Modern slave plantations to firms and labor markets: incentive theory for a growth disaster

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1. Introduction

The passage from slavery to free labor was followed by a fall in the average income per person of most regions of the Atlantic economy which used this mode, despite exploding demand for their products. In this reallocation of property rights at abolition, both ex-slaves and ex-masters seemed to have lost, as incomes in the US south, Brazil, Jamaica, among others, fell behind places outside the slave belt which had begun to grow rapidly with free migrant workers, in the same period before 1914 during which the US north made the US the richest country in the world (for GDP see table in appendix; for demand, see Eltis [1987] pp185-6). This paper offers a new economic explanation for the fall, derived from recent theories of the firm. Free workers may not have been enough. For certain activities, a new institution, firms using supervision and the right to fire, is shown to be socially superior to incentive-compatible mechanisms akin to sharecropping, tenancy and marginal-product wage labor. If firms are not viable in the polity, we argue, agents will resort to schemes which yield less income for both sets.

There are two economic theories about the transition. One is that the coercion or physical force available to slave owners and not to employers, induced output levels beyond what a free worker would choose. We can dub this the consumer inefficiency theory (Barzel [1977], Fenoaltea [1984] and Versiani [1994]). The other is an implicit producer inefficiency theory for free labor after abolition. It is based on the empirical discovery by Fogel & Engerman [1974, 1977, 1980] that the higher labor productivity on large slave plantations in the US south's cotton belt, 1840-60, was due to economies of scale, reinforced by material incentives to field slaves, to produce more in less weekly work hours. They argued [1977, p289] that coercion could not be a sufficient explanation because plantations of less than 15 slaves were not as productive.

The paper studies the mechanisms firms use - non-marginal product incentives, supervision and power, to model formally this failure of the Coase argument that, in the absence of transactions costs, property rights determine only the distribution and not total income (for a survey, see Holmstrom [1999]). It shows how wrong incentives can

induce inefficient choices, in levels, of 2 activities. One can be carried out by a single agent, working alone. The other activity requires a second complementary, cooperating type 2 agent for its execution. Neither activity needs physical capital. When done outside the plantation, the first is a stylized version of a single-family, peasant farm. It is not necessarily confined to subsistence crops. For example in Jamaica such farms even today grow bananas for export. In late 19th century Brazil, many raised cattle and planted food crops for local markets. The second activity, combined with the skills and effort of the type 2 agent, the master, is the core of a stylized plantation.

What is important here is that we assume that effort at the two activities by the type 1 agent must be supervised by the type 2 who, even under slavery, must offer the right incentives to induce an efficient combination with the complementary inputs of the plantation. Activity 1 can be the kitchen gardens and livestock which slaves were allowed to care for in their spare time. But the more subtle interpretation is that at abolition, before which a wage-labor market seemed unviable, this simplified model is equivalent to one with increasing returns to labor in the plantation staple. With increasing returns, the notion that individual effort is observable by an outside party (verifiable) becomes tenuous.

The gist of the argument of our model is that abolition induced inefficiently higher incentives for the now free, type 1 agents to allocate rationally, more effort to the first activity and less to the second, for the same product prices. However, to explain the fall in value of total output we need to assume that the relative price is such that the increased output in activity 1 does not compensate, in value, for the reduced output of activity 2. The best data available on the connection between the explosion of peasant crops at abolition and the fall in GDP are for Jamaica (Eisner [1961]) and British Guiana (Moohr [1971, 1972]).

If activity 2 (the plantation staple) did not exist in this economy, we would have a case of ancient slavery in which the master offers no cooperating skills in a joint effort at production. The master's share would be like a tax. The analysis of this case was done by Evsey Domar [1970] in economies with only labor and land, and constant returns. If land is in surplus relative to labor, no one will choose freely to work for someone else. For a *rentier* class of agents to emerge here, either access to land must be blocked, serfdom, or labor must be coerced, slavery. Labor productivity must of course be above subsistence.

For us, the distinguishing feature of modern slavery is the perception by masters, mainly in the Americas and from around the same time as the industrial revolution, that they could obtain more income from their slaves by offering both incentives and some complementary skill in certain activities of the plantation. This was the fundamental contribution of Fogel & Engerman's 1974 book, *Time on the cross*, which caused a furious debate among US economic historians (see especially Paul A. David et al [1976,1979]) some of whom contested, unsuccessfully in our view and Barzel's, their finding that the imputed real income of a slave in the US cotton belt around 1860, was more than that of a free peasant in the same region. Fogel & Engerman attributed the difference to the psychic income derived from being free. Barzel's interpretation of the extra food, time-off etc is that they were the biological complements of the forced labor regime, with no incentive component.

Jeffrey Williamson [1999] has published data on wage rates for free workers in late 19th century Brazil, Argentina and Uruguay which showed, for example, that in 1874, a free urban worker in the Brazilian southeast earned 1/5 the wage in Argentina which, in turn, was ¾ that of a British worker. In the Brazilian northeast, it was even lower, 5% (sic), comparable, according to Williamson, to those paid in Calcutta at the time (see Eisenberg [1974] for more details). Since both the southeast and Argentina were then operating very similar activities, mainly extensive cattle rearing, one can argue that it was the slavery regime in Brazil which depressed free workers' wages. Outside the US, I know of no comparison of incomes of slaves and the free peasantry.

Eisenberg´s work on Pernambuco, 1840-1910 [1974 p.213-4], gives the clue to our theoretical argument for the link between the role of supervision and the fall in incomes:

> "after the early 1870´s, the wage rate fell steadily. All three types of free labor (squatters, sharecroppers, and wage workers) could be hired and fired at will, without complications of contract or indemnizations …. One cannot escape the conclusion that in the later 19th century, they enjoyed little material advantage over the slave".

This is in a context where slaves co-existed with free employees on the plantations. He noted further that the apparently "better" treatment of slaves may well have been the source of Gilberto Freyre's polemical thesis on the paternalism of the Northeast's slave masters. Our model can explain this without resort to altruism as in Freyre, or to economies of scale as in Fogel & Engerman, but as the reward for taking orders which,

like in a firm, is justified by the gains to two parties in a voluntary transaction, from the supervision of one by the other. Nevertheless, under slavery, coercion can never be dismissed entirely. The problem we will try to solve is why at abolition, free workers did not reproduce the higher productivity.

An analysis of the mechanism by which the presence of slavery undervalues the productivity of free labor is, we hope, one of the contributions of this paper. During slavery, free workers seeking a wage contract would not be hired even though their intrinsic skills may be identical to that of a slave, because the wage regime would not be able to offer efficient incentives when effort at multiple tasks must be coordinated in complex ways. Thus we have a better explanation than Fogel & Engerman's psychic income theory for why free farmers in the US south did not offer to become slaves, even though their incomes were less than a slave's. We shall see that under slavery, a free worker would have to be offered more than a slave to induce him to accept the discipline of the plantation and produce its required combination of the 2 products. At abolition, we will show, the plantation would have to change its incentive scheme. It will not necessarily be worse off because it will no longer have to pay out the capital cost of the slave contract. In fact, slavery would become redundant if this cost were higher than any reduction in gross income of the plantation caused by abolition. These remarks will become clearer after we formalize these ideas in section 4.

Our explanation for the inability of these economies to sustain the higher incomes is not economic infeasibility due to the suppression of coercion as Barzel argues, but rather to the inadequate regulatory framework after abolition. With cotton, it led to sharecropping, which denied the type 1 agent access to the type 2's skills. With sugar, it led mainly to wage labor for the type 1 agent at activity 2 (the plantation staple), meaning marginal product incentives, which cannot discourage sufficiently activity 1. Both contracts would yield lower GDP in our model. Some plantations, mainly in sugar, did learn to develop reputations as good employers of free workers, just like modern firms do.

Ransom and Sutch [1975] have argued that freed slaves on small tenant farms in the US south were forced to produce more cotton than was rational because of "lock-in" by creditors who insisted on a minimal level in a crop-lien system, a kind of debt peonage. Such a binding minimum here would yield our free worker a higher income than without it but his total effort would have to increase, with all his extra effort going into cotton. Incomes certainly did not increase, nor did work loads. A more plausible

3

assumption (not made here) is that the worker's productivity at cotton on his peasant farm was lower because of the lack of the crucial complementary input from the plantation (sharecropping not supervised labor), then for the same total effort and product mix, his income will fall. Thus he may want to compensate for this by producing more cotton and less corn than our free worker.

Another issue on which our theory throws some light is the debate about the role of small-scale slavery, prevalent in many regions of the US south and Brazil (for Minas Gerais, see Martins and Martins Filho [1984] and the references therein). The model does not need economies of scale (large plantations) but it does need supervision and access of the slave to something the master has (land, a skill, a machine). Even in the absence of such complements, however, the legality of slavery allows the owner who buys the slave contract to charge a fee, a tax on the slave's output, provided his productivity was above subsistence, as many were. Some were highly skilled workers. Abolition would destroy these rents but if supervision was not essential, this would not cause a drop in the average income of the economy. There would be redistribution since these ex-slaves could continue the same jobs but now keep all their income. Some might work even harder. So this type of slavery is not likely to explain the fall in GDP after slavery ended.

The rest of the paper is laid out as follows. The next section treats of some relevant economic history and its interpretation by the historians. Section 3 explains the theory of the firm we use and section 4 gives some of its results. A concluding section draws some inferences for the construction of a general theory of economic growth.

2. Some related economic history, especially the Brazil case

We now know that from around 1800, all workers in the Atlantic economy, slave and free, began to increase their productivity. More importantly, we now know that there was no secular decline in the profitability of slave ownership as the 19th century progressed. Those regions which continued to use slaves up to around 1860 showed little sign of lags in income per head behind those which used free labor. For example, between 1840 and 1860, the income per head of the US south grew faster than the north. The Cuban and Brazilian economies seemed to have grown in the first half of the 19th century, but the GDP data before 1850 are sparse. However there are many indications that most slave regions then were somewhat richer than the non-slave, though by nothing of the order among nations later in the century.

For Brazil, our table cites two separate publications, both of which show the fall in income per head in the late 19th century. The primary sources are firstly, Contador *e* Haddad [1975], cited by Goldsmith [1986 pp20-21], who give an estimate for 1861-1900 of real GDP growth at 1.47% per year which, with population growth of 1.87%, yields negative growth of 0.40%. Secondly, Goldsmith's own per capita estimates were 1870-79 -0.51%, 1880-89 -1.13% and 1851-89 +0.34%.

Even so, some economic historians have been reluctant to place any confidence in these sources. The claim is that the data are very sparse. However, it is commonly agreed that the economy grew faster than the US in the first half of the 20th century. Real output per capita grew at 2.3% per year, 1900-47 (see Haddad [1974], output does not include services). Leff [1982, p.215] adds services to Haddad´s estimate to yield 2.2% for 1908-47, which can be compared to the US rate of 1.8% for 1913-47 (from Kuznets cited in Contador *e* Haddad [1975] p.413).

However, when these growth rates are used to make comparisons, in US dollars, with the US per capita income, as these authors have done, one can get gross over-estimates of the gap between the two economies. For example, Leff [1982, p.214] puts the US income per head in 1947 at 8.3 times Brazil's. Contador *e* Haddad [1975 p.413] has the US, in both 1860 and 1970, with 10 times. The main cause is the use of exchange rates rather than purchasing power parities (PPP). The Summers-Heston exercise corrected such errors for 1950-2000. For example, it gives the ratio for 1960 as just over 4 times and for 1990 3.3 times, as Brazil closed the gap during its *milagre* which for us is really the period 1950 to about 1980.

Nevertheless, even after this PPP correction, the gap around 1950 is still so large that Brazil's higher growth rate in 1900-50 would imply it had to begin the 20th century exceedingly poor. Both Maddison [1995] and Coatsworth [1993] estimate the ratio in 1913 at around 7 times (see table in appendix). Thus any monotone growth in the 19th century would put the economy below subsistence by 1850. This argument is similar to the one used by Paul Bairoch [1993] to correct Maddison's tendency to exaggerate the early 19th century differences in per capita incomes between the future first and third worlds (see our GDP table).

Celso Furtado's classic [1963, chap. 25] may have been misleading. Furtado claims (p.163) that between 1850 and 1950, Brazil's income per head grew faster than the "the average for western Europe". If this were so, either Brazil should have been a rich country in 1950, or it should have been exceedingly poor in 1850. For 1950 it is

certainly not true, and the 1.5% per year he gives for 1850-1900 is not corroborated by any of the other primary sources we cited. Furtado, however, correctly observed the significant fall in income in the northeast after 1850, then with about half the population (Leff p.41). This is the case most suited to our model as it had little in-migration or technological change.

Perhaps the main stylized fact which disguises the fall in income as slavery was phased out was the massive expansion in the coffee sector, outside the traditional, dominant northeast sugar region, coupled with large-scale European immigration. However, it would appear that this expansion occurred at an almost constant real wage for free labor which was not very different from the cost of using slaves (Michael Hall [1969] Chap.3 cited by Leff [1982] p.59). Further, these labor costs also seemed to have had the two components of the slavery regime, namely the part which accrues to the worker, his incentive, and the costs of sponsoring the migration. This realignment of total labor costs and work incentives at the transition from slavery to labor markets is the main focus of our theoretical work (De Castro [2004]).

We suggest that the major reason for the different economic performance in the second half of the 19th century relative to the US, with which its economic history bears the nearest comparison, is that Brazil had no region outside the slavery regime when free migrants started to become competitive with slave labor. The two regimes coexisted over many decades until final abolition in 1888 when only 4% of the population were then still slaves (Leff p.54).

The standard theory for the coffee expansion at the relatively constant wage is a version of Arthur Lewis´ two-sector growth model where the traditional sector, the source of the "unlimited supplies of (free) labor", is located not within the national economy but at the origin of the migration (Leff [1982], Chap 4). Now in the same period, 1850-1913 say, several new world economies grew with large increases in the real wage, also with free migration from Europe. The puzzle to be explained then is why Brazil's performance was so different despite the in-migration. Lewis himself gave a theory for this stagnation of incomes and we will return to the issue in the final section.

Engerman, the economic historian who has devoted the most attention to the comparative 19th century experience, and especially the use of indentured immigrants in the British regions after 1838, had spotted the failure of the Coase position at abolition (Engerman [1992], footnote 55):

"The argument that the initial allocation of ownership rights (over labor) will not influence the value of output will not hold in the presence of non-pecuniary tastes and low income and wealth effects."

This explanation of a failure however, does not coincide with Coase's own. He emphasized transaction costs, which at abolition, would involve the costs of bargaining over a new labor contract.

Engerman is hard put to explain the continued profitability of slavery even under competition with imported contract labor (indenture). Our explanation is that the indenture contract can induce the same effort mix as slavery except that it can cost the plantation more, unless slavery was redundant under the reigning conditions at abolition (see later). According to our theory, indenture can achieve this because it preserved the role for supervision, without the threat of violence, by postponing part of the workers´ payoff until the end of the contract – land, a return passage etc. The model also explains the more puzzling phenomenon, the almost complete reluctance to use non-indentured wage labor, right to the end.

He correctly rejects Domar's [1970] theory that the incentive to coerce labor would exist only when labor was capable of being forced to produce a surplus over subsistence. According to Domar, coerced labor would end when population growth or more generally, changes in the land/labor rates, drove labor's marginal productivity to subsistence. By the terms of the argument, Engerman [1992, p.20] pointed out, slavery in the Americas should have expanded, not ended, in the 19th and 20th centuries.

Sharecropping, another non-marginal product incentive, was used widely after abolition. Many papers, both historical and theoretical, have studied the efficiency properties of such contracts. Reid Jr [1973] examined creatively the two issues, the drastic fall of per capita income in the US south after abolition, and the apparent efficiency of the detailed contracts actually used by former masters. He formulated a theoretical model of the risk versus return variety to show that sharecropping achieved an optimal trade-off for the ex-slave between the security but low return of simple wage labor and the high risk, high return of rentals. From this he concluded that "the post-bellum fall in southern agricultural productivity cannot be directly attributed to the rise of tenancy (renting and sharecropping)" (p107). To explain the fall, he posited a reduced availability of agricultural capital caused by the Civil War, and a drop in the labor supply occasioned by emancipation.