

DEMAND FACTORS IN THE NINETEENTH-CENTURY BRAZILIAN SLAVE MARKET

1. Introduction

The study of slave prices in Brazil has recently benefited from a considerable expansion of the available factual information. Bergad's study on the province of Minas Gerais produced price series extending from the early eighteenth century to slavery abolition, in 1888; current research on Pernambuco is bringing to light comparable data for this Northeastern province, from the last decades of the 1700s to 1887 (Bergad, 1999; Versiani & Vergolino, 2002-b). This adds to price data originating from earlier studies on slave labor in the province of Rio de Janeiro, covering the period 1835-1887, and in the city of Salvador, Bahia, for the years 1811 to 1887 (Melo, 1984; M.J.Andrade, 1988). There is also some information related to prices in specific localities, generally based on small samples (as in Stein, 1957; Eisenberg, 1974; Dean, 1977). All in all we have now a fairly good general picture of the evolution of slave prices in various regions of the country, especially in the nineteenth century.

Some common trends can be recognized in the available price series. From 1800 to the early 1850s, there was, in general, a smooth increasing trend, with an average annual rise of around 2 to 4%; prices tended to increase faster in the 1820s and 1830s, and were more or less stable, or even decreased, in the 1840s. After 1850 there was a very marked price increase, with a peak around 1860; along this decade, the rise in prices averaged 10% per year, or above. From 1860 to 1888, price oscillations were more intense, with peaks around 1870 and 1880; the general trend up to 1880 was downward, except in Minas Gerais. After 1880, prices tended to decrease, at a faster pace in the years immediately before abolition.¹

As to the reasons for those price movements, the literature offers little beyond some general statements. Price oscillations are attributed, more often, to supply factors, particularly in what concerns the sharp price increase in the 1850s, which is almost universally related to the suppression of slave imports, in 1850. For instance: "The restricted supply [following the abolition of slave traffic] caused nominal slave prices in Pernambuco to more than triple by 1860" (Eisenberg, 1974:153). Similar quotations can be extracted from Stein (1957:65; 229), M.J.Andrade (1988:168), and many other authors.² Price decreases, as in the late 1840s, are generally credited to panic buying, due to expected restrictions on imports (Melo, 1984:115; Andrade, 1988:168).

The present paper is, to our knowledge, the first attempt to use statistical techniques to study the behavior of slave prices in Brazil. Its main purpose is to

¹ All prices mentioned in the paper are nominal prices. There is no satisfactory general price index for nineteenth-century Brazil.

² Bergad is an exception here; he points to the fact that slave price increases in the 1850s occurred in other countries as well (Bergad, 1999:168-71).

investigate the relationship of slave prices to factors that could affect the supply and demand for bondsmen, in nineteenth century Brazil.

The paper is organized as follows. The next section presents the main facts about the evolution of the slave trade in Brazil. Section 3 deals with the nature of data on slave prices, and the use of slave labor in the various regions of the country, in the nineteenth century. Section 4 deals with the economic rationale for using slave labor. Section 5 presents and discusses the empirical results. A final section gathers the paper's main conclusions.

2. Slave labor in Brazil: some facts

Brazil was by far the main importer of slaves from Africa. It is estimated that approximately 10.3 million enslaved Africans were shipped to various destinations, from 1450 to 1870; of these, around 4 million arrived in Brazilian ports, in the period 1550-1850. The flow of slaves to Brazil was most intense in the nineteenth century: a total of about 1.7 million arrivals, or 340 thousand per decade, with a peak of 430 thousand in the 1820s. It is noteworthy that some 700 thousand were imported in the period 1830-1850, when slave imports were formally illegal. Another 1.7 million arrived in the eighteenth century, and most of the remaining 600 thousand in the 1600s.³

This extraordinary flow of forced migration to Brazil was caused by a succession of export booms: sugar, in the seventeenth century; gold and diamonds, in the eighteenth; and sugar, cotton, and especially coffee, from the 1790s on. Production of those commodities was both labor-intensive and very lucrative, and could finance a steady stream of slave purchases for about three centuries. Those activities were, no doubt, the primary driving force for the slave trade; but evidence for the nineteenth century shows that slave labor came to be utilized in many other activities beyond plantation agriculture and mining: slaves were also present in small-scale farming and cattle raising, as well as in domestic and urban services, commerce, handicraft production, etc.⁴

Deaths systematically surpassed births, in the slave population, largely due to a strong sex imbalance in the import slave trade; the maintenance of a given size of the labor force would thus require continuous importation of bondsmen (which in turn contributed to maintain a high proportion of males over females).

In 1819, the number of slaves in Brazil was estimated to be about 1.1 million. When the first countrywide population census was taken, in 1872, bondsmen numbered slightly above 1.5 million (IBGE, 1990:32). In 1819, 55 % of the country's slaves were in the Northeastern provinces, where most of the sugar and cotton was produced. In 1872, this proportion had decreased to 34%, and about two out of three slaves were in the Center-South, where coffee growing was expanding rapidly. From 1850, when slave

³ Slave trade estimates from Klein (1999:App. Table A-2).

⁴ See on this, among other studies: Paiva (1996) and Bergad (1999), on Minas Gerais; Schwartz (1982; 1985) and Barickman (1998), on Bahia; Luna & Costa (1983), Costa & Nozoe (1989), Luna (1998), Marcondes, (1998; 2001) and Bacellar (2000), on São Paulo; Versiani & Vergolino (2002-a; 2003), on Pernambuco. Luna & Klein (2002), compared the cases of Minas and São Paulo, in the first half of the nineteenth century.

imports ended, to 1888, when slavery was abolished, it is estimated that around 200 thousand bondsmen were sent to the Center-South from other regions of the country, especially the Northeastern provinces. This is supposed to have caused, in some periods, a significant decrease in slave holdings in the supplying areas. There was also an important movement of slaves from urban to rural areas in the Center-South, after 1850.⁵

3. Data on slave prices

We use in this paper two series of slave prices: one from the Northeast (based on data from the province of Pernambuco, as described in Versiani & Vergolino, 2002-b), and other from the Center-South (Bergad's Minas Gerais numbers, published in Bergad, 1999: Table E-1). We use also, as a proxy for prices in the world market, series of Cuban slave prices (from Bergad, Iglesias García & Barcia, 1995: Table B-1).

Pernambuco had been, since the sixteenth century, the main sugar-producing province of Brazil. In the 1800s, about two thirds of Pernambuco slaves were in the *Zona da Mata*, a costal area, about fifty kilometers wide, where the land is particularly appropriate to sugar cane cultivation. Slave labor was also employed in the cultivation of cotton and food crops in the *Agreste*, an intermediary region located between the *Mata* and the semiarid backlands — the *Sertão* —, where cattle breeding was the main economic activity — also using slave labor (Versiani & Vergolino, 2003).

World demand for the province's products was positively affected by political events abroad, along the nineteenth century. Revolutionary movements in the French Caribbean colonies, following the French Revolution, and later the Napoleonic wars, opened new markets for Pernambuco sugar producers, especially in 1800-1830. In the 1860s, the Civil War in the United States caused a sharp increase in world cotton prices, and a boom to cotton producers in the *Agreste*.

Minas Gerais had been the center of the eighteenth-century gold and diamond boom. In the 1800s, there was still some mining activity, but agricultural production for the internal market turned out to be increasingly important along the century, especially in the southern part of the province.⁶ This was in part caused by the area's proximity to the city of Rio de Janeiro and to the coffee producing areas of the provinces of Rio de Janeiro and São Paulo. Later in the nineteenth century, the southeastern zone of Minas Gerais became a coffee producer in its own right.

Both the Minas Gerais and the Pernambuco slave price data are based on information from probate inventories included in wills registered in public notaries. Prices refer to slaves of working age (15 to 40 years), with no physical disabilities. The series for Cuba is also for 15 to 40 year-old, healthy slaves.

4. Demand for slaves: economic aspects

Various arguments are found in the literature concerning the economic rationale for the use of slave labor, in preference to wage labor.

⁵ On internal slave trade, see Slenes (1976).

⁶ See on this Prado Jr., 1981[1942].

In what concerns the initial introduction of forced labor in the Americas, starting in the sixteenth century, the traditional explanation is based on the limited available supply of free labor at the time, especially in the case of Brazil. The native population was not culturally suited to the tasks involved in large-scale agricultural production, and the availability of European labor was very limited. Scarce supply would push wages to such high levels as to make production in the colony economically unfeasible; only the use of forced labor could guarantee profitability. As put by Celso Furtado, in reference to sugar production in the Brazilian Northeast:

“The investment required to transport laborers from Europe, in the volume required, would probably have made the whole enterprise anti-economical. Working conditions [in Brazil] were such that only paying much higher wages than those paid in Europe would it have been possible to attract laborers from the latter region. [...] One should also consider the scarce supply of free labor in Portugal, especially at a time when the Eastern Indies business was flourishing.” (Furtado, 1976[1959]:11-12; our translation).

It could also be added that the way Brazilian lands were distributed by the Portuguese crown, in the form of large *sesmarias*, made it impracticable to reduce labor costs by offering small plots of land as a form of retribution to agricultural workers — as it was done with indentured servants, in North America. Small agricultural properties could not compete with large ones in production for export, due to lack of capital and diseconomies of small scale. On the other hand, there was no internal market for the output of such small units, either: the large estates were typically self-sufficient, in Brazil, buying very little from outside their limits. Under such conditions, small agricultural properties were not viable, in economic terms.

In the period we are concerned with, however, the above reasoning does not apply, for the alternative of using free labor was present. The existence of large numbers of free, unemployed or underemployed individuals, in nineteenth-century Brazil, is frequently mentioned in the literature. Caio Prado Jr., for instance, refers to the growing numbers of people with “uncertain or aleatory occupations, or no occupation at all”, in various parts of the country, by the end of the colonial period.⁷ In the Northeastern rural areas, free workers were also increasingly available, along the nineteenth century; see M.C.Andrade (1998[1973]: cap.3).

The most well-known justification for the superiority of slave labor, as compared to free labor, is that based on the economies of scale obtained by the use of gang labor, in plantation agriculture. This form of labor organization, requiring strict discipline and control, would only be economically feasible under coercion. This argument was presented in the now classical study by Fogel & Engerman (1974). Symmetrically to the Furtado quotation above, the following passage (by Engerman) maintains that the utilization of wage labor would have made large-scale agricultural production economically impracticable, in the North-American South, due to the occurrence of scale economies:

⁷ Prado Jr. (1981[1942]: 281 and ff.). In the 1880s, Couty (1988[1881]: 102) estimated that about half the population of the country, or about six million people, an intermediate layer “between the ruling class and the slaves”, were unproductive or only marginally productive.

“Not only was the optimum scale of production for those crops [agricultural staples such as sugar, rice, cotton, and tobacco] greater than that achieved by the family farm, but there were few, if any, large-scale units based upon the use of free labor. It could have been possible to pay free labor wages sufficiently high to compensate them for the sacrifice of control and other negative aspects of work in large units. However this premium was too large relative to the benefits of scale economies, and such operations would have been financial failures.” (Engerman, 1973:52).

The coercion element is crucial to this argument: the slave owner can only gain scale economies because he is able to force slaves to work harder (or under harsher conditions) than a free man would. As put by Engerman (1973: 48): “The slave owner is able to obtain higher output from his labor force than might be obtained where labor is free, because of the ability to manipulate the supply of labor available.” In fact, an argument about the comparative advantage of slave over free labor can be developed based solely on the question of coercion, without need to resort to scale economies. This was done, for instance, by Barzel (1977). He points out that coercion makes it possible for the slave owner to extend the slaves’ working day up to the biological maximum, which increases the productivity of forced labor, *ceteris paribus*, beyond what could be possible with free workers. The whip of the *feitoreiro* would be the main instrument to ensure maximization of the slaves’ productive efficiency, over and above that of free laborers.

This, however, raises the question: is it always possible to use coercion to obtain a given performance from the slaves? This point was explored by Fenoaltea (1984). He argued that coercion is only feasible, as a performance-inducing element, in activities where physical effort is the worker’s basic input. This would be the case, for instance, in most tasks involved in plantation-type agriculture. On the other hand, where skill is crucial (or care, or dexterity, or craftsmanship), coercion may be ineffectual, and in fact counterproductive. In the latter case, slave owners may need to use positive incentives, in order to extract from their bondsmen the desired performance. That is: coercion may be a means to compel slaves to achieve a superior level of productive efficiency, as compared to free labor, but this is only true in certain kinds of productive activity (such as large-scale agriculture).

It seems, therefore, that the classical analytical arguments about the economic rationale of the use of slaves, as productive agents, are mostly applicable, as far as agriculture is concerned, to the case of plantation-type agriculture. In the Brazilian case, to sugar *engenhos*, or coffee *fazendas*.

However, as mentioned above, there is increasing evidence that slave labor was commonly used in small-scale agrarian activities, in nineteenth-century Brazil. In particular, it has been found, in the case of Pernambuco, that a sizeable portion of the province’s slave stock, in the period, was in the cotton-producing *Agreste* or the cattle-raising *Sertão*; in both cases, the average slave holding was relatively small (Versiani & Vergolino, 2003).

It is not clear how this fact can be economically justified. As a matter of fact, it is frequently argued, in the literature, that cotton farming and cattle raising were both

activities to which slave labor was not suitable.⁸ Various authors sought to develop a non-economic explanation for the presence of slaves in those regions, as did the renowned historian Capistrano de Abreu: bondsmen would be there “not as an economic factor, but as an element of magnificence and splendor.”⁹

It is important, thus, to try to determine to what extent the demand for slaves in nineteenth-century Brazil, especially in the non-plantation area, was in fact associated to economic stimuli. One pioneering effort in this direction was made by Slenes, who tried to relate slave prices (using the scarce information on this which was then available) to commodity prices, in the second half of the nineteenth century (Slenes, 1976: 189 and ff.).

In what follows, it will be seen that the analysis of the much more complete slave price series now existing seems to confirm the findings of Slenes. Demand for slaves appears to be associated with the use of bondsmen in productive activities.

5. Econometric Results

In this section we describe the time series properties of the variables and their relationship in time.

A central objective of the analysis, as mentioned above, is to determine to what extent the evolution of slave prices is, in some way, associated to that of productive activities. To this purpose, relationships linking series of commodity production and series of slave prices would be, in principle, examined. It so happens, however, that series of commodity prices are more easily available than series of commodity production, for the regions involved, in the period we are concerned with. Thus, we used, in general, price series, except in the case of sugar, where a series for Pernambuco was also available (from Denslow, 1974).

Figures 1 and 2 show the main variables under analysis. In FIGURE 1, it is seen that the price of slaves in Pernambuco and in Cuba exhibit a rather similar behavior in time, in the period 1850 to 1870, with a considerable increase after the mid 1850s. This might suggest that Pernambuco slave prices followed the world slave market. This could only happen, however, by means of an indirect effect, as there were no slave imports in Brazil after 1850. Along this line, it is noteworthy that the increase in bondsmen prices after mid-century coincides with an expressive increase in the production of sugar in both Pernambuco and Cuba (and a corresponding decrease in sugar export prices).

In order to examine further the relationship suggested by the graphs in Figure 1, TABLE 1 presents pairwise Granger causality tests for some of the variables analyzed. The most significant result here is that the price of slaves in Pernambuco and Cuba cause each other in time. This reinforces the suggestion that the two series may have a common pattern.

⁸ On cotton, cattle, and slave labor, see, for instance, M.C.Andrade, (1998[1973]: 94); Simonsen (1977[1937]:151 and ff.); Prado Jr., (1974[1945]:45); Guimarães (1968:69).

⁹ Capistrano (1988[1907]:172). For a more recent statement along the same line, see Moura (1972).

FIGURE 1 shows also the series of sugar production in Pernambuco and Cuba, in physical units, and the value of sugar production (“*Sugar Revenue*”) in Pernambuco.

FIGURE 2 plots slave prices in the sugar-producing *Zona da Mata* and the cotton-producing *Agreste*, in Pernambuco, and in Minas Gerais, and also the prices of the main nineteenth-century Brazilian export commodities. Slave prices show similar patterns, up to the mid-sixties, but in the *Agreste* prices seem to have an upward movement in the 1860s. If we consider the sharp increase in cotton prices in this decade, as shown in the Figure 1, a relation between the two events suggests itself.

We proceed to test the series for the presence of unit roots; the results for the Augmented Dickey-Fuller (ADF) tests are reported in TABLE 2. We also performed other unit root tests, but we only comment on the results when relevant. We could only reject the null hypothesis of unit root (at 5% of significance) for two out of the seventeen series analyzed: *Price of Coffee* and *Sugar Revenue in Pernambuco*. The null of unit root is only barely rejected for the series *Slave Price Zona da Mata & Recife*. These series, however, cannot be considered stationary by some of the other tests applied. Therefore, our time series variables can all be considered integrated of first order, I(1).

Given that the series are non-stationary and that we are interested in investigating the existence of a long-run equilibrium relationship among them, we proceed with Johansen tests for cointegration (see TABLE 3). We find eleven economically interesting subsets of variables that are cointegrated (equations A through K). Equation A shows that *Slave Price Zona da Mata* have a long-run equilibrium relationship with the price of cotton and coffee, sugar production in Pernambuco, slave prices in Minas Gerais and slave price in Cuba. Cointegration persists if we exclude the variable *slave prices in Cuba* (Equation B). Equations C and D represent similar equilibrium relationships, when *sugar production in Pernambuco* is replaced by *price of sugar*. Other reported cointegrating equations include slave prices for *Agreste* (cotton production region), and male and female prices.

These results indicate strong evidence that slave prices (in different regions of Brazil and in Cuba) and commodity prices are interconnected and move together in time.

We further investigate the equilibrium relationship among the variables, estimating Vector Error Correction (VEC) models. The cointegrating equations, normalized by slave prices, from the best fitted models are presented in TABLE 4. Because slave prices in Cuba could only affect slave prices in Brazil before the abolition of slave imports in 1850, and the models including this variable are not very well adjusted, the selected models do not include the variable *Slave Price in Cuba*.

The first striking result to notice is that the abolition of slave imports does not have an effect on slave prices in Pernambuco, either in *Agreste* and in *Zona da Mata*. This goes against the widespread belief that supply factors were mainly responsible for the increase in slave prices on the second half of the nineteenth century — as seen above.

On the other hand, the freeing of newborn slaves, in 1871, had a negative effect on slave prices at *Zona da Mata*.¹⁰ It is known that this measure was taken, at the time, as a signal that slavery abolition was about to come. On the effect of the 1871 law on female slave prices, see below.

Another important result is that sugar production in Pernambuco has a positive relationship with slave prices at *Zona da Mata* (see Eq. B in TABLE 4, the coefficient is positive and significant; its proximity to zero comes from the scale the variables were measured).

It may seem puzzling that sugar prices show a negative relation with slave prices. This result is certainly influenced by the opposite movement of prices of sugar and slaves in the first half of the nineteenth century (as can be verified, by visual inspection, in Figure 2). However, sugar prices and sugar production would not necessarily move in the same direction, in the period. Prices were determined in the world market, and the gradual increase in beet-sugar production, in Europe, caused a decreasing trend in prices, along the century (see, for instance, Eisenberg, 1974). Even though prices were falling, compared to the peak in the early nineteenth century, they could still be profitable to Pernambuco producers, whose variable costs were comparatively low. (See on this Furtado, 1959: ch. 11).

Equations B and D, in TABLE 4, show that the coffee expansion apparently affected the country-wide slave market, as slave prices in the non-coffee area are positively influenced by coffee prices. This is consistent with the fact that the expansion of coffee caused a significant flow of slaves towards the coffee producing provinces, as seen above. Another evidence that there was a national slave market in Brazil is the fact that slave prices in Minas Gerais are positively related to slave prices in Pernambuco.

Analyzing slave prices in the cotton-producing area (*Agreste*) separately (Eq. G in TABLE 4), one notices that the price of cotton is positively and significantly related to slave prices at the region. It is significant to point out that, in the case of cotton, it is expected that production and prices move in the same direction, in the period. The cotton market, in the nineteenth century, was characterized by a strong and short-lived increase in prices, caused by the Civil War in the U.S., which caused a violent fall in American cotton exports. This opened the way for an equally short-lived boom in Brazilian cotton production, benefiting in particular the Pernambuco *Agreste*. Under those conditions, price movements can be said to be a good proxy for production movements in the region.

Finally, we investigate possible differences in the male and female slave markets in Pernambuco. Our main finding is that the law that freed the new-born slaves in 1871 decreased prices of female slaves, but had a smaller and statistically insignificant effect on male slave prices (see TABLE 5, Eqs. I and K). Apparently slave owners felt that the *Ventre Livre* Law caused a decrease in the economic value of women slaves, given the fact that their offspring could no longer be a source of profits for them.

5. Concluding remarks

¹⁰ Law no. 2040, of Sept. 28, 1971, declared free the children of slave women, from that date onwards.

The statistical analysis of data on slave prices in Brazil, in the nineteenth century, presents some very suggestive results:

1. Slave prices in Minas Gerais and Pernambuco are positively related; coffee prices are also positively related to slave prices in the non-coffee area. This points to the existence of a countrywide slave market in Brazil, in the period.

2. Sugar production in Pernambuco is positively related to slave prices in the sugar-producing area of the province.

3. Cotton export prices are positively related to slave prices in the cotton-producing area of Pernambuco.

4. Strikingly, in view of repeated statements to the contrary in the literature, the abolition of slave imports does not have an effect on slave prices, either in the sugar-producing or the cotton-producing areas of Pernambuco.

5. The freeing of newborn slaves had a negative effect on slave prices in the sugar-producing area; this effect was apparently stronger in female slaves.

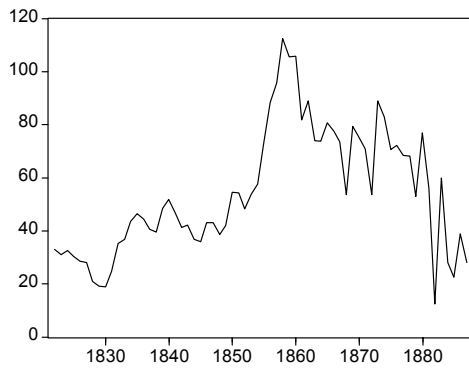
The general message of those findings is that slave price movements, in the nineteenth century, seem to have been strongly influenced by demand-side effects. This is significant, considering a long tradition of attributing the ups and downs of slave prices mostly to supply shifts. More important, this also shows that demand for slaves was associated to economic variables, and thus indicates that slave labor was used in productive activities, not only in the plantation areas, but also in regions where small-scale agricultural production (using small slave holdings) predominated.

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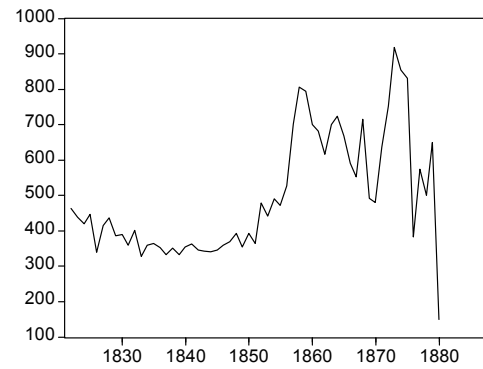
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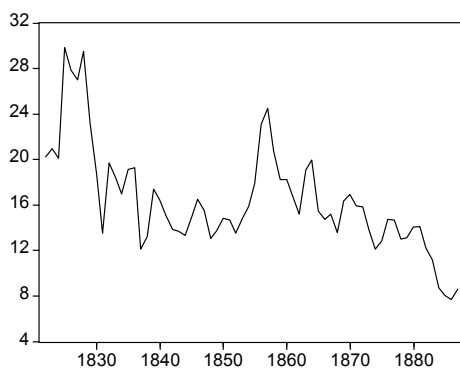
FIGURE 1 - Time Series: Price of Slaves, Price of Sugar and Sugar Production in Pernambuco and Cuba - 1821-1888



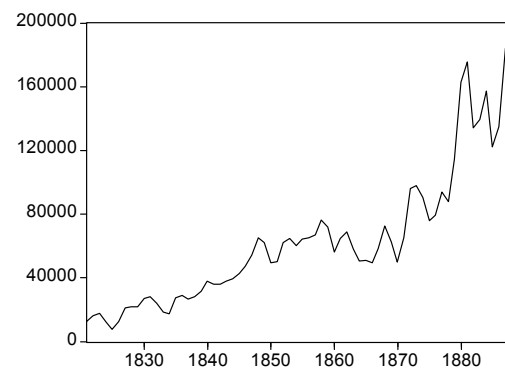
— Slave Price in Pernambuco



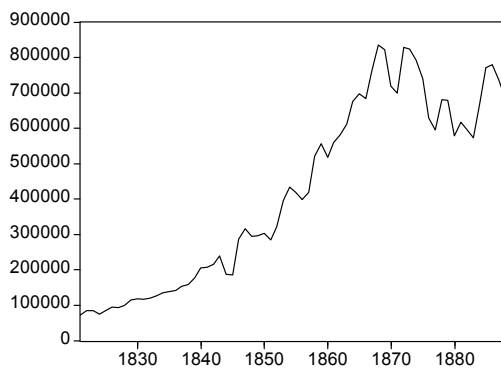
— Slave Price in Cuba



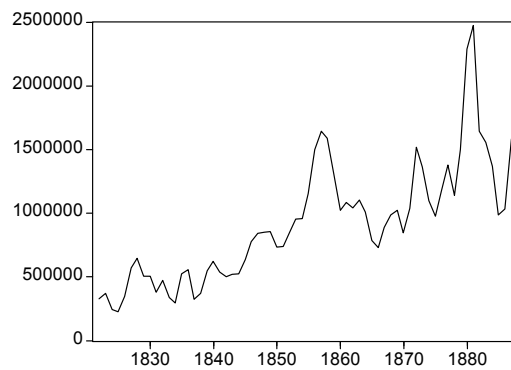
— Price of Sugar



— Sugar Production in Pernambuco



— Sugar Production in Cuba



— Sugar Revenue in Pernambuco

FIGURE 2 – Time Series: Price of Sugar, Cotton and Coffee, Slave Price in Zona da Mata, Agreste and Minas Gerais – 1821-1888

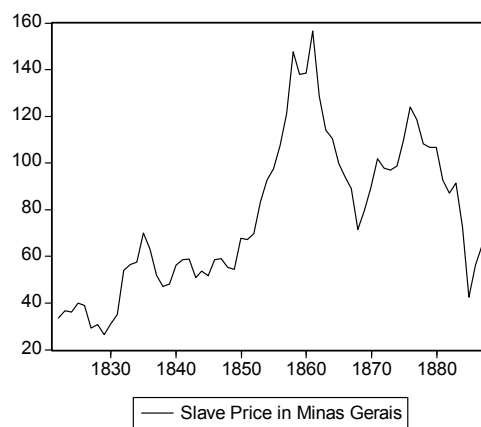
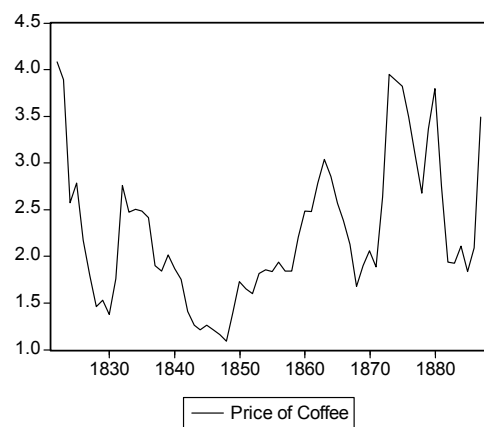
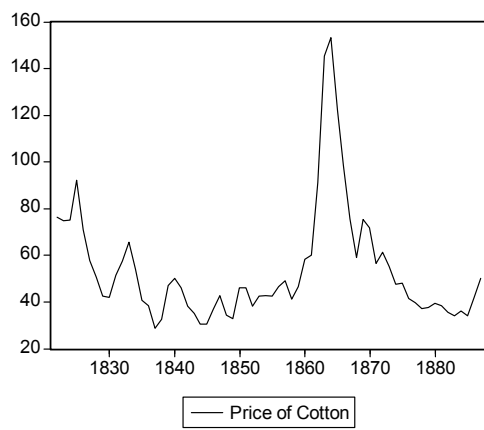
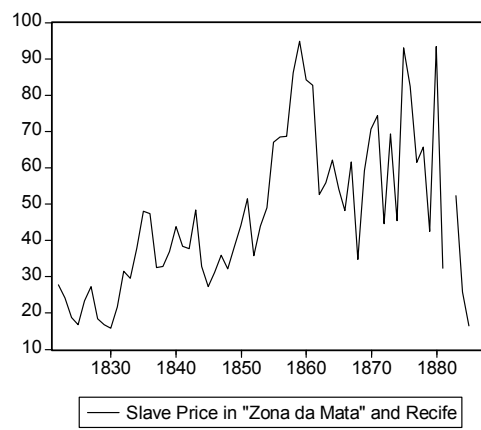
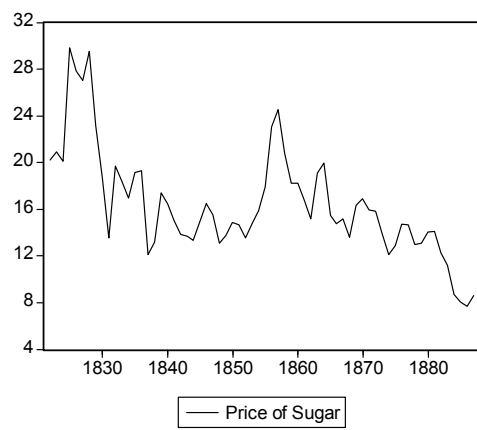


TABLE 1 – Pairwise Granger Causality Tests

Variable 1	Variable 2	# obs	F-statistic	p-value
Sugar Production in Pernambuco	Slave Price in Zona da Mata & Recife	59	2.7950	0.0699*
Slave Price in Zona da Mata & Recife	Sugar Production in Pernambuco	59	3.5347	0.0361**
Price of Sugar	Slave Price in Zona da Mata & Recife	59	0.5099	0.6034
Slave Price in Zona da Mata & Recife	Price of Sugar	59	0.7152	0.4936
Slave Price in Cuba	Slave Price in Pernambuco	57	3.6034	0.0342**
Slave Price in Pernambuco	Slave Price in Cuba	57	5.6194	0.0062***
Price of Sugar	Sugar Production in Pernambuco	64	0.7432	0.4799
Sugar Production in Pernambuco	Price of Sugar	64	2.6108	0.0819*

Note: H_0 : variable 1 does not Granger cause variable 2. *** reject 1%, ** reject 5%, * reject 10%.

Vectors- $\lambda_{\max-eig}$											
# of Cointegrating Vectors- λ_{trace}	3	1	1	1	1	1	1	1	0	1	0
Intercept (no trend) in cointegrating equation and in VAR:											
# of Cointegrating Vectors- $\lambda_{\max-eig}$	1	1	1	1	1	1	2	1	1	1	1
# of Cointegrating Vectors- λ_{trace}	4	1	1	1	1	1	1	1	0	1	0
Equations	A	B	C	D	E	F	G	H	I	J	K
Slave Price in Pernambuco					X	X					
Slave Price Zona da Mata & Recife	X	X	X	X							
Male Slave Price in Pernambuco								X	X		
Female Slave Price in Pernambuco										X	X
Slave Price in Agreste							X				
Price of Sugar			X	X	X	X	X		X	X	X
Price of Cotton	X	X	X	X	X	X	X	X	X	X	X
Price of Coffee	X	X	X	X	X	X	X	X	X	X	X
Slave Price in Minas Gerais	X	X	X	X	X	X	X				
Slave Price in Cuba	X		X		X						
Sugar Production in Pernambuco	X	X						X			
Male Slave Price In Minas Gerais								X	X		
Male Slave Price in Cuba											
Female Slave Price in Minas Gerais										X	X
Female Slave Price in Cuba										X	

Note: According to the Schwarz criteria, the best model specification, for all equations, is: intercept (no trend) in the cointegrating equation and no intercept in VAR.

TABLE 4 – Vector Error Correction Estimates – Normalized Cointegrating Eq. (CE)

	Eq. B	Eq. D	Eq. F	Eq. G
Variables	Slave Price Zona. Mata & Recife	Slave Price Zona. Mata & Recife	Slave Price in Pernambuco	Slave Price in Agreste
Price of Sugar	–	-1.0328 (-3.6876)	-1.2724 (-2.5980)	-1.3224 (-2.3444)
Price of Cotton	-0.2761 (-3.1099)	-0.0377 (-0.6350)	0.5966 (5.7817)	0.7757 (7.8185)
Price of Coffee	13.6259 (4.3158)	7.7903 (3.4220)	-5.8744 (-1.5023)	1.8591 (0.5665)
Slave Price in Minas Gerais	0.3819 (4.4783)	0.5078 (9.5697)	0.7852 (8.4553)	0.5904 (8.9964)
Sugar Production in Pernambuco	0.0002 (2.7516)	–	–	–
Abolition of Traffic	-2.6405 (-0.6336)	-0.7344 (-0.1799)	0.2227 (0.0493)	–
Freedom of New-born	-20.9696 (-2.6452)	-13.4935 (-2.2966)	-6.9800 (-1.5917)	–
N of obs	57	57	63	47
R-squared	0.54	0.54	0.39	0.20
Schwarz SC	8.74	8.75	8.53	9.26

Note: t-statistics in parentheses. “Abolition of Traffic” and “Freedom of New-born Slaves” are exogenous variables. Endogenous variables coefficients are multiplied by (-1) to facilitate interpretation.

TABLE 5 – Vector Error Correction Estimates, by Gender– Normalized CE

	Eq. I		Eq. K
Variables	Male Slave Price in Pernambuco	Variables	Female Slave Price in Pernambuco
Price of Sugar	-2.1111 (-3.1600)	Price of Sugar	-2.1680 (-3.2762)
Price of Cotton	0.4934 (3.5703)	Price of Cotton	-0.1582 (-1.0678)
Price of Coffee	7.6845 (1.3825)	Price of Coffee	26.2341 (5.0323)
Male Slave Price in Minas Gerais	0.6688 (5.7679)	Female Slave Price in Minas Gerais	0.4527 (3.1890)
Abolition of Traffic	-0.6932 (-0.1438)	Abolition of Traffic	3.7070 (0.9283)
Freedom of New-born	-8.6824 (-1.3950)	Freedom of New-born	-21.3498 (-2.9579)
N of obs	59		61
R-squared	0.23		0.51
Schwarz SC	8.91		8.56

Note: t-statistics in parentheses. “Abolition of Traffic” and “Freedom of New-born Slaves” are exogenous variables. Endogenous variables coefficients are multiplied by (-1) to facilitate interpretation.