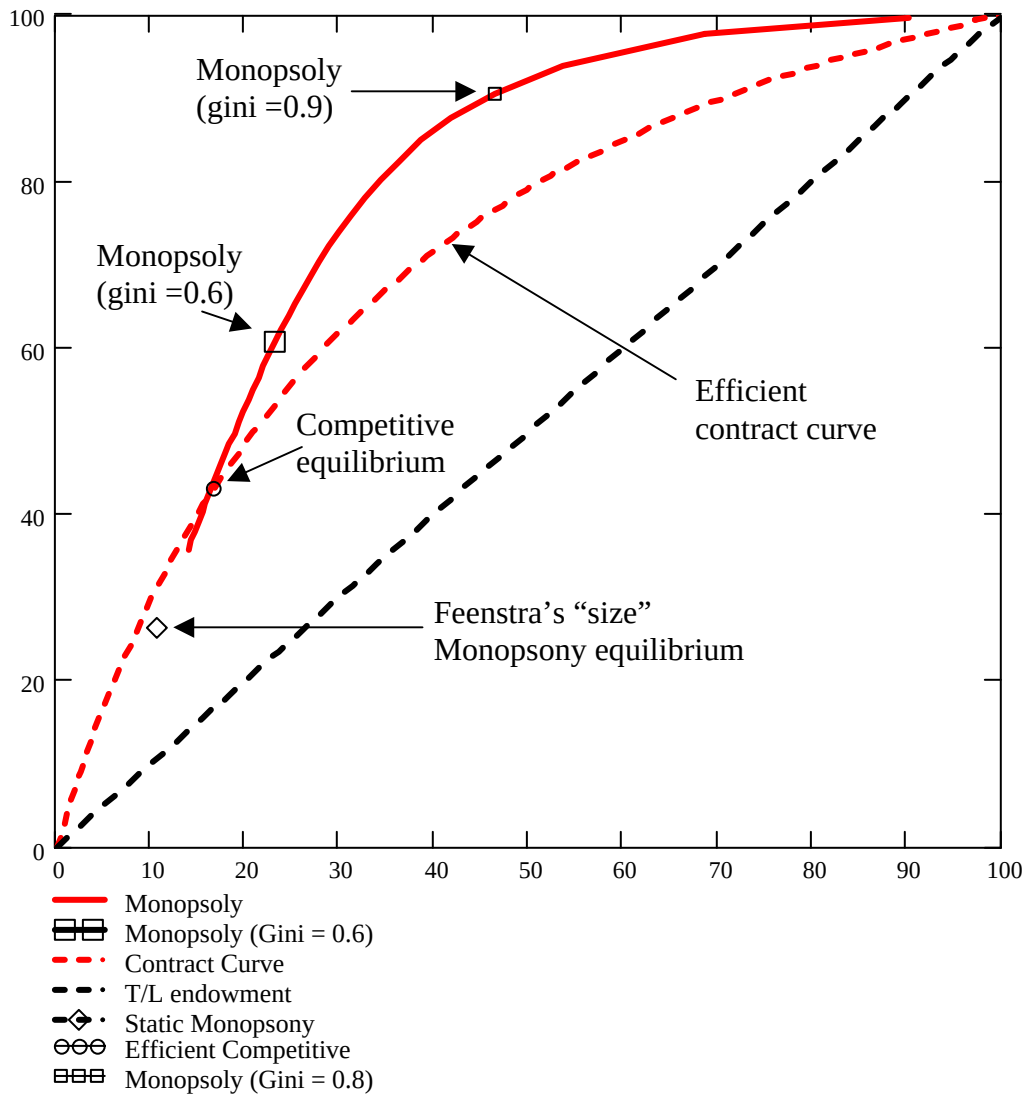
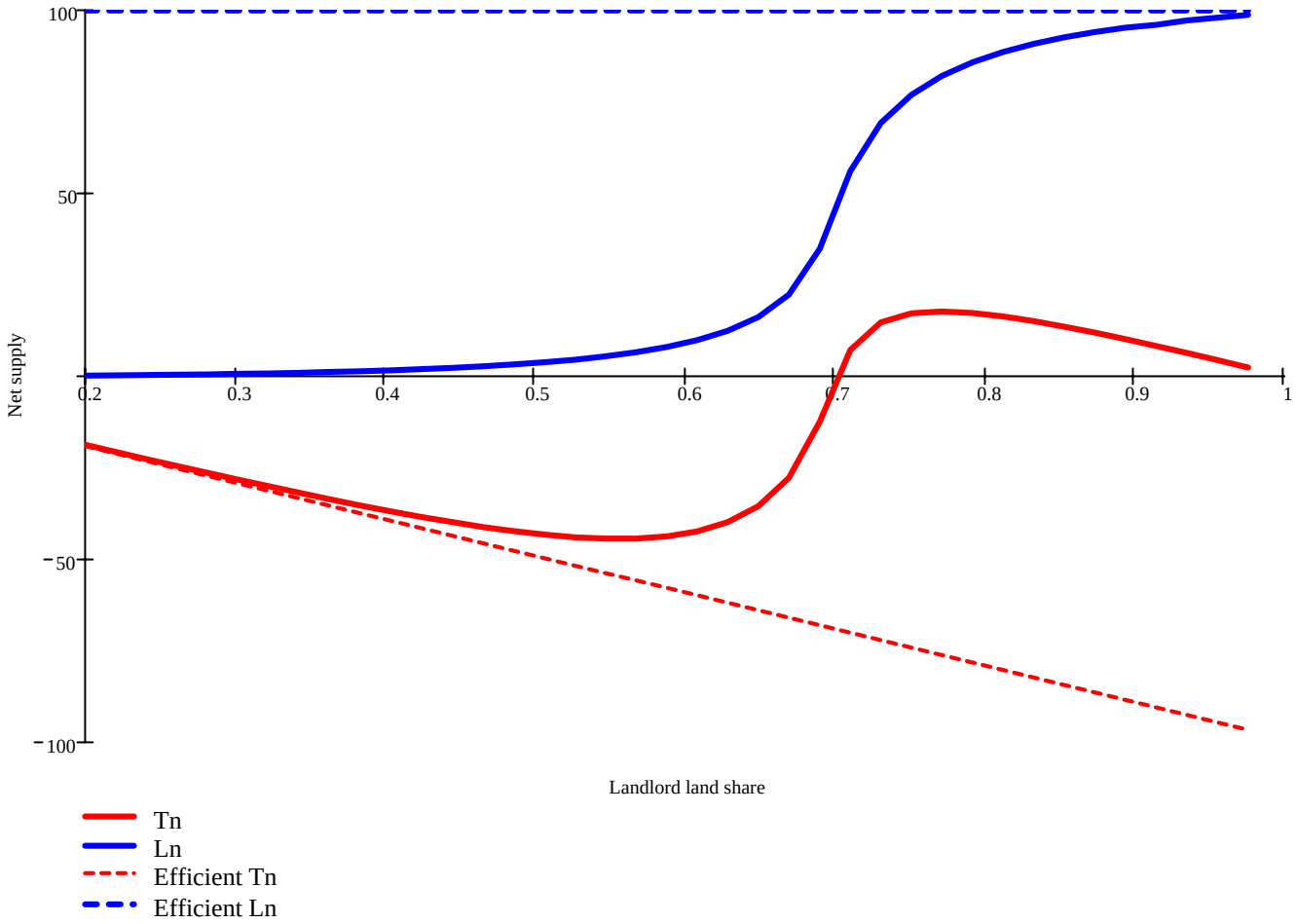


Figure 2: Equilibrium Peasant Sector Net Factor Supply of Labor and Land as a function of θ



American vs. Junker Road

Landlord, Peasant, and total farm output function of Land Gini

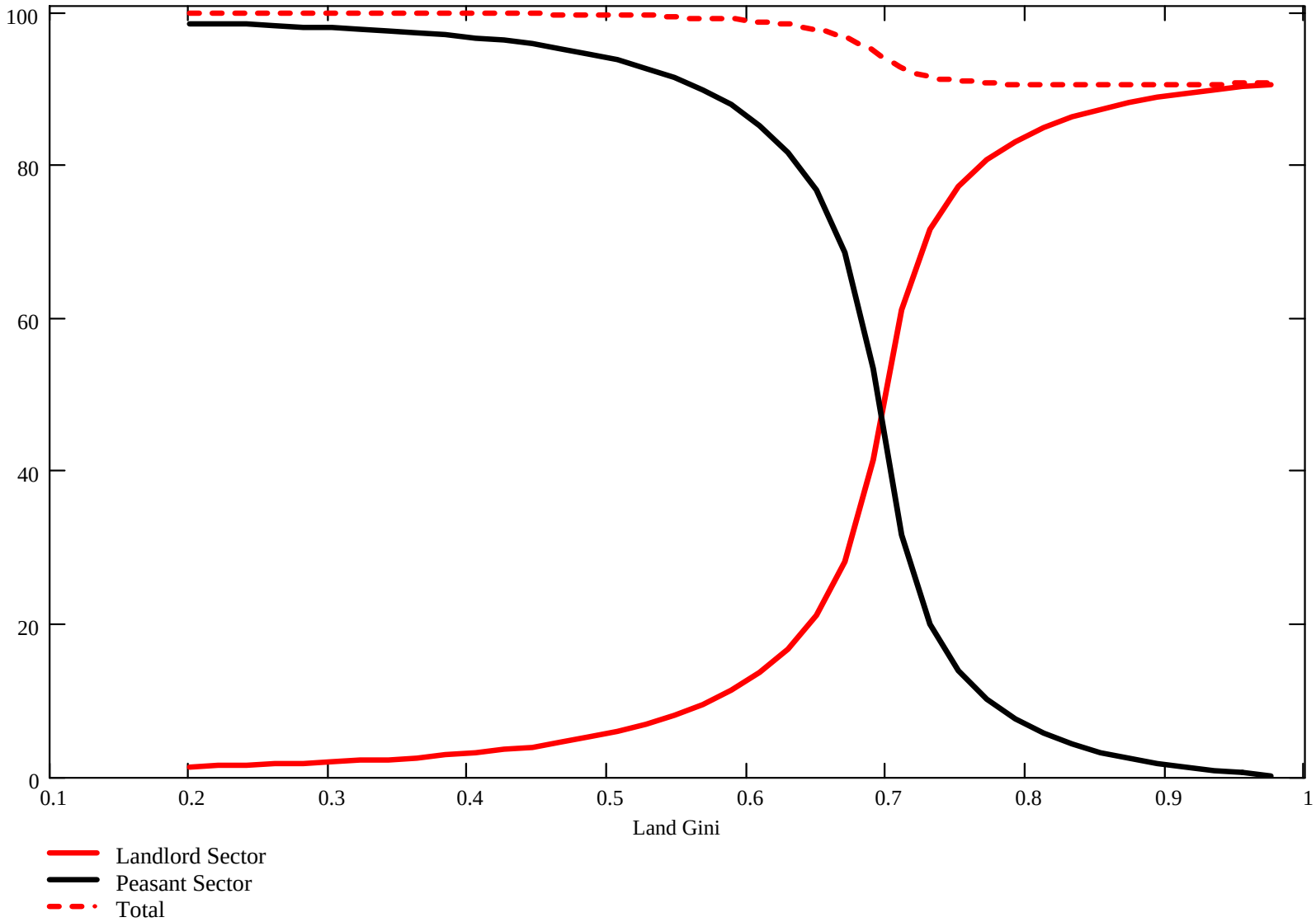
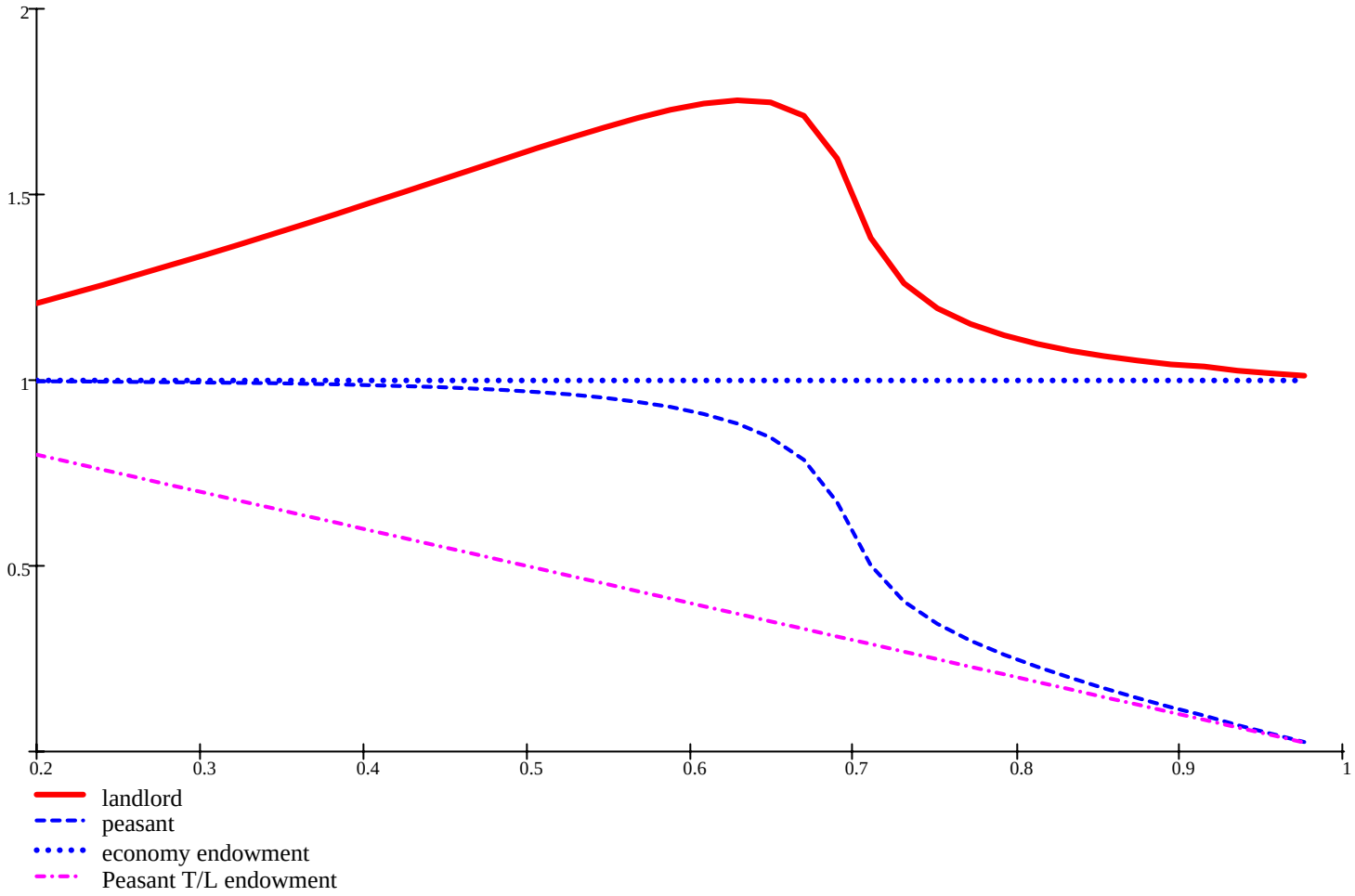
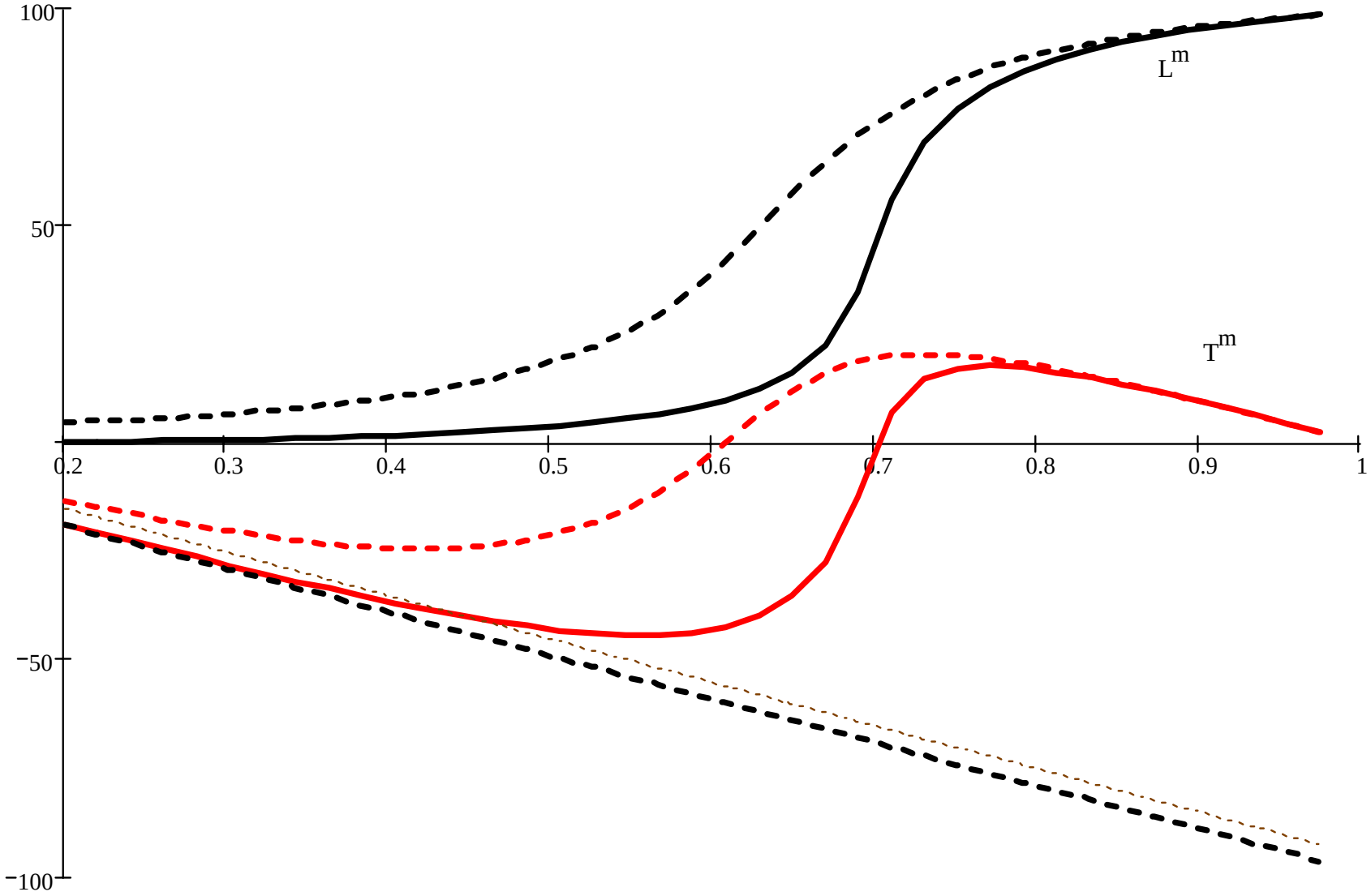


Figure 4: Equilibrium Land-Labor ratios as a function of θ



Improvement in Landlord's Relative Technology or Product Price

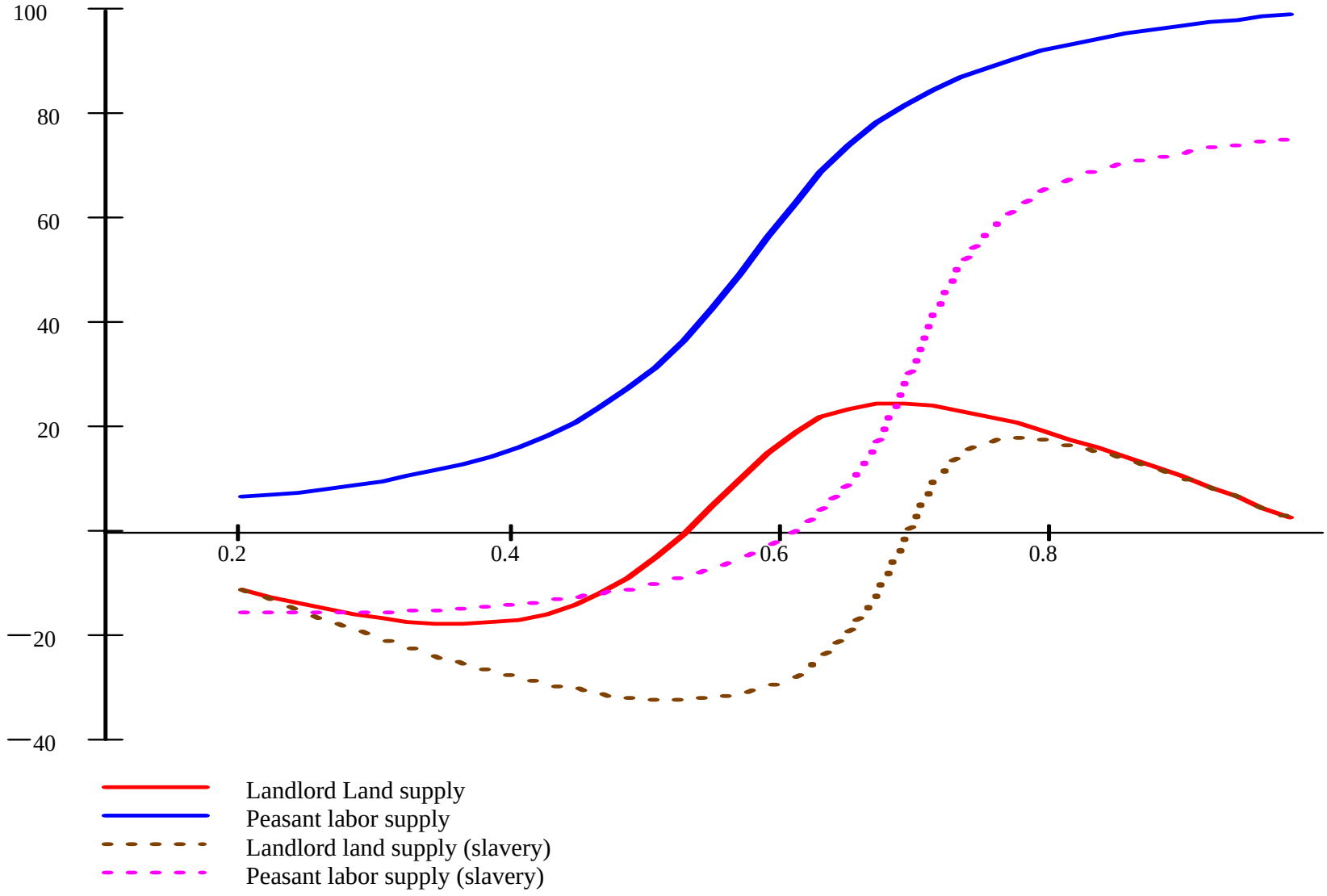
Effect on net factor supplies

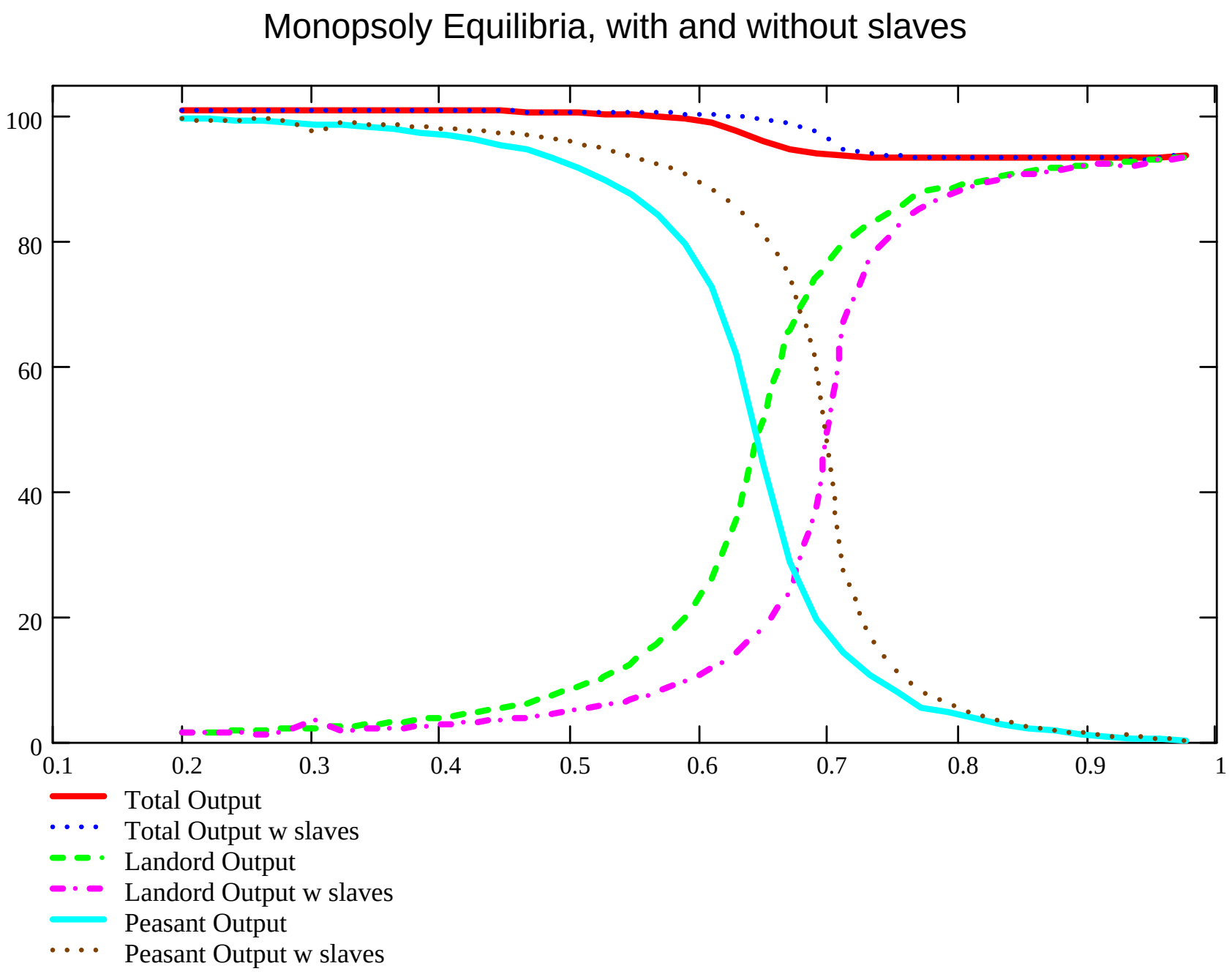


Net factor supply from free peasant farms

in slave and non-slave economy

as a function of land Gini




Monopsoly Equilibria, with and without slaves
100
80
60
40
20
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Total Output
Total Output w slaves
Landord Output
Landord Output w slaves
Peasant Output
Peasant Output w slaves