Slavery and Supervision in Comparative Perspective: A Model

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The familiar transaction-costs model is extended to allow for the varying costs and benefits of supervision and pain incentives on the one hand, and ordinary rewards on the other, in differentially effort- and care-intensive activities. Applied to unfree labor, this model accounts for the observed patterns of slave governance and manumission in extractive, industrial, agricultural, and service activities in antiquity and in the New World. Applied to free labor, it accounts for wage work on large estates in labor-surplus medieval England or modern Italy, the choice between bonuses and penalties in industrial contracts, and the growing paternalism of our own time.

I. INTRODUCTION

A very simple transaction-costs model of agricultural organization notes that rent-paying tenants are automatically motivated to work, because they retain any extra output they may obtain from the land; wage workers will instead tend to spare themselves at their employer's expense unless they are supervised. Since such supervision is costly, rental contracts or peasant ownership will be Pareto superior to alternative systems unless supervision is desired for other reasons, such as the supervisor's superior technical ability. This simple model

2 While supervision costs are not the only relevant element of a contract, it does not seem likely that they would be incurred for the sake of gains along other dimensions. The economies of scale and team production that may warrant them in modern industry do not seem relevant to agriculture.
appears powerful enough to account for a wide body of experience, from the carving up of the ancient slave plantations into petty tenancies to the sophisticated family farming of present-day North America; but it seems quite incapable of accounting for the apparent viability of the American slave plantations until slavery itself was abolished, or of the Mediterranean *latifondi* worked with day laborers in a technically stagnant environment.

This paper explores an extension of the simple transaction-costs model that seems capable of taking that further experience into account. It posits, first of all, that pain incentives and ordinary rewards are meaningfully different, in that the former are capable of generating greater worker effort, but less carefulness, than the latter; and, secondly, that productive activities are themselves differentially effort- or care-intensive. Since slaves (and “wage slaves”) may be driven by pain incentives, they may find themselves locked into Pareto-stable gang labor in effort-intensive activities. Where the worker’s productivity depends overwhelmingly on his brute effort and negligibly on his carefulness, that is to say, a shift to a system that eliminates the supervisor and lets the worker retain his marginal product would *not* yield a reduction in total labor costs, precisely because the attendant shift from pain incentives to ordinary rewards causes a reduction in the worker’s effort and productivity. In care-intensive activities, in contrast, the substitution of care for effort does not reduce the worker’s productivity; a shift from supervised gang work with pain incentives to self-supervised work with ordinary rewards will therefore be profitable, other things being equal, and the predictions of the simple model recalled above will hold good.

Section II develops the proposed model in the context of unfree labor. Section III applies it to the American and Roman slave plantations; the relative effort-intensity of cotton and corn, and care-intensity of vine and olive arboriculture, appear to reconcile the long-run viability of the American slave gangs with their disappearance in classical antiquity. Section IV applies the model to slavery in the economy at large. It suggests that slaves in care-intensive activities will tend to be motivated by rewards, so that both manumission and slave renting will be more common in skilled activities than in unskilled ones, in urban areas than in rural ones, and in antiquity than in the nineteenth century; the paradox of the privileged slave of classical times, in particular, seems

attributable to a legal system that had not yet invented the nonhuman person as a substitute for the human nonperson. Section V extends the model to free labor; it seems capable of explaining the viability of gang work with day laborers on the *latifondi*, and perhaps much else besides, from the revival of demesne farming in thirteenth-century England to contemporary patterns of labor contracts and relations. Section VI is a brief conclusion.

II. THE MODEL

The unfree are governed as their masters see fit. In general, the masters will use both pain incentives and ordinary rewards, adjusting their levels until they yield an equal marginal benefit per unit cost. Since neither corner solution is ruled out, this theoretical norm does not by itself generate empirical predictions; the proposed extension of the simple transaction-costs model aims to do so by imposing restrictions on the relevant cost and benefit curves.

The first premise underlying the restrictions on the benefit curves is that pain incentives and ordinary rewards have meaningfully different effects on worker performance. Pain incentives, it would seem, are the more effective in generating effort. The main reason is that effort varies directly with the level of anxiety, and a threat to one’s physical integrity produces very high anxiety indeed. A subsidiary reason is that threats can be of immediate pain, while rewards are typically of delayed gratification (because they are mediated by money and “household production”). On the other hand, pain incentives are the less effective in generating carefulness. One reason is that the ability to work carefully is enhanced by low levels of anxiety but inhibited by high ones, so that the severe tension produced by pain incentives is counterproductive even if one is doing one’s best. Another reason, of course, is that threats tend to cause ill will, and therefore intentional (“malicious”) carelessness.

The second premise is simply that the relative sensitivity of output to worker effort on the one hand and worker carefulness on the other varies across activities. In the traditional taxonomy, the critical variable appears to be the relative mix of “land” and “capital” with which “labor” is to work, as the direct exploitation of nature by primitive means seems generally far more effort-intensive, and less care-intensive, than activities that rely heavily on complex real or human capital.
These premises, singly or in combination, appear to be supported both by experimental evidence and by empirical observation. Lynn, drawing on the work of Eysenck, Feldman, Furneaux, Kellogg, Kimble, Mednick, and Spence, reports that high anxiety can motivate effort, but impairs the performance of skilled tasks. Scitovsky, drawing on the work of Court, Duffy, Fiske and Maddi, Freeman, Hebb, Malmo, Schlosberg, and Yerkes and Dodson, notes that “efficiency increases with the level of arousal at first, but it declines beyond a certain point. The level of arousal at which efficiency reaches its maximum is generally different for different types of activity, higher for simple, lower for difficult tasks, and also higher for physical, lower for mental activities. . . . Pain, hunger, thirst, extremes of temperature, and the other biological need deprivations are all known to raise arousal.”

The capacity of fear to motivate behavior where all else fails seems widely recognized. The military thus induce reluctant recruits to face the enemy by executing deserters: the dictum that “the ordinary soldier must fear his officer more than the enemy” is attributed to Frederick the Great, but the same principle was said to have guided Crassus two thousand years ago. The grim discipline that prevailed on sailing ships seems similarly based on the need to overcome fear by greater fear: when the safety of the ship required that men climb the rigging in a gale, the certainty of a lashing for disobedience ensured that they would do so despite the danger they thereby incurred. On the other hand, the deleterious effect of excessive stimulation in skilled tasks is perfectly familiar to anyone who has seen students, or athletes, perform poorly in pressure situations. The poor quality of work done under compulsion, and the attendant ill will of the workers, are also notorious. Pliny the Elder stated that the work of chained slaves is utterly poor, as is everything done by men without hope. An ancient Indian dialogue complains that in the master’s absence, the slaves “do not turn to look even if there were a loss of hundreds or thousands to the master.”

“effort” on the horizontal axis are everywhere steeper for the more effort-intensive activity. The proposed empirical generalization is that the slope, as well as the position, of these isoquants varies with the quantity of the various cooperating factors of production.


7 John Keegan, The Face of Battle (New York, 1976), p. 309, and also pp. 71, 115, 183, 277, 324; Appianus [Appian], De Bello Civile, 1, 14.118. Despite the training soldiers receive, “the emotional stress of battle tends to raise arousal to too high a level, so that no more than 20 to 25 per cent of men under attack manage to fire their rifles, let alone use them efficiently” (Scitovsky, Joyless Economy, p. 21).

8 Gaius Plinius Secundus [Pliny the Elder], Naturalis Historia, 18, 7.36.

9 Quoted in Orlando Patterson, Slavery and Social Death: A Comparative Study (Cambridge, Massachusetts, 1982), pp. 207–8.
Conversely, Xenophon’s Ischomachus elicits the good will of his slave steward “by rewarding him, of course, whenever the gods bestow some good thing on us in abundance,” because “that is the best instrument for producing loyalty.”

In the more recent literature, Genovese’s discussion of Africans as “a ‘lazy’ people” is particularly telling. A series of citations portray a superficially confusing picture of slave labor’s effectiveness, and they are taken as evidence of the workers’ “prebourgeois, and especially preindustrial” attitude. But the confusion disappears in the light of the distinctions considered here. Planters note “the great motive power” of the whip, but complain that “it is almost impossible to make a negro do his work well”; former slaves agreed that “to keep the whip off [their] backs [they would] work, work, and work hard,” but insisted that “they had worked much better for kind masters than for harsh ones.”

On the cost side, in turn, the relevant trade-off appears to be that between the direct cost of the workers’ consumption and the indirect cost of supervising them. With ordinary rewards, workers’ consumption tends to exceed subsistence. On the other hand, they can be motivated to work without supervision by being allowed to retain their product at the margin; but supervision may remain necessary for other reasons (for example, if the workers lack the skills to work independently, or if they would tend to escape even if well treated).

With pain incentives, workers’ consumption can be kept at subsistence. On the other hand, close supervision cannot be dispensed with: it is necessary to extract effort by maintaining the immediacy of the threatened punishment, and to limit the costs of worker ill will. Supervision costs appear to increase both with increasing harshness, which increases ill will, and with increasing capital- and care-intensity, which increases the scope for sabotage. In extremely land- and effort-intensive activities (for example, moving stones from here to there), targets are easily specified, compliance is easily monitored, sabotage is virtually impossible, and a single supervisor can effectively oversee an entire group of workers. Real capital is a hostage to ill will, and increasing supervision is needed to limit the damage workers may cause as its quantity and delicateness increase. Human capital—the exercise

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10 Xenophon, Oeconomicus, 12.6–7 (Loeb Classical Library translation).
12 This would not be the case if labor were so abundant, relative to the available real and human capital, that its marginal product did not exceed subsistence; but there would then be no point to owning men, and the efficient motivation of slaves would not be an issue. Evsey D. Domar, “The Causes of Slavery or Serfdom: A Hypothesis,” this JOURNAL, 30 (March 1970), 18–32.
of skill—is particularly subject to covert sabotage, as it involves the selection of appropriate responses in dynamic situations. Carefulness and quality are difficult to measure, so that target levels are difficult to specify; and compliance is similarly hard to determine without monitoring the information flow to which the worker is reacting, so that at the limit it would take the full time of one skilled supervisor to monitor one skilled worker.

Once again, these empirical regularities appear to be widely observed. The problems of adding qualitative dimensions to quantitative targets are familiar to students of Soviet planning, and appeared tels quelis in the wartime United States.\textsuperscript{14} Animals are particularly complex and delicate capital goods, easily damaged in ways that are not always immediately apparent; Cato the Elder, a slave master whose inhumanity was notorious even in antiquity, recommended that the bubulci be treated with indulgence, that they might take better care of the oxen.\textsuperscript{15} Columella noted the advantage of planting grapes that ripened at different times, as this would spread the harvest peak, but warned that they should not be intermingled—for this would require careful picking, and "one cannot assign one overseer to each man, to watch and make sure that the unripe grapes are not picked."\textsuperscript{16}

In summary, therefore, pain incentives appear powerful and easily administered in extremely land- and effort-intensive activities. As production becomes increasingly capital- and care-intensive, however, the effectiveness of pain incentives declines and the cost of administering them increases. The proposed model thus predicts that the continuum of activities from land- and effort-intensive to capital- and care-intensive will be matched by a continuum in the treatment of unfree labor from harsh and closely supervised to benign and unsupervised. Derivatively, it predicts that over this continuum the likelihood of manumission will grow from negligible to substantial, as the right to inflict pain will be worth more to the master who uses it than to the slave, and more to the slave than to the master who does not use it. It also predicts that the entire range can be long-run Pareto-stable. In particular sectors of the economy, therefore, slavery will be a permanent condition, and supervision-intensive structures will be viable despite their high transaction costs even if worker skills are adequate and team production is insignificant.

The inefficiency of brutality and close supervision in motivating skilled workers, and the corresponding tendency of skilled slaves to be

\textsuperscript{15} Marcus Portius Cato [Cato the Elder], De Agri Cultura, 5.6; Thomas Wiedemann, Greek and Roman Slavery (Baltimore, 1981), p. 182.
\textsuperscript{16} Lucius Junius Moderatus Columella, Res Rustica, 3, 21.5–6 (my translation).
motivated by rewards (and be manumitted), have of course been widely noted. The proposed model derives the assertion that it is so from the underlying structure of preferences and technology. As Barzel’s fine analysis has shown, it does not seem possible to do so in the context of the usual model of ordinal utility which does not distinguish between pain and ordinary pleasures, even though that model can explain very many aspects of slavery indeed.

At the nether extreme of the relevant continuum, on the other hand, the proposed model reverses the predictions of its simpler counterpart. The ordinary model ties the strength of motivation to the internalization of the worker’s marginal product: it suggests that when at the margin one is working directly for one’s self, one will always work at least as effectively as one can be induced by supervision to work for someone else. In the absence of the special considerations noted above, therefore, supervised gang labor will always be subject to erosion by a Pareto-improving shift to contractual forms that directly internalize marginal products and save the cost of supervision. The proposed model shows instead how the effectiveness of labor can be greater with supervision than with a fully internalized marginal product (even in the absence of the special considerations noted above) in activities where that marginal product depends on effort rather than care or skill and where the supervision is designed to promote effort by threatening pain and increasing anxiety. In activities so effort-intensive that the lash-wielding supervisor increases the workers’ productivity by more than enough to pay for himself, a pain- and supervision-intensive structure is Pareto-stable: the only way a self-directed worker could achieve the productivity the taskmaster can squeeze out of him would be by hiring somebody to whip him. If the proposed argument is correct, the widely accepted claim that rewards and the prospect of manumission will always raise the efficiency of slave labor is unwarranted, and the free play of economic forces cannot be counted on to promote the gradual extinction of slavery.

As noted above, the breaking and moving of stones is as effort-

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18 Barzel, “Economic Analysis,” p. 99. He notes, however, that “policing costs were high for slaves who subsequently bought their own contracts.”

intensive an activity as can be imagined.\textsuperscript{20} The proposed model predicts that unfree labor will have a special advantage in such activity: that it will tend to appear there first and disappear from there last, and tend to displace from there free labor that cannot be similarly driven.\textsuperscript{21} The record of the mining industry appears amply to verify this prediction. In classical Athens, most slaves were employed in the Laurium silver mines.\textsuperscript{22} The first slave gangs recorded in Rome appear to be the Etruscan captives quarrying tufa for the city's "Servian" walls.\textsuperscript{23} In the Roman Empire, slaves were comparatively rare outside of Italy and Sicily—with the exception of the mines in Spain, Egypt, Gaul, Greece, and Asia Minor, where tens of thousands of slaves, criminals, and captives were brutally worked to death.\textsuperscript{24} Conversely, "throughout antiquity free miners were a negligible element," and mining appears to be the only industry thus monopolized by the unfree.\textsuperscript{25} In later centuries we find that the mines were the magnet for the first African slaves transported to the New World, and for the last transported to Western Europe on the eve of the French Revolution.\textsuperscript{26} Where the totally unfree do not suffice, the mines attract the forced labor of serfs; examples may be found in the late Roman Empire, and in late colonial Spanish America.\textsuperscript{27}

With traditional technologies, public works also consist largely of manual stone- and earth-moving. As expected, such construction also relied heavily on coerced labor: peasants owed labor services on the

\textsuperscript{20} Pulling on an oar would appear to be another, and the galley slave is a familiar figure. In fact, however, the technically superior rowing configuration did require skilled oarsmen; and the choice between free and slave crews was further influenced by the permanence of the fleet, the length of the campaigning season, and the use of the crews as fighting men. See John Francis Guilmartin, Jr., \textit{Gunpowder and Galleys: Changing Technology and Mediterranean Warfare at Sea in the Sixteenth Century} (Cambridge, 1974), pp. 108-20, 267-68.

\textsuperscript{21} So too, in international trade, the sector in which a country's international advantage is greatest is the one where exports will be the last to disappear as the balance of trade deteriorates; it need not account for the greater part of exports until these are sufficiently reduced.


\textsuperscript{23} Tenney Frank, \textit{An Economic Survey of Ancient Rome} (Baltimore, 1933-1940; reprinted New York, 1975), vol. 1, p. 34.


\textsuperscript{25} Moses I. Finley, \textit{The Ancient Economy} (Berkeley, 1973), pp. 72-73.

\textsuperscript{26} David Brion Davis, \textit{The Problem of Slavery in Western Culture} (Ithaca, 1966), pp. 45, 129.

\textsuperscript{27} Frank, \textit{Survey}, vol. 2, p. 242; Enrique Tandeter, "Forced and Free Labour in Late Colonial Potosi," \textit{Past and Present}, 93 (Nov. 1981), 98-136. The unfree workers were all in unskilled activities (carrying, grinding), while the skilled pick-men working at the seam face were all free. The high rates of manumission among the slave miners in the Colombian Chocó, noted by Patterson (\textit{Slavery}, p. 270), are only apparently an exception to the present generalizations: these mines were actually placer operations, so that the extraction of the precious metal was care- rather than effort-intensive.
dikes and embankments of ancient Egypt, Rome's soldiers doubled as navvies, Russia's railroads were built largely by gangs of serfs (as well as prisoners and soldiers), corvée road work survived in Europe into the nineteenth century, and the convict road gang is part of Southern lore.  

As the proposed model also predicts, finally, harshness of treatment seems to decline by relatively fine gradations as the capital- and skill-intensity of the coerced activity increases. On Jamaican plantations, conditions were less harsh the longer-lived the plant (improving from planting estates through ratooning estates to coffee plantations), and better yet on animal farms.  

### III. PAIN INCENTIVES AND THE VIABILITY OF PLANTATION SLAVERY

The spontaneous disappearance of the slave plantations of classical antiquity long suggested that the American plantations were similarly doomed; and this issue was the first to be addressed by the then "new" economic history. John Moes argued cogently, but for a long time in deserto, that normal profits and high slave demand prices did not in fact establish viability: slavery would disappear not because it was unprofitable, but because it was even more profitable to allow the slave to buy himself back. Findlay recalled, and accepted, Moes's argument; but the cliometric fraternity appears generally to have ignored it, and our consensus as to the institution's viability continues to be based on the logic and evidence that Moes effectively undercut.

It is possible, of course, that Moes is simply right: that the profitable manumissions documented by Matison and others were indeed a

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portent of the future, and that American plantation slavery would have
gone the way of its classical predecessor had it only been given equal
time to do so.\textsuperscript{33} Since the market for the commutation of forced labor
services is notoriously viscous, moreover, the Coasian drift of property
rights to those who value them most cannot here be expected to happen
quickly, and Moes's contention is strictly speaking irrefutable.

The prevalence in the post-bellum era of contractual arrangements
that provided for continued supervision tends to support Moes's
argument.\textsuperscript{34} Indeed, it suggests that supervision-intensive production
with slave gangs may have been warranted, in the short run, by the need
to provide technical direction (which would in turn reduce the opportu-
nity cost of supervision to motivate effort). If this were so, the American
experience could be considered entirely analogous to the Roman one, as
understood in the context of the simple transaction-costs model recalled
at the beginning of this paper.\textsuperscript{35}

Against Moes's contention, however, the proposed model can rescue
the cliometric consensus with the argument that Southern plantation
agriculture was sufficiently land- and effort-intensive, and pain-driven,
that the slaves could not have maintained their productivity in the
absence of the lash. The sector's land- and effort-intensity is suggested
by the fact that the main crops were annual plants (so that next year's
harvest was unaffected by this year's carelessness), and by the available
estimates of the composition of assets per slave.\textsuperscript{36} Reliance on pain

\textsuperscript{33} Moes, "Another Comment."
\textsuperscript{34} See for example Lee J. Alston and Robert Higgs, "Contractual Mix in Southern Agriculture
since the Civil War: Facts, Hypotheses, and Tests," this JOURNAL, 42 (June 1982), p. 331; Reid,
\textsuperscript{35} Fenoaltea, "Authority," p. 701. The quantum reduction in supervision that accompanied the
transition from gang slavery to sharecropping indicates that the supervision of the slaves exceeded
that actually required by the level of their expertise. A slave cannot bargain as a free worker can,
however, so that the erosion of supervision that was no longer necessary would naturally proceed
more slowly with slavery than without it; once again, therefore, the long-run nature of Moes's
argument protects it from direct refutation by the evidence.
\textsuperscript{36} Roger L. Ransom and Richard Sutch, One Kind of Freedom: The Economic Consequences of
Emancipation (New York, 1977), pp. 209–10, suggest that in 1860 American slaves worked with
some $600 of assets per capita; of that, land and buildings together represented 82 percent, and
livestock and equipment 18 percent. Martin L. Primack, Farm Formed Capital in American
Agriculture, 1850 to 1910 (New York, 1977), p. 41, indicates that buildings on Southern farms
represented some 17 percent of land and buildings together. Land includes improvements, which
may have represented some 56 percent of its value; see Fogel and Engerman, "Explaining the
Relative Efficiency of Slave Agriculture in the Antebellum South," American Economic Review,
67 (June 1977), 284. However, some 90 percent of these improvements were absorbed by the initial
clearing of the land and the digging of ditches, and only the residual consisted of capital that was
effectively liable to malicious damage (Primack, Capital, p. 139). Overall, therefore, the share of
care-sensitive capital in the stock of assets is some 18 percent, plus 17 percent of 82 percent, plus 10
percent of 56 percent of 83 percent of 82 percent, or about 36 percent. The resulting figure of about
$200 was just one-quarter of the value of an average slave, and one-eighth that of a prime field hand
(Ransom and Sutch, One Kind of Freedom, pp. 213, 357). Compare below, footnote 50.
incentives to generate anxiety and effort, in turn, is suggested by a variety of indicators.

The most direct of these, of course, is the slaves’ own description of the dreadful punishments and torture they had to endure. The associated production costs are revealed by the complaints (and admissions) of slave carelessness, sabotage, and abuse of their tools. The associated benefits are perhaps best revealed by the econometric evidence that the gang slaves worked more productively than free men; since the predominant response to Emancipation was the breaking up of the gangs, rather than their reconstitution with free labor, the superior productivity of the gang slaves appears attributable specifically to their subjection to the lash, and not to conventional economies of scale.

The argument that in Southern agriculture a pain-driven, supervision-intensive system was in fact Pareto-stable is consistent with the observed infrequency of manumission in general, and rural manumission in particular, in the states that lacked anti-manumission laws as in those that had them. It also shows how such laws could be prompted by the planters’ individual interest (by making hard work the only way to avoid the lash), obviating any appeal to prejudice, irrationality, or public-spiritedness.

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37 See John W. Blassingame, *Slave Testimony: Two Centuries of Letters, Speeches, Interviews, and Autobiographies* (Baton Rouge, 1977); the index, under the words “brutality” and “whipping,” gives 125 page references, exclusive of duplications. Patterson, *Slavery*, p. 206, states that in the American South “punishment was not used mainly as a labor promoter but as a form of social control”; but the point suggested by the context is simply that in ordinary circumstances slaves could avoid punishment by working hard enough.


40 Theodore Bergstrom, “On the Existence and Optimality of Competitive Equilibrium for a Slave Economy,” *Review of Economic Studies*, 38 (Jan. 1971), 29–30. Moes, “Another Comment,” p. 185, devotes a paragraph to self-purchase on plantations. He cites two cases: that of an unidentified Mississippi planter who let his slaves buy themselves by installments; and that of John McDonogh. Moes’s source for the former is Matison, “Manumission,” p. 162; Matison, in turn, refers back to Booker T. Washington, *The Story of the Negro* (New York, 1909), vol. 1, p. 194; and Washington’s more extensive account establishes with virtual certainty that the planter in question was in fact John McDonogh. Moes’s two planters thus reduce to one; and an examination of McDonogh’s own record reduces that one to zero, since it makes clear that his business was an integrated brickyard, construction, and real estate firm, employing slaves who were “excellent mechanics” and built fine houses. Moreover, McDonogh turned down $5,000 for a slave whose self-purchase price he set at $600, so that the whole scheme smacks of philanthropic consumption rather than simple profit maximization. See John McDonogh, “Letter of July 10, 1842 to the New Orleans Commercial Bulletin concerning the liberation of his slaves and the colonization of Liberia,” in *Some Interesting Papers of John McDonogh*, ed. James T. Edwards (McDonogh, Maryland, 1898), pp. 50, 63, 65–68. Matison, “Manumission,” p. 163, had noted that rural manumission was very rare, and that the ordinary plantation slave could not hope to purchase himself.

The further argument that the efficiency of pain incentives on the plantations was due to the specific input-intensities that characterized Southern agriculture suggests that slavery was there uniquely advantageous. In the first place, therefore, the proposed model is entirely consistent with Goldin's finding that the elasticity of demand for slave labor was much lower in the rural South than in the cities, since this result "indicates that slave labor was a resource especially suited to Southern agriculture."\(^42\) The South here appears analogous to the Caribbean: there too, as the number of slaves declined with the abolition of the slave trade, they were increasingly concentrated on the sugar estates, where their subjection to pain incentives seems undisputed.\(^43\)

In the second place, the proposed model is consistent with the failure of slavery to establish itself in the northern United States even before the banning of slave imports.\(^44\) The widespread emphasis on the contrast between the year-round agriculture of the South and the seasonal cultivation of the North makes a valid and important point.\(^45\) It seems but a partial explanation, however, since leisure is not the only alternative to outdoor work.\(^46\) The critical constraint, rather, appears to be the lack of complementary or year-round activities that were equally suitable to pain incentives: animal husbandry, and the traditional artisanal, commercial, and domestic activities all seem too care-intensive to give slaves an advantage over free labor.\(^47\) In fact, the only

\(^{42}\) Claudia Dale Goldin, *Urban Slavery in the American South: A Quantitative History* (Chicago, 1976), p. 105. Indeed, the present model directly explains the otherwise perplexing inability of free labor to compete with slave labor on the plantations; see also below, footnote 82.


\(^{44}\) In the absence of slave imports, slavery would survive in the North only if the slaves' net revenue product matched that obtained, at the margin, by slaves in the South; with slave imports, viability required only that the capitalized value of that product cover the slaves' import price.


\(^{46}\) Barzel, "Economic Analysis," p. 94, suggests that during the Northern winter "even indoor work was formerly limited by the paucity of artificial light." One notes, however, that Lancashire is further north than any of the contiguous United States, less sun-lit than New England and the Midwest, and ran its mills in pitch darkness without the benefit of gas or electricity (though these innovations of course reduced the cost of doing so); see H. H. Lamb, *Climate: Present, Past, Future* (London, 1972), vol. 1, p. 502; M. E. Falkus, "The Early Development of the British Gas Industry, 1790–1815," *Economic History Review*, 2nd ser., 35 (May 1982), 218–19. In antiquity, slaves appear similarly to have worked at night by artificial light; see Cato the Elder, *De Agri Cultura*, 37.3, and Columella, *Res Rustica*, 11, 2.12.

\(^{47}\) Wiles, *Institutions*, p. 204; also below, section IV. Factory production did not get established until after legal abolition. Yeo, "Economics," pp. 469–70, argues that wheat is itself unsuited to
significant Northern activity possibly as well-suited to slavery as Southern agriculture would appear to be the exploitation of the forests for lumber and naval stores; but it was too peripheral an activity to protect the institution from abolition.  

In the third place, the proposed model is consistent with the long-run nonviability of the slave plantations of ancient Rome. The cash crops of the latter were oil and wine, obtained not from effort-intensive annual plants but from capital- and care-intensive vines and trees. The vines, with their supporting stakes and withes, appear to have cost twice as much as the land they occupied, and their yield was negligible for perhaps two years. Their proper nurture required both skill and constant care: in dressing the vine, to make it run to fruit, and even in cultivating the soil, lest the roots be damaged by the spade. The olive trees may have cost less to plant than the vines, and they may have been less demanding of day-to-day care once they were established; but their slave labor because its relatively low ratio of labor to land raises supervision costs. However, that low ratio does not in fact imply that the workers are dispersed over the estate on any particular day; the contrary, rather, seems implied by the organization of the medieval open fields. See Stefano Fenoaltea, “Risk, Transaction Costs, and the Organization of Medieval Agriculture,” Explorations in Economic History, 13 (April 1976), 141–44. The frequency of grain cultivation on large estates with supervised labor, whether free wage-earners or *kresty* serfs, also argues against Yeo’s interpretation.

48 In the South, lumbering appears to have used slaves very profitably indeed, and turpentine farms were the last hold-out of pain incentives, prison gangs apart, even after the formal abolition of slavery; see Pete Daniel, The Shadow of Slavery: Peonage in the South, 1901–1969 (Urbana, 1972), pp. 36–40; and Robert S. Starobin, “The Economics of Industrial Slavery in the Old South,” Business History Review, 44 (Summer 1970), 132. Even here, however, the Northern work year may have been interrupted by winter storms, and the North’s density of settlement, lack of impenetrable swamps, and proximity to Canada would all have made it harder to prevent escape.

49 See for example Cedric A. Yeo, “The Development of the Roman Plantation and the Marketing of Farm Products,” Finanzarchiv, n.s. 13, no. 2 (1952), 334–35; Yeo, “Economics,” p. 463. Given the similarity of the marketing conditions for plantation products in the ancient and modern worlds, it does not seem possible to attribute the decline of the Roman plantations to the fact that “the crops were not mass-products like cotton and tobacco” (Wiles, Institutions, p. 195).

On the other hand, Yeo’s argument that the ancient and modern plantations were similar in every relevant respect is obviously rejected by the present interpretation, which is closer to that of Wiles in its search for significant agricultural differences; Chester G. Starr, “An Overdose of Slavery,” this Journal, 18 (March 1958), 18, 23, also contrasts the “extensive” agriculture of the South and the “intensive” agriculture of the Mediterranean. The present argument seems most nearly anticipated by Wiedemann, Slavery, p. 136, as he notes that the closer supervision of the slave gangs on the ancient plantations made them less efficient than in the New World; but he attributes this difference to inferior practice by the ancients, rather than to the greater care-intensity of their crops.

50 Columella, *Res Rustica*, 3, 3.8–9. As noted below, part of the cost of planting the vines represented irreversible improvements; on the other hand, the plantation’s capital included buildings, equipment, and animals as well as the vines and trees. The improvements alone cost some 2,000 sesterces per *iugera*; an ordinary work slave cost about as much, and could tend about five *iugera* of established vineyards (Frank, Survey, vol. 5, pp. 150, 235; White, Roman Farming, p. 373). The value of the improvements alone, per slave, is thus comparable to the value of an ordinary hand even if the latter is allowed as many as four dependents. Compare above, footnote 36.

51 White, Roman Farming, pp. 237–39.
growth to maturity was notoriously slow. In both cases, therefore, the magnitude of the capital at risk and the dependence of future output on current care meant that production was intrinsically ill-suited to the resentful work of pain-driven slaves. This suggests that Columella's apparent humanitarianism was entirely rational; and, by the same token, that slave labor was not a resource especially suited to Mediterranean agriculture.

The present model therefore remains compatible with the hypothesis, generated by its simpler counterpart recalled above, that the slave gangs would appear in viticulture and arboriculture only as a short-term phenomenon, warranted in the first instance as a means of extending scarce expertise to inexpert workers; that the gangs would be abandoned in favor of petty free or slave tenants as the necessary expertise became common; and that in the long run slavery would tend to be eroded by manumission.

It suggests, however, a further reason for the short-run viability of gang slavery on vine and olive plantations. Once established, these plantations were indeed capital- and care-intensive; but the investment process itself involved the digging of holes for the trees and trenches for the vines even into the limestone underneath the topsoil, and it appears to be as suited to pain incentives as mining or public works. The

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52 Columella, *Res Rustica*, 5, 8.1. Frank, *Survey*, vol. 1, p. 171, allows olive trees half the planting cost Columella attributed to vines, but the discount appears to be a rough estimate. The elder Pliny (*Naturalis Historia*, 15, 1.3) notes that in Hesiod's time olives would be harvested only by the descendants of the planter of the trees, though by his own day they were first harvested just one year after transplanting; White, *Roman Farming*, p. 227, renders this passage as "the fruit is [now] picked seven years after planting." It is of course the olive's tremendous "round-aboutness" that made it the symbol of peace.

55 For the same reasons, the vine and the olive appear unsuited to wage-work or short-term tenancies. See André Aymard, "Les capitalistes romains et la viticulture italienne," *Annales: Économies, Sociétés, Civilisations*, 2 (July-Sept. 1947), 265, on the superiority of small units of production; Columella, *Res Rustica*, 1, 7.6, on the damage tenants can do to vines and olive trees; Fenoaltea, "Authority," p. 707, on the parceling-out of the Bordeaux region's vine-growing demesnes in the thirteenth century; Frank, *Survey*, vol. 4, pp. 93-95, 477, vol. 5, p. 74, on the tendency to petty tenures where vines and olive trees were grown, noting the multi-year rent remissions to tenants who planted them; Pliny the Elder, *Naturalis Historia*, 12, 54.113, on the battles to defend balsam trees against malicious damage.

56 John Bradford, *Ancient Landscapes: Studies in Field Archaeology* (London, 1957), pp. 194, 199, 204, 206, and plates 25, 28, and 49b; White, *Roman Farming*, pp. 225-26, 237, and plate 51. On established plantations, it might be more profitable to have such digging done by hired jobbing gangs than by the estates' own slaves, since the latter could not be driven by pain incentives without jeopardizing their future good will; see Columella, *Res Rustica*, 3, 13.10-12, and
present model thus suggests that the heyday of the slave gangs in the late Republic is attributable to Rome's victorious wars through two distinct paths. One is the already noted importation of masses of locally unskilled slaves; the other is the effort-intensive investment in capital-intensive agriculture induced by interlocal specialization within the unified Mediterranean.\textsuperscript{57}

In later generations, the survival of the slave plantations seems attributable to the persistence of the same mechanisms, albeit on a much reduced scale. Columella's estate is to be worked by slaves who need instruction, and he stresses that they are to be chosen for their brains as well as their brawn.\textsuperscript{58} In the area buried by the eruption of Vesuvius in A.D. 79, large-scale cultivation with gangs of slaves is clearly associated with an expansion of viticulture: one notes the "great heaps" of vine stakes found on the larger estates, and the ongoing conversion of the Villa dei Misteri.\textsuperscript{59}

The proposed model can thus attribute the erosion of the ancient plantations to the very nature of their resources and technology. By the same token, it renders unnecessary a variety of alternative explanations of their decline, the empirical validity of which is open to question.

The first of these is the traditional argument from the gang slaves' putative inability to reproduce their own numbers. Though advanced by no less an authority than Marc Bloch, this account appears contradicted both by the American experience and by the evidence of successful slave-breeding on the classical plantations.\textsuperscript{60}

Another is the argument advanced by Yeo, who appeals to a decline in the demand for the products of Italy's plantations.\textsuperscript{61} There is no doubt that Italy shifted from exporting to importing oil, wine, and manufactures within a century of Actium, and that this development is related to the growth of such production in Spain and Gaul. However, the lack of substitute commodity exports suggests that these were paid for by tribute and by rents from private and imperial properties in the provinces.\textsuperscript{62} There is no evidence that the production of Italian wine

\textsuperscript{57} Yeo, "Development," pp. 321–22. While grain continued to be grown in Italy, there is no reason to assume that the only grain imported from the provinces was that received as tribute; compare Frank, \textit{Survey}, vol. 1, pp. 68–69, vol. 5, pp. 139–40, 182–83; White, \textit{Roman Farming}, pp. 66, 398.

\textsuperscript{58} Columella, \textit{Res Rustica}, 1, 9.4.


\textsuperscript{61} Yeo, "Economics," pp. 479–83.

and oil actually declined; the failure to replant the vineyards on Vesuvius seems attributable to simple prudence, and it is only with hindsight that we know that the investment would in fact have been a safe one.\footnote{Yeo, “Economics,” pp. 482–83, noting that the cited text by Dio Cassius (66, 24.2–3) refers to the immediate aftermath of the eruption. The virtual absence of Campanian and Latian jars among the mainly Spanish ones in Monte Testaccio is not evidence that the Roman market was lost to provincial competition, since few jars of Italian origin from any period have been found in Rome; see Frank, Survey, vol. 5, pp. 135, 272; Yeo, “Development,” pp. 341–42. One conjectures that Italian wines were shipped in barrels, possibly because of the relatively high cost of fuel and therefore of pottery in Italy.}

The argument that true slavery requires a state-enforced owners’ cartel, so that the decline of the gangs is tied to the decline of the police power of the state, is also difficult to accept in the context at hand.\footnote{Davis, Problem, pp. 48–49; Patterson, Slavery, pp. 58–62; Frank W. Walbank, “Trade and Industry under the Later Roman Empire in the West,” in Cambridge Economic History of Europe, vol. 2, ed. M. M. Postan and E. E. Rich (Cambridge, 1952), p. 73; Wiedemann, Slavery, p. 194. Barzel, “Economic Analysis,” pp. 108–9, points out a further advantage of race-specific slavery. Since slaves generally lack the capacity to sue, illegally enslaved citizens would be unable to recover their freedom even if they were not transported to an alien jurisdiction; but the restriction of slave status to an alien race eliminates this risk for the the members of the ruling group. As Barzel notes, however, this issue concerns the overall advantage or disadvantage of allowing slavery, so that it is relevant to legal abolition rather than to the observed erosion of gang slavery.}

The Roman state seems to have been better organized, and indeed more willing to assist in the return of runaway slaves, in the first centuries of the Empire than when the slave plantations were at their peak.\footnote{Westermann, Slave Systems, pp. 77, 107; also Frank, Survey, vol. 1, p. 303, vol. 5, p. 50.} In general, moreover, it is disorder, and not order, that promotes slavery: as Augustus restored domestic peace, he sent officials to empty the \textit{ergastula} of citizens who had been deprived of their liberty by the private violence of powerful landowners.\footnote{Douglass C. North and Robert Paul Thomas, “The Rise and Fall of the Manorial System: A Theoretical Model,” this \textit{Journal}, 31 (Dec. 1971), 779; Pierre Dockès, \textit{La libération médiévale} (Paris, 1979), pp. 44–45, 106–15.}

A related argument suggests that the racial distinctiveness of American slaves made it easy to identify runaways, and thus reduced the cost of recapturing them below that which prevailed in the ancient world.\footnote{Barzel, “Economic Analysis,” pp. 100, 109; Engerman, “Considerations,” p. 61; Wiles, \textit{Institutions}, pp. 188, 195.} That cost difference does not appear significant, however, in view of the ease with which status differences could be made visible, as needed, by brands, tattoos, collars, physical deformations, and the like.\footnote{Gaius Suetonius Tranquillus, \textit{De Vita Caesarum}, 2, 32.1. As noted for example by Bloch, “L’esclavage antique,” p. 31, the troubles of the late Empire brought about a recrudescence of slavery; see also Starr, “Overdose,” p. 28.} Since the investments of wealthy Romans were so heavily biased towards the provinces that Trajan felt the need to force senators to own land in Italy, it is highly unlikely that an effective protectionist lobby existed at all; see Frank, Survey, vol. 1, pp. 387–92, vol. 5, p. 88. A more likely explanation is a concern for an adequate provincial grain surplus, on which depended the quiescence of the mob; this is consistent with the failure to prohibit the planting of olive trees in the provinces, since the latter were more likely to be intercultivated with grain (White, \textit{Roman Farming}, p. 398).
The greater significance of race seems to lie, rather, in the vexing context of externalities and changes in tastes. Slavery is civil death, and indeed a dishonorable death. Societies therefore find it difficult to enslave their own members (except of course as a punishment for crimes): as a rule, slavery is restricted to aliens, or transformed into an altogether milder form of servitude. By the Middle Ages, and whatever their internal hatreds and divisions, Western Europeans considered themselves members of a single Christian community, and slaves continued to be recruited only from among pagans or Muslims. One can hardly doubt that the main significance to New World slavery of the Africans' racial distinctiveness is that it defined them as aliens: sufficiently alien, in fact, to warrant their utter lack of status within the legal community, and their resulting exposure to pain and abuse.

But race did not continue forever to provide the needed measure of psychological distance. Though the American slave plantations may have been Pareto-stable in terms of the interaction of masters and slaves alone, they proved in fact nonviable because slavery offended third parties. To an economist, at least, the rise of abolitionism seems best understood as a change in tastes; and there is evidence of a parallel by the individual actions of slaveholders. One can also query the validity of his premise: in Roman law, for example, the *causa liberalis* existed to cover precisely such contingencies (and, in accord with the basic principles of the law, the action had to be brought by a *free adversor libertatis* until the late Empire granted legal personality to the slaves themselves); see for example Buckland, *Law of Slavery*, p. 652ff.

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69 See for example Buckland, *Law of Slavery*, p. 434; Patterson, *Slavery*, pp. 77–101. In Roman law, "on enslavement the old personality was destroyed and did not revive on manumission"; so too, in medieval English law, outlawry is civil death, and "the inlawed outlaw is not the old person restored to legal life; he is a new person." See W. W. Buckland, *The Main Institutions of Roman Private Law* (Cambridge, 1931), p. 49, and Frederick Pollock and Frederic William Maitland, *The History of English Law*, 2nd ed. (Cambridge, 1898), vol. 1, p. 477. There are of course degrees of servitude, and the socially dead individual without legal rights represents an extreme case. Semantically, however, it seems useful to restrict "slavery" to that specific extreme, since "servitude" already serves as the generic term; the terms are so used here.

70 See for example Davis, *Problem*, pp. 47, 62ff; Richard Hellie, *Slavery in Russia, 1450–1725* (Chicago, 1982), pp. 517–18; Patterson, *Slavery*, pp. 38–45, 117–18, 125; Westermann, *Slave Systems*, pp. 30, 43, 124–26; Wiedemann, *Slavery*, p. 39. Both Athens and Rome suppressed slavery for debt early in their history (respectively in 594 B.C., as part of Solon's reforms, and in 326 B.C., by the *lex Poetelia Papiria*). In the Middle East, by long tradition, individuals could not be slaves to members of their own tribal group; in Ur, the very word for slave implied foreign origin. Debt bondage was limited to three years by the Hammurabi code, and to six by Hebraic law (but only so long as the debt "slave" was also Jewish). Sixteenth-century Muscovite "slave" is a typical case in point, and Hellie's arguments to the contrary turn on the unusual breadth of his definitions. Internal recruitment was accompanied by extensive legal protection and extremely mild treatment: the "slaves" were not sexually available to their masters, and their marriages and families were inviolable; the "slaves" were not driven or sold away; and entire families could abscond with such ease, if they were dissatisfied with their treatment, that runaways display the same demographic profile as the "slave" population as a whole. As Patterson points out, most of these so-called slaves were simply contractual indentured servants. See Hellie, *Slavery*, pp. 18–21, 33ff, 91ff, 115ff, 139, 339–40, 350, 504ff, 556; compare Patterson, *Slavery*, pp. 44, 130, 183–84.


72 Patterson, *Slavery*, p. 7.
change in tastes and laws in antiquity, which again suggests an alternative to the account proposed here. Both Stoicism and Christianity stressed the masters’ common humanity with their slaves; and their growing acceptance among the cultured classes of the Empire was accompanied by a series of legal innovations that eroded the masters’ formerly absolute power over their slaves.\textsuperscript{73} The earliest of these, under the Julio-Claudians, may have been designed primarily to extend the power of the state; but the Antonines granted slaves the power to invoke the law against a cruel master and to enforce a self-purchase agreement, and Constantine protected the integrity of the slave’s family as well.\textsuperscript{74} While not all imperial legislation favored the slaves, the meliorative trend is indisputable, and “it is clear from the language of the Institutes that the power of the master was in Justinian’s time limited to reasonable castigation.”\textsuperscript{75} Classical slavery had disappeared, and the servus had become a serf.\textsuperscript{76}

It is possible, therefore, that pain incentives were efficient and Pareto-stable on the ancient plantations as on their modern successors, and that the former were destroyed, like the latter, by the declining social and legal acceptance of those incentives. Against this view, however, one can offer a number of arguments. The first is that the hutting of slaves goes back at least to Augustan times, and thus appears

\textsuperscript{73} For present purposes, it is of course immaterial whether Stoicism and Christianity caused the legal changes, or were jointly caused with them by something deeper. There has been a tendency, in the English-language literature, to deny the positive role of Christianity; but this seems to have been in essence a reaction to the excessive claims of nineteenth-century abolitionists. See for example Bloch, “L’esclavage antique,” pp. 40–41; Davis, Problem, pp. 55, 89; Finley, Ancient Economy, pp. 88–89; Genovese, Jordan, pp. 4–5; Patterson, Slavery, p. 189; Starr, “Overdose,” p. 28; Edoardo Volterra, Istituzioni di diritto privato romano (Rome, 1961), pp. 57, 71, 73; Westermann, Slave Systems, pp. 109, 116–17, 149–162 (which Starr misapprehends); Wiedemann, Slavery, p. 13 (but also p. 178).

\textsuperscript{74} Buckland, Law of Slavery, pp. 36–38; Codex Theodosianus, 2, 25.1. While Wiedemann, Slavery, p. 173, no doubt correctly stresses the imperial state’s desire to limit the scope of the dominica potestas as of the patria potestas, Claudius did favor the liberty of slaves abandoned for ill health (who were otherwise simply res derelictae, subject to ownership by occupatio). The Antonine innovations appear to be the critical ones, since with them the servus was no longer “a man without rights, i.e. without the power of setting the law in motion for his own protection”—that is to say, a slave, in the strict sense used here; see Buckland, Law of Slavery, p. 2. As Buckland makes clear, the notion that a slave is legally a thing and not a person turns on the strict definition of a legal person as one who can be the subject of substantive and procedural rights; it is entirely consistent with provisions which recognize that the slave is a human being, for example for purposes of punishment. Compare for example Davis, Problem, p. 58, Genovese, Jordan, p. 4, Patterson, Slavery, p. 22.

\textsuperscript{75} Buckland, Law of Slavery, p. 38; also Buckland, Institutions, p. 41, and Westermann, Slave Systems, pp. 108–9, 114–15.

\textsuperscript{76} In the late Empire, the hutting of slaves appears less likely to resolve itself in formal manumission. With the growth of legislation protecting the person and family of the servus on the one hand, and tying free peasants to the land on the other, the servile quasi colonus became all but indistinguishable from the free colonus. The value of formal manumission to the huttover slave may thus have been reduced enough to make the manumission tax prohibitive despite its low nominal rate. See for example Jones, “Slavery,” pp. 198–99, and Westermann, Slave Systems, p. 95.
to antedate its purported cause.\textsuperscript{77} The second is that "reasonable castigation" did not exclude harsh beatings of one's dependents even in very recent times, and pain incentives appear to have remained legal in the late Empire.\textsuperscript{78} The third is that a softening of attitudes, and especially their autochthonous embodiment in effective legislation, are altogether more likely where the income of the landowning aristocracy does not depend on continued harsh treatment of their labor force.\textsuperscript{79} The fourth and perhaps most telling is that the slave plantations which eventually reappeared in the Mediterranean absorbed but a fraction of the medieval slave trade, and grew sugar cane rather than vines or olive trees.\textsuperscript{80}

On balance, therefore, the contrast between the land- and effort-intensity of the modern Southern and Caribbean staples and the capital- and care-intensity of the ancient Mediterranean staples appears to provide much the most significant single explanation of the viability of plantation slavery in the New World and its nonviability in antiquity.

\textbf{IV. PAIN INCENTIVES AND SLAVERY IN THE ECONOMY AT LARGE}

The distribution of slaves among the various sectors of the economy is determined by comparative advantage; as their numbers increase, they tend to spill over into sectors to which they are progressively less suited. As argued above, the slaves' subjection to pain incentives makes them particularly suited to effort-intensive activities; one therefore expects to find mines, tropical plantations, and the like worked by harshly treated slaves.

At the other extreme, given sufficient numbers, slaves will be employed even in activities where they have no advantage over free

\textsuperscript{77} Digesta, 15, 3.16; also Frank, Survey, vol. 1, p. 303. This argument is a relatively weak one, since the hued slave may have been a former *vilicus* who continued to work the estate with gangs of slaves; see Heitland, *Agricola*, p. 369.

\textsuperscript{78} See for example Genovese, *Jordan*, pp. 73–74; Hellie, *Slavery*, p. 505; Clark Nardinelli, "Corporal Punishment and Children's Wages in Nineteenth-Century Britain," *Explorations in Economic History*, 19 (July 1982), 283–95; Patterson, *Slavery*, p. 7. Constantine's assimilation of slave killing to murder specifically excepted disciplinary whipping (*Codex Theodosianus*, 9, 12.1–2; *Codex Iustinianus*, 9, 14.1).\textsuperscript{79}

\textsuperscript{79} Engerman, "Considerations," pp. 64–65. Provisions similar to those of the late Empire were embodied by the codes of French and Latin America, with notoriously little effect on plantation life; see for example Davis, *Problem*, pp. 102, 233–36; Lawrence M. Friedman, *A History of American Law* (New York, 1973), p. 198. If Constantine's decree on slave killing marked a retrogression from the Antonine legislation, it may be tied to the above-noted recrudescence of slave imports (and, with them, of supervision- and pain-intensive gang labor) in those troubled times.\textsuperscript{80}

\textsuperscript{80} See for example Davis, *Problem*, pp. 42–43. Since the slaves picked up in the Black Sea could as easily have been transported to Western Europe as to the Levant, it is once again the intrinsic unsuitability of European agriculture to the plantation system that best explains the unimportance of agricultural slavery in medieval Europe on both sides of the Alps.
men, and work side by side with them under similar conditions. One expects these to be activities in which the master's dependence on the worker's carefulness and good will makes rewards more profitable than pain incentives; and they appear to include most traditional crafts and trades, commerce and transport, administrative services, and at least the skilled branches of factory production.\textsuperscript{81} These are the activities in which we find slaves living and working independently as if they were free, subject only to a quitrent to their owner; and Goldin's econometric analysis has shown that such slaves were indeed close substitutes for free workers.\textsuperscript{82}

Because such slaves are not profitably subjected to pain incentives, moreover, their personal inviolability will be worth more to them than to their owner, and manumission rates will be relatively high.\textsuperscript{83} The cases of self-purchase observed in the South, as of successful coartación in Latin America, pertain overwhelmingly to skilled slaves.\textsuperscript{84} In Roman Italy, also, the great number of freedmen in these activities revealed by the surviving inscriptions suggests a high incidence of manumissions.\textsuperscript{85}

Subjection to pain incentives at the master's discretion is not the only point on which slave and free labor differ from each other, however, and there appears to be a significant intermediate range of activities that are specially suited to slaves but not to pain incentives. Here too, as in mining, the labor force will be predominantly servile; but the slaves will be governed by rewards rather than by the lash.

One of the principal consequences of the slave's legal incapacity is


\textsuperscript{82} See Goldin, \textit{Urban Slavery}, pp. 35–47, 104–5; also, for example, Henry Rosovsky, \"The Serf Entrepreneur in Russia,\" \textit{Explorations in Entrepreneurial History}, 6 (May 1954), 207–36; Starobin, \"Industrial Slavery,\" pp. 131–74. Fogel and Engerman, \textit{Time on the Cross}, vol. 1, p. 238, suggest that while \"the nonpecuniary disadvantage of gang labor was no less to blacks than to whites, . . . the advantage of slave labor was much less in urban industry than in agriculture [because] the nonpecuniary disadvantage of accepting the monotonous and intense routine of the factories appears to have been offset by nonpecuniary benefits which both black and white workers attached to life in the cities.\" The argument seems forced, however, since urban slaves worked predominantly in the crafts, trades, and services rather than in factory industry (Goldin, \textit{Urban Slavery}, pp. 42–46), and \"industrial slaves . . . lived in rural, small-town or plantation settings, where most southern industry was located, not in large cities\" (Starobin, \"Industrial Slavery,\" p. 132).

\textsuperscript{83} The master may let the slave accumulate funds and buy himself back, or prefer to reward him with his freedom rather than with income. There is little substantive difference between the two: manumission is always gratuitous, since the slave buys himself with funds which actually belong to the master; it is always earned, if granted for services rendered. See for example Patterson, \textit{Slavery}, p. 210.

\textsuperscript{84} See for example Matison, \"Manumission,\" and above, footnote 40; also Davis, \textit{Problem}, pp. 267–68.

that the slave cannot choose his work and working conditions as a function of his own preferences. This subsumes exposure to pain incentives as a particularly significant special case, but is altogether more general than that. It implies that slave labor is cheaper than free labor wherever working conditions are intrinsically unpleasant, because free men would have to be paid their alternative marginal product plus a premium to cover the supernormal disutility yielded by the working conditions, while the cost of using slaves is reckoned as their alternative marginal product alone.

Domestic service appears to be the archetype of such intrinsically unpleasant work, since the servant suffers the master's exercise of dominance, including sexual use, and lacks a private world in which to extend his own personality. In antiquity, domestic service seems second only to mining in its suitability to slave labor: neither attracted the free, and the main difference between the two is that slaves shared domestic service with freedmen. At the same time, it is work that is not well suited to pain incentives: most masters, at least, do not want their own homes to be armed camps, and prefer to surround themselves with servants who are loyal and even cheerful. In general, therefore, domestic slaves will be governed by rewards, and their lot will appear to be a privileged one next to that of slaves in the fields and mines. In Rome's senatorial households, in particular, the work of the domestics appears relatively light (not least because their numbers were multiplied

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86 However, the slave can influence his master's choice by determining the shape of the labor (effort, good will) offer curve that the latter faces. The Marxian analysis of the breaking up of the Roman plantations presented in Dockès, La libération, is cast in terms of the class struggle in historic time, while the present transaction-costs analysis is cast in terms of individual interaction in abstract time; but the two seem fundamentally similar.

87 By the same token, slaves will have a general disadvantage in unusually pleasant work. See Fogel and Engerman, Time on the Cross, vol. 2, pp. 113–14, for a masterly exposition of the argument.

88 See for example Finley, Ancient Economy, pp. 82–83; Genovese, Jordan, pp. 333–34; Hellie, Slavery, pp. 505, 676, 692, 703; Jones, "Slavery," p. 186; Wiedemann, Slavery, pp. 175–76. In our own times, the supply of domestic servants has declined very rapidly with the growth of alternative employment opportunities, and it remains ample only where emigration also continues on a large scale. Examples of minor activities that similarly appear to have been the preserve of unfree laborers because of their unpleasantness include the grinding of ore in Potosí and the cleaning of the cloaca in Roman cities; Frank, Survey, vol. 4, p. 808, vol. 5, p. 99; Tandeter, "Labour," p. 110.

89 Finley, Ancient Economy, p. 72. There is also a demographic difference, of course: captive women and children tend to become household slaves, as they are sexually attractive and not dangerous, while the men are more often relegated to effort-intensive activities or killed outright. The pattern recurs from archaic times at least into the Renaissance; see for example Finley, "Greek Civilization," p. 145, on the Homeric poems, and William L. Rodgers, Naval Warfare Under Oars, 4th to 16th Centuries (Annapolis, 1940), pp. 162–63, on the Ottoman capture of Nicosia.

90 Genovese, Jordan, p. 332.

91 See for example Genovese, Jordan, p. 329; Wiedemann, Slavery, pp. 101 (for direct evidence of manumission as a reward for loyal service), 122, 231. In Rome, the contrast between the conditions of rustic and domestic slavery appears sharpest in the late Republic; see White, Roman Farming, pp. 358, 365.
by conspicuous display), and loyal servants could look forward to manumission within a decade or less.92

The herding of animals also appears to have been "a particularly undesirable occupation"—harsh, dangerous, and solitary—from which slaves largely displaced free men.93 Close supervision of these wandering herdsmen was of course impossible, and the manifold risks of the business meant that it was similarly difficult to judge their work by its results; yet a good deal of care and skill were required if avoidable losses were to be kept down.94 The master thus depended on the servant's good will; and the very term peculium suggests that even in archaic times the master elicited that good will by making the herdsman a junior partner in the enterprise.95

It may be true, therefore, that herding was indeed "the greatest field for slaves in Italian agriculture"; but it is very hard to accept the related contention that the servile wars were fueled by masses of herdsmen who rebelled because they were harshly treated.96 In fact, the numbers of herdsmen involved appear vastly exaggerated, as the scholars familiar with the carrying capacity of Italian land have pointed out.97 Moreover, the most cogent analyses of the servile revolts indicate that these were provoked not by harsh treatment, but by the massing of psychologically undefeated prisoners of war under charismatic leaders or their own former officers.98 Regardless of their treatment, finally, herdsmen would in any case be exceptionally likely to rebel, since the very nature

92 Manumission would not necessarily free the domestic from his work, since manumission was often granted on condition of continued service; but it did transform the slave into a legal person, exempt from the punishments specific to the unfree. Manumission thus remained a valuable reward; and it was presumably gratuitous, since domestic slaves lacked the opportunity to earn money with which to pay for themselves. See Wiedemann, Slavery, pp. 46–47, 51, 55–56, 101, 122, 169–71; also pp. 5, 78, 90, on slaveholding for conspicuous display. While the latter phenomenon would normally lighten the slave's burdens, it could lead to perverse effects, from the denial of profitable manumission to the slaughter of the potlatch; see for example Hellie, Slavery, pp. 490ff, 690–91, Patterson, Slavery, pp. 84, 191, Rosovsky, "Serf Entrepreneur," pp. 215–16.


94 Columella, Res Rustica, 6 and 7; Marcus Terentius Varro, Res Rusticae, 2; White, Roman Farming, pp. 272–327, passim.

95 The peculium applied as much to free citizens alieni iuris as to slaves, since under the Republic the patria potestas was as unlimited as the dominica; see for example Buckland, Institutions, pp. 57, 64, Volterra, Istituzioni, pp. 76–78.


of their business meant that they were a selected group of fit young men, little supervised, and armed into the bargain.99

Another of the principal consequences of the slave’s legal incapacity is that the slave is legally an extension of his master, so that a sum paid to the slave of Titius is considered paid to Titius himself.100 Nowadays, this would matter little: legal intermediation by an agent is not difficult, and in any case most of our bills are paid not directly to individuals but to abstract legal persons (which in substantive terms are also intermediaries). In classical antiquity, on the other hand, both legal agency and abstract legal persons were restricted to very special cases where they were recognized at all; but an effective substitute for the nonhuman person or the legal agent was found in the human nonperson, who was legally but his master’s instrument.101 Slaves thus also had a specific advantage in the role of agents, and slave agents were common even where slaves were generally scarce.102

To the modern mind, slave estate agents supervising free tenants appear to be “curious anomalies,” and there is a tendency to explain them away by assimilating administrative work to domestic service.103 The argument seems forced, however, since the agent typically lived independently, away from the owner’s supervision; and the paradox disappears if one recalls the different legal framework of the times. Precisely because the agent was largely unsupervised, moreover, the master depended on his loyalty and good will, and would therefore motivate him with rewards." Formal manumission could be among these, as in the case of domestics; but one notes that here the slave status itself, and not only the services which could survive it, was of value to the master.105

A transaction-costs model that distinguishes between pain incentives and ordinary rewards, and considers their relative suitability to different types of economic activity, thus seems directly to account for the observed patterns of manumission. Manumission rates appear to be activity-specific; for the reasons noted, they tend to be high in varieties

99 Varro, Res Rusticae, 2, 10.1; Wiedemann, Slavery, p. 146. Caesar’s decree that one-third of the herdsmen should be free men thus seems prompted by considerations of security; Frank, Survey, vol. 1, p. 378.
100 Buckland, Institutions, pp. 42–43; Volterra, Istituzioni, p. 55; Wiedemann, Slavery, p. 31.
101 Buckland, Institutions, pp. 86–90, 161; Frank, Survey, vol. 1, p. 148, vol. 5, p. 217; Patterson, Slavery, pp. 303–4; Volterra, Istituzioni, pp. 119–24, 147–49. In classical Roman law, the causa liberalis (above, footnote 69) was one of the few exceptions to the rule against representation; see for example Buckland, Law of Slavery, p. 655.
103 Jones, “Slavery,” p. 186; similarly Finley, Ancient Economy, p. 76.
104 Recall for example Xenophon, Oeconomicus, 12.6–7, cited above.
105 For this reason, slave agents are more likely to remain slaves than other slaves governed by rewards. That a rural actor died at 60 still a slave is not therefore grounds to infer that rural slaves in general were rarely manumitted; contrast Brunt, “Review of Westermann,” p. 168.
of skilled labor or services, and negligible in brutish work. Deriva-
tively, they appear to be time- and place-specific. In general, manumis-
sion rates will be high where and when slaves are numerous next to the
employment opportunities in the pain-incentive sector, and low where
and when they are not; urban rates in particular will tend to be high,
because cities are the locus of skill- and care-intensive activities.

The essential contrast between the temperate zones of Transalpine
Europe and the Mediterranean on the one hand, and the tropical and
subtropical zones of the Americas on the other, thus appears to be the
relative size of the effort- and therefore pain-intensive sector in the local
economy. In antiquity, masses of slaves were created by capture; but
the long-run equilibrium of the economy absorbed only a small number
in activities where rewards were not more profitable than the lash, and
where slaves were at all numerous manumission rates were correspond-
ingly high. Where the manumitted were young, their offspring were
born free, and the family made the transition to freedom in one swoop;
where they were older, but good treatment and eventual manumission
were foregone, slavery became a life-cycle phenomenon, and freedman
father was followed by freedman son.

106 Patterson, Slavery, pp. 180, 264–66, and above, footnotes 40 and 84. The sectoral distribution
of manumitted slaves cannot therefore be considered representative of the sectoral distribution of
slave employment; see for example Wiedemann, Slavery, p. 133, and contrast Starr, “Overdose,”

107 On the correlation of urban residence with high manumission rates in Latin America, the
Caribbean, South Africa, Greece, Rome, Han China, and most of the Islamic world see Patterson,
Slavery, pp. 180, 269, and references therein.

108 According to the Eighth Census of the United States, vol. 4 (Washington, D.C., 1866), p. 337,
in the 1850s American manumission rates were in the neighborhood of 0.06 percent per year.
Frank, Survey, vol. 1, p. 384, uses what he identifies as the yield of the tax on manumissions to
estimate the manumissions at 16,000 per year from 81 to 49 b.c. Given a slave population of 3 to 4
million (Brunt, Manpower, pp. 4, 124; Frank, Survey, p. 315), one obtains a rate one order of
magnitude higher than the American one even when, for the reasons noted above, the pain-
tensive sector appears to have been at its most extensive; and Frank’s 16,000 may be far too few,
if, as seems likely, the tax was not collected on the freedmen who returned to their own lands and
were never enrolled by the censor (see Wiedemann, Slavery, p. 70). However, Brunt is probably
right to dismiss such calculations as simply worthless (Manpower, pp. 549–50). Somewhat sturdier
evidence is obtainable for a later period from Diocletian’s edict on prices, which values an ordinary
male slave 40 to 60 years old at 80 percent of one 16 to 40 years old (Wiedemann, Slavery, p. 105).
The ratio of these values, and the very breadth of the categories, suggest that slaves were not
valued for their brute strength, or expected to serve very long (though high mortality would have
the same effect as prompt manumission); compare Fogel and Engerman, Time on the Cross, vol. 1,
p. 72, Hellie, Slavery, p. 340. The strongest evidence here appears to be the literary evidence of
common experience, such as Cicero’s reference to six years as the normal term of captivity, and
the prohibition of manumission, for decades or for life, as an unusual punishment (Wiedemann,
Slavery, pp. 32, 51, 117; also 133, 186, on Aristotle’s belief that it was advantageous to let all slaves
earn their freedom by good service over a clearly stated number of years).

109 The best-documented examples are the freedmen of the familia Caesaris, but the practice
appears general; see for example Jones, “Slavery,” p. 193. An inscription listing the public slaves
and freedmen in Ostia is particularly telling: it identifies the latter by two names, the former by
one—followed by a blank space to allow the addition of the name they would acquire on
manumission (Frank, Survey, vol. 5, p. 252).
In these circumstances, the share of slaves in the population would tend to decline once mass captures came to an end; and with the overall population essentially stagnant, their absolute numbers would also tend to dwindle. Precisely because slaves were few, and those harshly treated were predominantly criminals or novel captives from foreign parts, slavery would not be a social problem: it could survive for centuries, as it did in Europe, without generating the abolitionist reaction that destroyed it in the New World.

The proposed model would thus again attribute the major contrasts between classical and modern slavery to the very nature of the available resources and technologies; the recent theoretical literature has looked instead to the interest rate and to voluntary enslavement.

The interest rate is the focus of Findlay's analysis of the profit-maximizing time to manumission. In general, it is difficult to obtain empirical predictions related to this variable unless we assume that manumission terminates the slave's obligations; this makes the analysis unhelpful if slaves could borrow the funds with which to pay for themselves, as Findlay points out, and also if manumission could be conditioned, as it often was, on continued service. In the present case, in particular, interest rate differentials appear simply inadequate to explain anything at all: the standard rate assumed in the cliometric analyses of American slavery is in the neighborhood of 6 percent; and that is the exact figure used by Columella in costing out his vineyard.

Barzel suggests that the ancient slaves who were relatively well treated, free in their movements, and more likely to buy their freedom were in fact voluntary slaves—individuals enslaved for debt, whose "slave contracts" reflected "degrees of default" and could therefore be relatively lenient (in contrast to "forced slaves who, by the very nature of their position, lose all the income that can be extracted from them"). As an empirical matter, however, the identification of better-off slaves with former debtors does not seem supported by the evidence; and in any case this concept of voluntary slavery seems relevant to slavery loosely defined—what is here called servitude—rather than to the strictly defined slavery of classical Roman law.

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111 See above, footnote 92; also Bloch, "L'esclavage antique," pp. 42–43.
114 See Frederic L. Pryor, "A Comparative Study of Slave Societies," Journal of Comparative Economics, 1 (March 1977), 26–27, and Hellie, Slavery, pp. 20, 488. Pryor defines slavery broadly but very carefully; and his broad definition seems critical to his argument that it may be rational to choose "an economically secure life as a slave" over "an economically insecure life as a free person," since an utter lack of rights implies utter insecurity (note for example the evidence of starvation among Barbadian slaves, Davis, Problem, p. 322; also Wiedemann, Slavery, p. 176). While individuals certainly accept relatively mild servitude voluntarily and for themselves (as in the Muscovite case), strict slavery or pain-intensive conditions seem more typically accepted for one's
In ancient Rome, enslavement for debt resulted in expulsion trans Tiberim, to a foreign community where the individual became a forced slave like any other; and debt slavery (though not servitude) was destroyed early in the fourth century B.C., whereas the privileged slave appears common in the late Republic and the Empire. Until the Antonines, moreover, there is no sense in which one can speak meaningfully of a slave contract, enforceable by either party, since the slave lacked any power to invoke the protection of the law.

There is one further point on which the present interpretation seems generally confirmed by the evidence. This is the matter of slave renting, which is closely related to that of manumission. The analysis of the transaction costs associated with various contractual forms notes that the cost of enforcing rental agreements includes that of monitoring the owner's capital. The attractiveness of rental agreements is thus lower, the greater the capital's susceptibility to abuse, and the greater the renter's incentive to dilapidate the capital in the first place.

This suggests that the transaction costs of slave renting will be high in effort-intensive activities, since the renter has an incentive to work the slave to the brink of death by the expiration of his term; they will be low in care-intensive activities, since the renter will have no incentive to drive the slave whom he motivates most profitably by rewards. As the present interpretation predicts, the renting of slave craftsmen appears to have been common, in classical antiquity as in modern times. The renting of agricultural slaves appears to have been dependents than for oneself (thus the children sold or abandoned into slavery in antiquity, or sent to work in Lancashire's cotton mills); where an individual's actions result in his own subjection to harsh treatment, that outcome is typically the unfortunate result of an accepted gamble (thus debt slaves and criminals), or of misinformation or reduced volition (thus the immigrants who discovered brutality on turpentine farms, or the "volunteers" who served before the mast). See for example Daniel, Shadow of Slavery, p. 38; Nardinelli, "Corporal Punishment"; Patterson, Slavery, pp. 129-30. In Rome, the recorded cases of voluntary elite slavery are of noncitizens who become slaves of citizens in view of eventual manumission and citizenship; see for example Volterra, Istituzioni, p. 67. In a broader sense, of course, all slavery is voluntary, as it is preferred to death (Patterson, Slavery, pp. 5, 26).

Nor was debt slavery voluntary when it did exist, in the sense that the borrower could have posted some security other than his own person (Barzel, "Economic Analysis," p. 105): the creditor's right to seize the delinquent debtor, and after 60 days to enslave him, was granted directly by the XII Tables (Volterra, Istituzioni, pp. 60, 209-10).

See above, footnote 74.

The deleterious incentives of temporary slaveholding in effort-intensive activities have been widely noted, not least by legislators contemplating delayed emancipation; see Claudia Dale Goldin, "The Economics of Emancipation," this JOURNAL, 33 (March 1971), 71. For similar reasons, it was a fortunate convict who survived his term as a galley oarsman; see Alberto Tenenti, Piracy and the Decline of Venice, 1580-1615 (Berkeley, 1967), pp. 115-16. The holder of a debt bondsman has similar incentives, but is constrained by the legal personality of his man; it is thus grossly misleading to claim that "indentured servants were in essence temporary slaves, the personal property of their masters" (Friedman, History, p. 71).

relatively rare in the New World, where absentee plantation owners hired overseers rather than rent out their land and slaves en bloc.\textsuperscript{120} It appears instead to have been normal in the peaceful centuries of the Empire: thus the younger Pliny, contemplating the purchase of an estate in Northern Italy, notes that he would have to provide slaves (and relatively good ones at that) for the tenants' use.\textsuperscript{121}

Two cases of slave renting where harsh treatment was foregone are only apparently exceptions to the rule. In the South, one way of punishing agricultural slaves was precisely to rent them out, to "a professional 'nigger breaker,'" who obtained needed labor for his farm by renting slaves for a nominal sum from planters who wanted them cured of 'impudence'."\textsuperscript{122} In ancient Greece, slaves were rented to the mines on a large scale: not as individuals, however, but as a fungible mass, "on condition that [the renter] paid [the owner] a clear obol a day per man and always maintained the number of workers at the same level."\textsuperscript{123}

V. PAIN INCENTIVES AND FREE WORKERS

The distinction between pain incentives and ordinary rewards seems relevant to free workers as well. In the first place, physical violence was until recently an entirely normal aspect of interpersonal relations, and women, children, servants, and apprentices routinely suffered punishment at the hands of their superiors in the household hierarchy.\textsuperscript{124} With the growth of factory production and child labor in the industrial revolution, however, such violence appeared on a significant scale even outside the household; and it was largely transformed from the simple expression of anger into a rationally administered system of labor control.\textsuperscript{125}

Factory production generally includes both skilled and unskilled activities, albeit in proportions that vary widely from industry to industry. One would not expect anxiety-producing pain incentives to be

\textsuperscript{120} Genovese, \textit{Jordan}, pp. 10–12; Patterson, \textit{Slavery}, pp. 180–81. Individual slaves surplus to their masters' requirements could of course be rented out for agricultural labor, but the contrasting incentives of owners and renters made the arrangement an inefficient one; see for example Frederick Law Olmsted, \textit{A Journey in the Seaboard Slave States, with Remarks on Their Economy} (New York, 1856), p. 100.

\textsuperscript{121} Frank, \textit{Survey}, vol. 5, p. 179; also Heitland, \textit{Agricola}, pp. 297–98.

\textsuperscript{122} Genovese, \textit{Jordan}, p. 22. Analogous cases of slaves rented to mines in order to be disciplined are noted by Lewis, \textit{Coal, Iron}, p. 115.

\textsuperscript{123} Wiedemann, \textit{Slavery}, p. 96.

\textsuperscript{124} See for example Hellie, \textit{Slavery}, pp. 505–6.

\textsuperscript{125} Sidney Pollard, "Factory Discipline in the Industrial Revolution," \textit{Economic History Review}, 2nd ser., 16 (Dec. 1963), 260. The sailing navies were another notorious case in point; strict discipline of adult males was there made necessary by the collective dependence on individual acceptance of severe risk, and possible by a uniquely escape-proof environment. These navies thus appear analogous both to the military and to the post-bellum turpentine farms—and, as in both of these, recruitment seems to have relied largely on compulsion or deceit (above, footnote 114).
profitable in motivating skilled workers. The beatings were in fact restricted to children, and "the typical child laborer performed the lowest sort of unskilled labor."\(^{126}\) Since factories rely primarily on mechanical power, moreover, one would not expect the effort-enhancing effect of pain incentives to make a major contribution to profits. Beaters and non-beaters could therefore survive side by side in a competitive environment, as they apparently could not, for example, on Caribbean plantations.\(^{127}\)

More significantly, perhaps, free workers on the margin of subsistence face hunger, which threatens self-preservation as effectively as the lash; and hunger may explain the supervision of technically competent free workers just as the lash explains that of technically competent slaves.

As noted above, the simple transaction-costs model seems quite unable to explain the South Italian latifondi, worked with day laborers in a technically stagnant environment.\(^{128}\) These estates pose a double puzzle, in fact, since they incur apparently needless supervision costs by relying on wage laborers rather than renters, and needless negotiation costs by hiring them by the day rather than for the season or the year.\(^{129}\)

The expanded model, on the other hand, draws attention to two points. In the first place, the technical unsophistication and land-intensity of extensive wheat monoculture, like the cultivation of cotton and corn, seem suited to worker controls that elicit effort rather than carefulness. In the second place, the grinding poverty of the South Italian day laborers seems effectively to have exposed them to anxiety- and effort-inducing pain incentives, as in that labor-surplus society the threat of dismissal was very much the threat of hunger.\(^{130}\)

In the circumstances, wage-work seems justified, despite its atten-

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\(^{126}\) Nardinelli, "Corporal Punishment," pp. 293–94. The extremely long hours worked by these children also suggest that sustained carefulness, at least, was not expected of them; see Pollard, "Factory Discipline," p. 263. Their young age is also relevant, both in restricting the likely cost from incurring their ill will, and in restricting their freedom not to submit to such employment conditions in the first place. Some employers thus beat only the younger children (ibid., p. 260).

\(^{127}\) Robert Owen, among others, could "prohibit [the beating of children] outright," yet run his mills "at regular high annual profits, largely because he gained the voluntary co-operation of his workers"; the attempt of the Society for the Propagation of the Gospel to convert the Codrington plantations on Barbados into "model estates where masters and servants would be bound by ties of mutual affection and obligation" proved instead a dramatic failure, and as late as 1827 "Codrington Negroes, including women, were still driven in the fields by whips" (Pollard, "Factory Discipline," pp. 260, 267; Davis, Problem, p. 221). See also Nardinelli, "Corporal Punishment," pp. 289–95.

\(^{128}\) See for example Shepard B. Clough, The Economic History of Modern Italy (New York, 1964), pp. 103, 142.

\(^{129}\) In medieval England, in contrast, large estates tended to be parcelled out to petty tenants, and farm servants were normally hired from harvest to harvest; see for example Fenoaltea, "Authority," pp. 702–11, and "Risk," pp. 141–44.

\(^{130}\) Clough, Modern Italy, p. 142.
slavish supervision costs, because it maintains the immediacy of the threat of dismissal. Only a wage earner can be easily replaced, and therefore easily dismissed, at any time; rental agreements instead tend inevitably to be relatively long-term affairs. For a renter, therefore, the threat of dismissal is normally months or years away, and even a shortfall of income is more likely to lead to a postponement of the rent than to dismissal and destitution.

Daily hiring similarly seems justified, despite its attendant negotiation costs, because it increases anxiety and effort by making dismissal automatic and continued employment discretionary rather than vice versa. Those negotiation costs are also limited by the local labor surplus: the workers are in no position to haggle, and the foreman simply takes his pick of the men huddled in the village square.

The proposed model thus suggests that the productivity-enhancing effect of anxiety in effort-intensive activity may justify gang labor with destitute wage workers as with plantation slaves. The laborer facing the immediate threat of hunger thus appears to be a wage slave in an entirely meaningful sense, and the proposed model is heir to that of Barzel, who made the analogy between poverty and slavery the centerpiece of his analysis. By tying that poverty to observable market-specific real wages and employment conditions, moreover, the proposed model is kin to the Domar-Nieboer hypothesis. That hypothesis notes that landowners can capture the entire surplus above subsistence without resorting to slavery, if the marginal product of labor is no higher than that. The present analysis adds the point that high rents and low wages are not equivalent means of squeezing poor free workers

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131 Because the state of the cooperating assets and the quality of the husbandman are so much more difficult to evaluate than the laborer’s prospective productivity and working conditions, the time-invariant per-contract transaction costs of rental contracts far exceed those of wage contracts; and even the time-related transaction costs of rental contracts decline, as those of wage contracts do not, with the length of the contract. Rental contracts thus run from an apparently irreducible minimum of one year to de facto perpetuity; see Stefano Fenoaltea, “The Rise and Fall of a Theoretical Model: The Manorial System,” this JOURNAL, 35 (June 1975), 391, and “Authority,” pp. 695–97. The role of uncertainty as to the quality of the parties to a rental agreement is acutely discussed by Joel Mokyr, “Uncertainty and Prefamine Irish Agriculture,” in Ireland and Scotland, 1600–1850: Parallels and Contrasts in Economic and Social Development, ed. T. M. Devine and David Dickson (Edinburgh, 1982), pp. 94–96.


133 Clough, Modern Italy, p. 142.


135 Domar, “Causes,” pp. 21–23. Subsequent writers have taken Domar to task for stressing the land/labor ratio, noting that the critical variable is rather the surplus over subsistence, which depends also on the quality of the land and technical knowledge; but Domar was not unaware of the need to keep such variables reasonably constant. See Domar, “Causes,” pp. 31–32; Engerman, “Considerations,” pp. 56–57; Orlando Patterson, “The Structural Origins of Slavery: A Critique of the Nieboer-Domar Hypothesis from a Comparative Perspective,” in Rubin and Tuden, Perspectives, pp. 23–25; Pryor, “Slave Societies,” pp. 30–32, 39–40, 46.
as hard as slaves, since only wage-work can mobilize pain incentives and effort as effectively as the lash.\footnote{136}

The contrast between Southern latifondi and Northern family farms thus appears as a difference in the equilibrium structures dictated by transaction costs in the presence of radically different demographic pressures on the available stock of land. Such pressure varies over time as well as across space, however, and the empirical association between population pressure and prosperous large-scale agriculture is a leitmotiv of English agricultural history.\footnote{137}

In that empirical context, the simple transaction-costs model seems to have a good deal of explanatory power: but the expanded model appears more powerful still. The simple model ties the expansion of wage-worked demesne farming in the thirteenth and sixteenth centuries, and its triumph in the eighteenth, to the technological innovation induced by the population pressure of those hungry times; it ties the erosion of demesne agriculture in the twelfth century, with its increased opportunities for migration to urban and rural frontiers, and again in the fourteenth and fifteenth centuries, in the wake of demographic collapse, to technological stagnation.\footnote{138} The expanded model instead ties those developments directly to the changing opportunities to motivate workers by fear; it can thus explain the rise and fall even of non-innovative demesnes, as the simpler model cannot.\footnote{139} Moreover, its stress on the critical role of labor-market conditions is in entire agreement with the argument of the traditional historians, to which it supplies the necessary analytical underpinning.\footnote{140}

\footnote{136} The debt peon who can borrow his subsistence only if his efforts satisfy the lender is under greater compulsion than the ordinary tenant; but even he is protected, in comparison to the day laborer, by the longer-term nature of his contractual arrangements. See Ransom and Sutch, \textit{One Kind of Freedom}, p. 149ff.


\footnote{139} The extent of the phenomenon is not clear. While the conventional accounts of the sixteenth- and eighteenth-century enclosures for capitalist mixed farming explicitly link them to technical progress, only a minority of the accounts of the revitalized demesnes of the thirteenth century do so as well; but the silence of the rest is difficult to interpret. See for example N. S. B. Gras, \textit{A History of Agriculture in Europe and America}, 2nd ed. (New York, 1946), pp. 157ff, 208ff; Fenoaltea, "Authority," pp. 709–10, and references therein. Emancipation and the First World War here seem analogous to the Black Death, as pressure to break up large units of exploitation appeared in the wake of substantial reductions in labor supply; see for example Clough, \textit{Modern Italy}, pp. 206–7, Ransom and Sutch, \textit{One Kind of Freedom}, pp. 44–47.

\footnote{140} The standard argument in the historical literature appeals to the inverse relation between profits and real wages, while altogether neglecting the positive relation between profits and rents; see for example Fenoaltea, "Authority," pp. 693–94, and references therein. Innovation and labor-market conditions can of course jointly contribute to the profitability of supervision, and the two hypotheses are complements rather than substitutes. In a similar vein, the opportunity to drive unskilled workers may have contributed to the extent of wage-work during the industrial revolution; a case of skilled workers renting space in a factory instead of working there for wages is cited by Friedrich Engels, \textit{The Condition of the Working Class in England}, trans. and ed. W. O. Henderson and W. H. Chaloner (Oxford, 1958), p. 224.
More significantly still, individuals seem to remain exposed to pain incentives even where their physical integrity is not at stake. Behavior towards risk suggests that utility functions are not invariant to current expectations: expectations appear generally to define "a neutral reference outcome" around which other outcomes are evaluated as positive or negative deviations, with the negative systematically receiving a greater weight than the positive. As an empirical matter, the choice between \( x \) and \( y \) (\( y > x \)) is not evaluated in the same way whether \( x \) is the norm and \( y - x \) is a gain, or \( y \) is the norm and \( y - x \) is a loss, even though with invariant preference functions these alternatives would be entirely equivalent.\(^{141}\)

In a similar vein, the public at large seems to consider premature removal from high office a severe punishment, and arguably a sufficient one for malfeasance. Subsistence is similarly viewed as a social norm, and not just a physiological one; the poverty line adapts to ensure that the poor shall always be with us. Indeed, the argument has been made that long-term economic growth does not increase the sum of human happiness, because "the increase in output itself makes for an escalation in human aspirations, and thus negates the expected positive impact on welfare."\(^{142}\)

All this suggests that any firm set of expectations can define a standard to which individuals are attached much as they are to their physical integrity. If this is indeed so, to fall short of one’s standard is genuinely painful, and the prospective frustration of one’s expectations produces genuine anxiety. Given the above-noted relation between anxiety levels, the varying effort- and care-intensity of different activities, and worker productivity, three further sets of predictions can be obtained from the model at hand.

In the first place, worker anxiety will depend on the movement, as well as the level, of the equilibrium real wage. Unskilled workers can thus be profitably driven as the real wage is declining, even if they are not exposed to hunger; thus, for example, the intensification of effort in the Lowell mills when the Irish immigration increased labor supply.\(^{143}\) If the real wage then remains constant at its lower level, and worker expectations adjust, the opportunity for motivation by fear is correspondingly reduced; whence perhaps the erosion of demesne farming as population stopped increasing in the late thirteenth century, even before the plague sharply reduced the supply of labor.\(^{144}\)


\(^{144}\) See Fenoaltea, "Authority," pp. 710-11, noting that the relation of fear to population growth here exactly mimics that of innovation. Since wages are sticky, markets are less likely to clear
In the second place, employers can exercise a measure of control over their employees' expectations, and therefore over the degree of anxiety that incentives generate, by choosing the way in which the incentives are framed. The fact that the evaluation of a choice between a given pair of outcomes depends on the perceived "neutral reference outcome" suggests that the performance-related component of income will be profitably presented as a potential loss in activities where high anxiety is productive, and as a potential gain where it is not.

This prediction also seems borne out by experience. In the industrial revolution, for example, fines appear to have been a common sanction; but the heaviest fines were inflicted in the effort-intensive mining industry, and managers and foremen were instead promised bonuses. Aitken's fine study of the short-lived experiment in Taylorism at the Watertown Arsenal provides a particularly well-documented case in point; it similarly suggests that it did not prove profitable to drive skilled labor by generating "a higher level of tension and insecurity among the workmen."

In the third place, the employers' reaction to the autonomous evolution of their employees' expectations can be expected to vary systematically with the extent to which anxiety is productive or counterproductive. Skilled workers were the first to obtain recognition for their unions, no doubt because their skills protected them from competition; but the fact that their productivity does not gain from high anxiety may have helped induce a conciliatory attitude on the part of management. At the other extreme, one again finds the mining industry: long the preserve of the most wretched of slaves, it also witnessed the most bitter struggles between masters and men, despite the relative lack of labor competition often created by the mines' physical isolation.

In our own day, a growing dependence on worker carefulness and

when the equilibrium wage is changing than when it is constant, and changes in the prospective period of unemployment reinforce the anxiety-producing effects of the wage changes themselves.

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147 Hugh G. J. Aitken, Taylorism at the Watertown Arsenal: Scientific Management in Action, 1908–1915 (Cambridge, Massachusetts, 1960), pp. 214. With the new methods, the machine-shop foreman complained, "the men . . . are frequently punished for making mistakes, . . . but . . . the more often the men are punished for making mistakes the more terror-stricken they are. . . . They seem fear-stricken that they are not competent to read the drawings correctly, or do the work correctly. It imposes a great deal of responsibility on me and it makes my work harder" (ibid., pp. 214–15).
good will seems traceable to the decreasing role of manual labor, and to
the increasing share of complex durables in commodity production.
From Delta Air Lines to Japanese industry, the successful organizations
that the business community holds up for emulation are enlightened
paternalists who earn the loyalty and indeed affection of their employ-
ees.150
This triumph of Owenite benevolence, and the attendant reduction in
the detestability of the work place, are no doubt to be applauded; but
they may have a perceptible drawback. As firms become increasingly
reluctant to incur their workers' ill will, they become correspondingly
reluctant to frustrate their employees' expectations even when those
expectations are unreasonable and cannot in fact be met. Rather than
hold the line on wage increases, firms accede to the wage demands, and
let the workers' real-wage expectations be frustrated by inflation, the
onus of which falls on the community at large (or the government in
particular). The capital- and skill-intensity of modern economic devel-
opment may thus be at the root of the secular drift of the Phillips curve.

VI. CONCLUSION

The analysis of transaction costs recognizes that the supervision of
workers is costly, and prompts a search for the offsetting benefits. The
now familiar benefits from the economies of team production or the
manager's superior technical knowledge seem to account for much of
the observed supervision; but the unexplained residual includes such
significant institutions as the American slave plantations and the Italian
latifondi.

The present analysis considers the effect of supervision on labor
productivity through its influence on anxiety, effort, and carefulness.
Supervision necessarily accompanies the use of pain incentives to
maintain high levels of anxiety: only gang slaves can be subjected to the
constant and immediate threat of the lash, and only wage workers can
be subjected to the constant and immediate threat of dismissal (and
therefore of hardship, in a labor-surplus environment). A high level of
anxiety can in turn generate a level of effort in excess of the level
achievable, without it, by a self-supervised worker earning his marginal
product; but it also generates an accompanying loss of carefulness and
good will. In general, it seems, land-intensive activities are effort-
intensive rather than care-intensive, and in them supervision can
cheaply counter ill will. Real and human capital-intensive activities are
care-intensive rather than effort-intensive, and in them supervision to

72; "The Best at the Game: A Survey of Japanese Industry," The Economist, no. 7194 (July 18,
1981), insert.
counter ill will is costly if not impossible. Supervision, threats, and high levels of anxiety will therefore enhance overall productivity in land- and effort-intensive activities but not in capital- and care-intensive activities.

The proposed model therefore predicts that supervision-intensive structures will be Pareto-stable (in the absence of team production and the like) if workers are engaged in effort-intensive activities and can be driven by the fear of pain, but not otherwise. The land- and effort-intensity of sugar, cotton, and corn would thus explain the viability of plantation slavery in America, and the capital- and care-intensity of the vine and the olive its nonviability in the Mediterranean. Population pressure and the fear of hunger would similarly explain the viability of large-scale grain production with wage workers in Southern Italy and thirteenth-century England, for example, and their absence its nonviability in Northern Italy or twelfth-century England.

The proposed model also predicts that slaves in care-intensive activities will tend to be motivated by rewards, including manumission. The preponderance of such activities in the urban economy would thus explain the relatively high manumission rates observed in urban areas; the relative scarcity of slave employment opportunities in the effort-intensive sector in antiquity and the relative abundance of such opportunities in the New World would similarly explain the tendency of manumission to erode slave numbers in the former case but not in the latter.

The proposed model further predicts that industrial labor contracts and relations will also tend to reflect the activity-specific optimum level of anxiety. The lower level of anxiety produced by prospective gains than by prospective losses and the lower optimum level of anxiety in managerial activities than in manual ones would thus explain the tendency of industry to offer bonuses to the higher echelons and impose penalties on the lower ones. The land- and effort-intensity of mining would similarly explain the high level of antagonism between masters and men historically observed in that industry; and the capital- and care-intensity of modern economic development would similarly explain the growing reluctance of industry to antagonize its employees, and perhaps the secular drift in the Phillips curve.

The extension of the simple transaction-costs model to incorporate the relations among supervision, pain incentives, and productivity thus seems relevant to a considerable body of experience. In some contexts, it promises an explanation additional to those already current; in others, it promises an explanation where none exists that an economist could accept. It should prove a useful addition to our tool kit.