Slave Prices and Productivity in the 18th Century at the Cape of Good Hope: The Winners and Losers from the Trade

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Abstract

The question about the productivity of slavery is a strongly debated issue, for example in the USA the seminal work by Engerman and Fogel (1974), "Time on the Cross", sparked a flurry of publications debating the issue from different angles.

The debate about the economic worth of slaves in the Cape of Good Hope already started with Pasques de Chavonnes (the only member of the Council of Policy who opposed the principle of using slave labour) who in 1717 remarked that slavery would inhibit economic development since 'the money spent on slavery is dead money'. In this paper we provide an overview of slave prices and the value of their marginal productivity in the Cape Colony and ultimately we ask whether Cape slavery was "dead money".

Our approach is to estimate a hedonic price function for slaves in the Cape Colony for the time period 1700-1725 using the *Changing Hands* database, and comparing these with slave productivity estimates from the *opgaafrollen*. The initial price paid for a slave is, by conjecture, constituted by current marginal productivity of slaves plus the expected net present value of slave characteristics (which by implication will yield productivity returns in the future). These productive characteristics include gender, age and origin. We furthermore investigate whether the gradual increase in slave prices was driven by overall price levels in the economy, by the importation of "better quality" slaves over time or by the policy induced change in demand for labour away from European wage labour to slave labour.

Lastly, we investigate whether slave prices matched the value of their marginal product by comparing estimates of the hedonic price series with

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estimates of marginal productivity. Real prices track marginal productivity closely, suggesting that slavery was profitable over most of the period. However, this effect is heterogeneous, with small farmers showing no signs of profitability and the opposite for large farmers. Small farmers attempted to mimic the production process of large farmers unsuccessfully, and consequently many impoverished farmers had made over-investments in slavery.

1 Background and approach

The study of slavery is associated with strong moral and emotional considerations, given its inhumane history. Proponents of the slave trade primarily had economic benefits in mind, namely in the form of cheap labour. This begs the question whether slavery is economically viable (abstracting from the human cost). Slave productivity is a strongly debated issue, for example in the USA the seminal work by Engerman and Fogel (1974), sparked a flurry of publications.

We turn the focus to another slave society, *viz* the 18th century Cape Colony, which leaned largely on slavery In particular, this study asks this question in the context of the Dutch East India Company or *Verengide Oost-indische Companje* (VOC) occupation at the Cape of Good Hope, where policymakers expressly agreed that the importation of slaves was one of the primary vehicles to develop this fledgling economy. While many authors[1] point to the importance of slavery in developing this primarily agricultural economy, the verdict on its profitability has not been established quantitatively up to this point.

The debate about the economic worth of slaves in the Cape already started before modern academic analysis, when Mauritz Pasques de Chavonnes was the only member of the Council of Policy of the VOC who opposed the principle of using slave labour to develop agriculture (Giliomee, 2004). In 1717 he remarked that slavery would inhibit economic development since "the money spent on slavery is dead money", with large amounts of colonists' capital tied up in the trade. Chavonne's assertion was contradicted in 1804 by Janssens, Governor of the Cape when he remarked that "the whole industry of this country is based on the existence of slaves... Those who possess *many* slaves can easily be recognised by the condition of their farms; everything looks better and more prosperous than with those who have to work with scanty means" (quoted in Worden, 1985 - emphasis added). Apparently slavery did have benefits for individual farmers, though Janssens' comments only explicitly relate to the case of farmers who owned a sufficient number of slaves to realise economies of scale. This verdict is silent on whether small farmers could successfully mimic large farmers' profitability, or whether they (along with the slaves themselves), were losers from the trade.

In this paper we investigate whether slave prices matched the value of their

[1] Giliomee (2004), Van Duin & Ross (1987), Guelke & Shell (1983), Fourie & von Fintel (2012), Fourie (2011), Muller (1983), Worden (1985)

marginal product. We develop a hedonic model of slave prices to decompose nominal prices into inflationary trends, current marginal productivity of slaves and expected returns on slave characteristics over their lifetimes. It is clear that over a significant period prices (adjusted for overall price fluctuations) on average track the value of marginal productivity. However, after "purifying" the micro price data of anticipated lifetime returns on slave characteristics, it is apparent that prices exceed one period of the value of the marginal productivity (VMP) of slaves. At first glance, therefore, slave prices reflected a potential for expanding the slave force profitably – *one* year of VMP covers both anticipated lifetime profits from slaves and one year of productivity. However, further investigation suggests that small farmers attempted to emulate this success by expanding their slave labour forces, but their scale limited them to achieve VMPs that warranted the averages prices that were paid on the market. Hence, profitability strongly depended on how large the farming operation was.

This paper proceeds as follows. Section 2 reviews some empirical evidence on the profitability of slaves internationally. Section 3 follows up with a presentation of the evidence on slavery in the Cape Colony, while section 4 outlines the methodology followed in establishing the profitability of slaves. Data sources are discussed in section 5 and are followed by a presentation of the results of the empirical analysis. Finally, section 7 concludes.

2 The profitability of slavery – some empirical evidence

One of the earliest contributions in the slavery debate was by Conrad and Meyer (1958) who found slavery to be profitable. Fogel and Engerman (1974) extended this work in their book "Time on the Cross" and supported earlier findings, in that slavery was profitable relative to returns on other investment possibilities. The prices of slaves were found to be an accurate reflection of expected profits to be earned, and slaves were as productive as their European non-slave counterparts. These results received substantial criticism, amongst these from Gutman (1975). He criticised their assumptions and methodologies, and commented on the use of unrepresentative samples and their interpretation of the data.

The study of Vedder and Stockdale (1975) was the first attempt at a direct statistical estimation of a production function to determine the profitability of slavery. They applied a Cobb-Douglas production function, indicating that this type of function is most commonly used in agricultural economics studies due to its simplicity and the extensive validity in empirical observations. Their estimated Cobb-Douglas production function includes two inputs, namely the number of slaves[2] on each farm and a combination of land and capital. Their results reflect a positive contribution from both inputs to farm output, and the

[2] The number of slaves used in the estimation is not equivalent to the number of slaves on the farm as they adjust it according to slave labour participation (by age and gender of slaves) – see Vedder and Stockdale (1975: 396) for more details.

absence of economies of scale. They then continue with a calculation of the rates of return to these inputs, based on certain assumptions about (amongst others) input costs, maintenance costs of slaves, and output prices (Vedder and Stockdale, 1975). Their results show that slavery was as profitable as other forms of agricultural inputs. They conclude that cotton production in the South (of the USA) was profitable and that it was worthwhile for slave owners to invest in the institution of slavery.

Kotlikoff (1979) investigates slave prices in New Orleans during 1804-1862 by analysing the economic rationality of the slave system. He focused on explaining the structure of slave prices, and assumed that even though the level of slave prices changed over time, its structure remained time invariant. More recent analyses of the slave data from Kotlikoff's (1979) study comes in the form of a hedonic price index and an analysis of the impacts of changing qualities of slaves by Levendis (2007). This study's contribution to the debate is its focus on a crucial element, namely the benefits of slave capital through a separation of slave prices into a pure price element and the changing attributes of slaves. This approach paves the way for an analysis of slaves through hedonic modeling, which is used below.

3 Slavery in the Cape Colony

Slavery in the Cape Colony has been intensively studied in the historical literature, and includes the work of Worden (1985), Armstrong and Worden (1988), Worden and Crais (1994) and Shell (1994). All of these studies provide a thorough historical overview of Cape slavery and they also highlight the linkages between slavery and the Cape economy. Dooling (1999) makes an indirect link between slave ownership and the wealth of owners: "the very wealthy were typically owners of extensive landed property and an above average number of slaves. Johannes Louw was the owner of 6 farms as well as 39 slaves, whereas Jan Martinus Coors farmed without slaves, but with his death the farm was worth a mere 63 rixdollars". These isolated cases illustrate the common thread found in the literature, that large farmers became successful through extensive slavery[3], while small farmers failed because they did not invest in many slaves. This study affirms the first assertion, while it contests the second. The evidence presented below suggests that Chavonne's concern with over-investment in slavery was warranted for small farmers: these farmers were limited by their scale, and were not able to employ slaves profitably.

The first significant number of slaves was imported to the Cape in two shiploads (one with 228 and the other with 174 slaves) in 1658, shortly after the first settlement was established by Jan van Riebeeck of the VOC in 1652 in Cape Town. While the VOC had no intention to start an extensive colony, they hoped to use the Cape as a halfway refreshment station for ships on their

[3] Other reasons speculated as possible explanations on why large farms became successful include the system of property rights, cultural and social networks, large credit markets and Company policies and practices (Fourie 2012).

way to the lucrative trade ports of the East Soon, however, it became clear that the refreshment station could not satisfy the demand from ships with the small, intensive agricultural activities in Cape Town. Van Riebeeck allowed farmers (*burghers*) to expand into the interior, establishing (larger) independent operations, from which 10% of crops had to be paid to the VOC. This was the start of an expanding economy, which also required new sources of labour.

Figure 1 shows the substantial increase in the share of slaves in the total population during the 18th century. Europeans constituted more than 60% of the population at the beginning of the period, with a rapid decline to less than 40% by 1733. This demographic shift was the direct result of a decision made by the VOC policy council at the turn of the 18th century to discourage the immigration of Europeans and to satisfy labour demand with slavery. As the slave population in the Cape Colony did not reproduce itself due to mortality being higher than fertility, the increase in the slave population relied on imports.

Worden (1985) and Armstrong and Worden (1988) discuss different sources of Cape slaves. One source was foreign traders that stopped at the Cape and sold some of their cargo before proceeding to the New World. Slaves were sold in the Cape if the immediate sale had an advantage against an anticipated higher price in the New World. To sell some slaves in the Cape was a form of hedging against the risk of slave losses when crossing the Atlantic.

A more significant source was Company sponsored voyages to Mozambique, Madagascar and later on the East African coast (Armstrong and Worden, 1988). More than 95 percent of slaves arrived in the Cape in the "good months" between December and June, when the southeaster brought the returning fleets to the Cape. Farmers from the interior, who missed these fleets, paid much higher prices for their slaves in the winter months, when few (if any) ships called. Slaves were especially in short supply during winter as many slaves died of ill health (Shell, 1997).

As slaves were relatively expensive, farmers with larger tracts of land were in a better position to exploit economies of scale and use slaves profitably. Muller (1983) indicates that if European labour had been used instead of slaves, smaller land areas would have been cultivated and more labour-saving technology required. However, after settlers were released by Van Riebeeck, they could depart from intensive European farming practices and establish large farms on the available land. This allowed, in certain instances, very large farmers to constitute a large elite, based partially on the use of slavery in viticulture (Fourie & von Fintel, 2012).

During the early 18^{th} century a close correlation developed between the number of adult male slaves owned and the output of arable farms. Although there were fluctuations, the farmers producing both wine and grain had the closest relationships[4]; more efficient exploitation of slaves resulted, as they could be put to work throughout the year when various crops were harvested. Economies of scope are therefore also likely to have influenced profitability of slaves in farm-

[4]Most farmers in the wine and grain producing regions used more than 15 slaves, with some wine farms even using more than 80 slaves (Muller, 1983).

ing. Fourie (2011) suggests that only the richest farmers' inventories recorded expensive capital goods that were used in non-agricultural production, so that their scale also allowed them to diversify into other modes of production.

After the 1740's the use of free labour increased, especially the Khoikhoi (Ross, 1983). According to Guelke and Shell (1983), Khoikhoi labour was especially beneficial to the smaller farmer as they were less expensive than slaves and *knechts* (hired European labourers) Nevertheless, the VOC became increasingly concerned about the large amounts of capital invested by colonists in slavery, with Guelke (1974) estimating it at 13-17% of the total between 1731 and 1780 and rising to 20% in the last two decades of the century. Both scale and scope are investigated in this study to understand the potentially heterogeneous profitability of slavery at the Cape.

4 Methodology

In order to establish the profitability of slavery at the Cape, we construct price and marginal productivity indices for slaves. The basic notion of profitability is applied here: should prices exceed the value of the marginal product of slaves in any period, then acquiring an additional slave is deemed to be unprofitable and vice versa

4.1 Estimation of a price index

Slaves were not paid in wages, and therefore a standard comparison of this indicator with marginal productivity is not possible. Hence, we must turn to a close proxy for annual wage costs in the form of the prices paid for slaves. This indicator, however, represents the *lifetime* cost of the slave to the owner (as opposed to one year of productivity that is observed in other data), so that more careful analysis is required. Prices could potentially be analysed over time by aggregating them over all sales in any given year. However, as indicated by Levendis (2007), such an approach ignores the heterogeneity of the slaves sold in any given period. Consequently, great variations in sale prices are recorded in any given period, as slaves with more desirable "productive characteristics" fetched higher prices on the market. Furthermore, the type of slave that was sold clearly changed over time, so that an intertemporal comparison of prices and productivity is not possible by simply comparing means. Characteristics also represent *anticipated* values of slaves, so that accounting for this can offset the discrepancy between lifetime prices and annual productivity.

We proceed to isolate the value of the marginal product that a buyer hoped to obtain from acquiring an additional slave *at the point of sale* in order to compare this quantity to estimates of actual slave productivity. The price that a buyer is willing to pay for a slave reflects various rewards that they hope to

reap from acquiring an additional slave:

$$\begin{aligned} \text{Price}_{it} &= E\left(NPV_{\sum_{t=time\ of\ sale}^{T=death\ of\ slave} Value\ of\ Marginal\ Productivity\ of\ Slave_{it}}\right) \quad (1) \\ &= VMP_{slave_i at point of sale} + E(NPV_{\text{Return on } Slave_i\ characteristics\ over\ lifetime} \end{aligned}$$

Because wages are not offered over the slave's life-time, a "once-off" payment is made for the expected returns (in terms of productivity) that the slave offers in all the time that the slave remains the property of the buyer. At the point of sale, the buyer had to make a judgment on these potential productivity returns based on a slave's characteristics. For instance, a native slave had longer life expectancy and would therefore have more "lifetime productivity" to offer the buyer. Consequently a native slave should presumably have fetched a higher price on the market, for example We consider more of these characteristics below. However, these future returns cannot be compared to the *current* value of marginal productivity (for the year that the slave was bought) to assess profitability. To isolate the latter component, therefore, it is necessary to control for the anticipated productivity returns on lifetime characteristics.

For these reasons it is necessary to estimate a hedonic regression model that purifies the aggregate price time trend from the lifetime returns on slave characteristics, as Levendis (2007) did. This approach allows for the isolation of the component of prices in a given year that is not driven by the characteristics of slaves, but that only reflects the immediate expected marginal productivity of the slave in each period for which price data is available. Comparisons with estimates of the value of the marginal products of slaves in those periods are therefore enabled to assess profitability. A secondary research objective of estimating the hedonic model is to understand how Cape buyers valued various characteristics on the market. The discussion that follows provides an overview of the literature on the most important determinants of slave prices.

Many studies in various regions (Kotlikoff, 1979; Fraginals et al. 1983; Chenny et al. 2003) document a premium paid for male slaves, given the returns to physical strength over their lifetimes. This attribute took precedence over fertility and the reproduction potential of females (in order to obtain slaves for free outside the market). Fraginals et al. (1983) indicate that a childbearing premium that did exist was small since evidence from the USA reveals that being able to bear children explains less than 20% of the capital value of female slaves. This is supported by Shell and Rama (2007) who investigate slave prices in the Cape Colony, and conclude that slaves were more valued for their skills than their ability to reproduce. Fraginals et al. (1983), however, do report some instances where the female slaves received a higher price than males. This could possibly be ascribed to the type of occupation for which the slave was required. For example, in urban areas more female slaves were needed for domestic tasks.

In each of the studies cited above, the age-price relationship is concave. The polynomial shape indicates the increments in prices for each additional year and rise most rapidly for very young slaves (Kotlikoff, 1979). After the age of 22 years, however, prices started falling. In their study, Fraginals et al. (1983) define the prime-ages to lie between 18 and 35 years.

Skill levels of slaves contributed positively to price differentials. In his regression model, Kotlikoff (1979) includes a dummy for slave artisans, which has a positive relationship with the slave prices. Slaves in other occupations, however, received no premium. Empirical evidence by Chenny et al. (2003) support these findings

Native slaves usually sold at a premium over imported slaves (Fraginals et al. 1983). They had a higher life expectancy due to acclimatization to the disease environment, and consequently offered a longer period over which owners could reap productivity gains from their acquisition.

A further dimension is the consideration of ethnicity. Chenny et al. (2003) report that Malagasy slaves were less likely to be used on the plantations as opposed to slaves imported from Mozambique, as they were not as content as the latter slaves and were more likely to become unruly. Slaves from India were considered small in physique and therefore less suitable to be used in plantation work. They were therefore sold at a lower price than the Creole slaves.

5 Data

Various historical data sources are required to conduct the proposed analysis of comparing prices with productivity. Primarily, price data on slaves are required to generate a representative index of how slaves were valued by buyers. In particular, micro level records over a period of time are required to build a hedonic model that isolates a time trend that is independent of expected lifetime returns on slave characteristics. For this purpose, the *Changing Hands* database (Shell, 2007) is used[5], where a full set of sale deeds of slave transfers are recorded, along with slave characteristics. The full records span 1658 to 1768, though only the entries from 1700 to 1725 are used because of the overlap with other sources[6]

The following hedonic models are estimated:

$$\log(Slave\ \ \Pr ice_{it}) = \beta_0 + \lambda_t + e_{it}... \tag{2}$$

$$\log(Slave\ \ \Pr ice_{it} * CPI_{1700}/CPI_t) = \tilde{\beta}_0 + \tilde{\lambda}_t + \tilde{e}_{it}... \tag{3}$$

$$\log(Slave\ \ \Pr ice_{it} * CPI_{1700}/CPI_t) = \grave{\beta}_0 + x'_{it}\ \grave{\beta} + \grave{\lambda}_t + \grave{e}_{it}... \tag{4}$$

$$i = 1 \ldots N_t; t = 1700; \ldots; 1725$$

Model (2)'s estimates of the time fixed effects (λ_t) are equivalent to the deviation from the base period's mean $\log(price)$ and are similar to a price index based simply on the mean of the dependent variable at each point in time. Alternatively, model (3) estimates a time trend based on prices that are deflated by an overall price index to reflect 1700 prices. The reason for this alteration is

[5] We are indebted to Robert Shell for sharing the databases in a user-friendly format with us.

[6] Though micro level records over time are contained in this database, they do not constitute a panel dataset. We use pooled cross section data with various time fixed effects to model the price index.

to remove the effect of overall price inflation from the real trend in slave prices. For this purpose prices are scaled by the price index developed by Du Plessis and Du Plessis (2009) from various archival sources, including the auction roles of the Master of the Orphan Chamber. Because of the limits of the time coverage of their data, the entire analysis omits all data before 1700. This date also represents the first significant record of viticulture in the production data mentioned below. As noted above, wine production was the most strongly correlated with slavery. Finally, model (4) partials out the hedonic characteristics of slaves The resultant index calculated from $\grave{\lambda}_t$ now represents only the average of the VMP of slaves *at* time t, while the additional coefficients signify the lifetime expected returns ($\grave{\beta}$) to slave characteristics (x_{it})[7], as indicated in equation (1).

The idea of this paper is to consider whether the purified price index (derived from λ_t) compares to the VMP of slaves to assess profitability. To this end, the *opgaafrollen* of the VOC are used to estimate Cobb-Douglas "total marketable value" (TR) functions – as in equation (7) - with the ultimate objective of finding the Value of the Marginal Product of Slaves (VMP_s) for each farmer. To do this, coefficient estimates on *log(S)* are multiplied by each farmer's average revenue per slave, as shown in equation (6). This dataset consists of detailed tax records, outlining the size of harvests and labour types used by the entire European population at the Cape. The records were digitised by Dr Hans Heese of the Stellenbosch archive in The Hague, Netherlands. Fourie & von Fintel (2010; 2011; 2012) provide a fuller description of the dataset. The functional form follows:

$$TR = \beta_0 S^{\beta_1} K^{\beta_2} HH^{\beta_3} \Pi_{l=1}^{m} K_m^{\beta_3+m} \tag{5}$$

$$VMP_i^s = \frac{\partial TR}{\partial S} = \beta_1 \beta_0 S^{\beta_1 - 1} L^{\beta_2} HH^{\beta_3} \Pi_{j=1}^{m} K_j^{\beta_3+j} = \beta_1 \frac{TR_i}{S_i} \tag{6}$$

$$\begin{aligned} \log(TR_{it}) \quad = \quad & \beta_0 + \beta_{t1} \log(S_{it}) + \beta_{t2} \log(L_{it}) + \beta_{t3} \log(HH_{it}) \\ & + \sum_{j=1}^{m} \beta_{3+j} \log K_{jit} + \lambda_t + \varepsilon_{it} \ldots \end{aligned} \tag{7}$$

where TR is the total marketable value of farm production[8], S is the total number of slaves owned by a farmer, L is the number of European *knechts* (hired workers) employed, HH represents the number of household members

[7] It is evident in the micro records that many sales were conducted as "batch sales". In these cases slaves were clearly not bought on the basis of their qualities, but a discounted price was offered. This does not concur with the notion of value that accrued to buyers, nor to expected returns to characteristics. However, much information for these observations was omitted (such as productive characteristics), so that these peculiar cases were excluded from estimates by default. Furthermore, many characteristics were omitted from the records in later years, so that controlling for the hedonic features dramatically reduces the sample size. It is evident that estimating model (2) with the smaller sample introduces sample selection bias for later years. Additionally, estimates of $\hat{\lambda}_t$ are sporadic in later years and imprecisely estimated. For this reason, the study period is truncated to 1725, where these biases are absent or insubstantial.

[8] By this we mean that even quantities of products that were consumed by the household could potentially have been sold at market prices. The data record the total of home consumption and products that were sold, without distinguishing between them.

(which is included for the sake of measuring the impact of subsistence farmers working their own lands[9]), and each of the K_j items represents other inputs into the production process of a capital nature (such as vines, grain that was sown and horses). The i subscript denotes the farming household, while t denotes time. Time fixed effects are included, while household fixed effects are omitted, because this dataset consists of repeated cross sections. Estimates for the value of the marginal product of slaves (VMP) are obtained from the coefficients estimated for each period, multiplied by the average revenue of each farmer in each period, as indicated in equation (6) Due to the overlap in the various sources, the *opgaafrolle* for 1700, 1705, 1709, 1712, 1719 and 1723 are used to estimate VMP of slaves.

The total marketable value of farm production is obtained by multiplying quantities with relevant product prices from the Master of the Orphan Chamber auction rolls, scaled by the general price index of Du Plessis and Du Plessis (2009), so that estimated VMPs are expressed in 1700 prices (to aid comparison with the real hedonic price index, that is also estimated in 1700 prices). Annual wine and grain harvests are incorporated into TR in this manner, while the treatment of stocks is slightly different. Since not all stock is consumed or sold on the market in a given year, it is assumed that 15% of all animals (sheep, cattle and pigs) were deemed "marketable" in a given year. This figure was also used by Fourie & von Fintel (2011) to construct total wealth indicators as suggested by Van Duin & Ross (1987). Horses, in contrast to cattle, are included as a production input, rather than as a part of the marketable value of the farmer's operations.

Coefficient estimates are obtained by OLS[10] to obtain the VMP for the average farmer, while quantile regressions are implemented along various parts of the total value distribution to investigate the role of scale economies[11]. Additionally economies of scope are investigated, by repeating the entire analysis, but by varying the slope coefficients of slavery according to the quintile of a diversity index (in both the regression and quantile regression contexts). The latter is a Herfindahl-Hirschman index that is calculated for each farmer, based on the sum of squared shares in total values for each product that was produced. The index is generalised and subtracted from 1, so that 1 represents complete diversity, while 0 represents perfect specialisation in one product type.

All households that produce zero household value are omitted from the analysis. These households were likely to be non-farmers, as they were also concen-

[9] Fourie (2011), however, suggests that even poorer farmers possessed diverse assets, indicating that they had market connections and were not likely to be purely subsistence farmers.

[10] Results are not discussed in great detail, but are available in Table 3 in the Appendix.

[11] Quantile regressions were estimated in quantile intervals of 5 from 5 to 95. This yields a series of estimates of $\hat{\beta}_1$, weighted at the different values of the TR distribution. Farmers are classified into intervals of a 5 percentile range centred at the respective quantile regression weights – these observations are associated with respective coefficients from the various regressions. Relevant coefficients are multiplied by each farmer's average revenue with respect to slaves, so that each farmer obtains an individual VMP that now also reflects their position in the scale distribution. Results for selected years are available in Tables 4 to 6 in the Appendix. Additional results are available from the authors on request.

trated in the district of Cape Town, where other industries dominated. Unfortunately no indicators of non-agricultural activity are available in the records provided, so that the study is limited to farm production. Fourie & von Fintel (2011) impute incomes to these individuals, with slaves as the main predictor. By default, however, such a strategy imposes identical marginal products of slaves to both groups, so that this becomes a superfluous task in this context. Hence, the marginal revenue products are only estimated for the farming population under the assumption that slaves were concentrated largely in this form of industry. Indeed, Fourie (2011) reports that the Cape economy remained largely agricultural, with the only evidence of diversification and proto-industrialisation amongst the largest asset holders. However, to aid comparison, the hedonic model also controls for the civil status of buyers, so that the price indices represent fluctuations for farmers (which forms the reference category).

6 Results

6.1 The Hedonic Price Component

Before turning to an analysis of productivity and profitability, this section briefly investigates the hedonic price determinants of slaves at the Cape. As noted above, the value placed on recorded slave features represent expected lifetime returns to various characteristics. These are reflected by estimates in Table 1.

Firstly, the concavity in age that is found in other studies is also evident here. Secondly, no statistically significant male premium is estimated in the data; in fact the coefficient suggests an insignificant disadvantage for the youngest males. Figure 2 interrogates these factors. Local polynomial smoothers with 95% confidence bands confirm that across most of the age range, prices offered for male and female slaves were statistically indistinguishable. However, between the ages of 20 and 30 a significant male premium arises (where the confidence bands do not overlap). This segment represents the prime age of slaves, when males (and perhaps not females) could perform physically intense labour in vineyards (say). While prices flattened off after the prime age, they did not reflect the strong declines noted in the literature after ages as early as 22 (Kotlikoff, 1979).

Information on slave origin is highly collinear with variables that control for the origin of the seller. Hence, none of the ethnic effects noted in the literature manifest in these estimates. Interestingly, the coefficient on Southern African slaves is negative, which goes against all expectations of a native premium.

A clearer view is obtained by considering the origin of sellers[12]. With Batavian sellers (who lived abroad) as a reference category, it is evident that sellers who were in transit at sea or resident in Table Valley (at the coast) received no statistically different prices from foreign buyers. This indicates that all slaves from foreign sources were treated similarly on the local market. Table Valley sellers' classification with this group suggests that slaves that were sold by locals in

[12] While this does not directly measure a characteristic of slaves as is commonly understood in the hedonic framework, it does proxy for one of these, namely their susceptibility to disease.

Cape Town were dominantly constituted by shipments from abroad which they re-sold to other local households. This is confirmed by Shell's (2007) accounts of active slave trading and swapping within Cape Town. In all, the premia of other groups relative to this one, suggest that slaves that arrived from abroad did not fetch high prices on the local market. The further the sellers' district was from the coast[13], the greater the premium, with sellers from the broader Cape District obtaining an 18% premium above foreign sellers, 23.3% for those in Drakenstein and 63.3% for those in Hottentots Holland. This suggests that slaves that were sourced from the interior were more likely to have been born in the country, or had served other farmers for long periods and would have acclimatised to the local disease environment.

However, the lower prices accepted by foreign sellers are also reflected in the policy of emancipation of slaves that completed the journey to the Netherlands. Sellers would therefore forego higher market-related prices to partially recover what would have been a complete loss of property, which would have occurred if slaves were sold en *route* to the Cape, where they were not emancipated and remained tradable.

Buyers' civil status do not directly represent slave characteristics, but controls for non-market arrangements. In particular, it is evident that VOC employees paid statistically less for slaves than all other groups. In contrast, the gentry paid a large premium for slaves (not accounted for by other productive characteristics), suggesting that their financial strength allowed them to bid up prices at the auction. We account for this factor, so that willingness to win an auction is not captured in other citizens' price offers.

6.2 Profitability

Figure 3 summarises the core results of this paper. Three price series' are plotted along with estimates of VMP. It is evident from the unconditional nominal price series (reflecting only changes in average prices) that inflation in slave prices was fairly rapid from 1700 to 1713 Over this period comparisons with the real price series (using prices scaled by the general price index) highlights that this trend is not dominated by an overall inflationary trend. In fact, Du Plessis and Du Plessis (2009) document a deflationary overall price trend over this period.

Remembering that the real mean price tracks average prices after accounting only for *overall* price trends (and not yet for lifetime returns on slave characteristics), the discussion of this series takes cognizance of the fact that this price still contains a component that the buyer anticipates in *future*, while VMP only represents a *current* quantity in a given year. VMP started at a low annual level of less than 50 Rixdollars per slave in 1700 before increasing steadily until 1709, as the wine industry – which used slaves most intensively and successfully – became established and changed the production function of the Cape Initially

[13] Liesbeeck valley is the one district that does not fit this pattern. This was one of the first areas that Van Riebeeck allocated to free farmers to cultivate. However, recorded sales from this region only appeared in 1708, so that this may be an outlying result rather than part of a systematic pattern.

real prices exceeded this value, and did not seem to be related to slave productivity; note, however, that the price premium does not signify unprofitability, as buyers hoped to regain this in slave productivity in future years. From 1705 to 1719 a rough cyclical correspondence arose between real prices and VMP: the initial rise in VMP until 1708 was followed by a rise in real prices from 1707, to levels not dis-similar from the VMP. VMP was the first to peak in 1719, while prices followed, before turning downwards from 1713 (the year when the smallpox epidemic struck the colony), after which they fell until 1719. It is therefore evident that buyers' willingness to pay for slaves was determined by the realized VMP they had observed during previous harvests. However, average farmers based their willingness to pay on *one* year of VMP, while additional benefits were likely to accrue over slaves' lifetimes. Essentially they were risk averse by making a pricing decision that assumed only one year of production. Judging by this behaviour, and assuming that slaves would only survive one year of work, average farmers did show some form of profit-maximising behaviour, given that from 1713 to 1719 their willingness to pay declined on the back of productivity declines, and these two series had similar levels. From 1719 the link between real prices and VMP is broken. After the 1717 policy discussion of the VOC to substitute European immigration with slave importation, prices increased in real terms, which at first glance seems to be demand driven, despite continued decreases in slave productivity. With declining VMP over this period, it is tempting to conclude that slavery was unprofitable, though it is possible that higher prices reflect a slave with better characteristics and hence a higher probability of longevity and future productivity. Demand for *more* slaves therefore appears to be the unlikely explanation for this rise in prices. This is discussed in greater detail below. Table 2 indicates that the smallest farmers were the most likely to increase their use of slave labour in this period, with a doubling in the average number of slaves from 1712 to 1723 (compared to a stable number for the largest farmers). This group also realized the lowest VMP from slaves (see Figure 4), which suggests that the importation of slaves in this period would not have added substantially to productivity. However, as discussed below, larger farmers who enjoyed scale economies also witnessed stark declines in VMP over this period, so that scale is not the reason for this change.

An alternative explanation to demand-driven increases in the real price is that a different type of slave (with better characteristics and expected lifetime production potential) was progressively being bought at the Cape. The third price series in Figure 3 controls for the hedonic features of slaves (as outlined above): firstly, it is evident that the level of the index drops substantially, and secondly the trend flattens out markedly. Hence, the post-1719 price increase is primarily the result of the premium that farmers were willing to pay for slaves that would live and work longer. Progressively more slaves were sourced locally, so that farmers would face reduced exposure to disease risks experienced by non-native slaves. This represents a rational response following the declines in productivity witnessed after widespread illness and death during the 1713 smallpox epidemic.

Once characteristics that are valued over slaves' *lifetimes* are controlled for,

the dramatically lower series represents the *current* value anticipated by buyers - in other words the short term production that an additional slave could offer in the next harvest (which is comparable to the VMP of one year that is estimated from the *opgaafrollen*)[14]. If viewed in this context, slave labour could be profitably expanded by the average farmer throughout the pre-1719 period, when the "purified" price series consistently fell below the VMP realized by the average farmer. Hence a so-called "excess capacity" for using slaves was apparent. However, post-1719 even this advantage disappears.

The intertemporal flattening of the index (relative to the climbing unconditional series after 1719) is suggestive of *why* buyers preferred not to expand their slave labour force even more, despite the excess capacity for doing so profitably: evidently slaves with better endowments and long-term anticipated returns were being traded more frequently on the market. In other words, owners chose to buy fewer, but more expensive, slaves than they would have had they responded appropriately to profit incentives It is not immediately clear whether this change in preferences for better quality slaves resulted from a more steady foreign supply of highly valued slaves. What is, however, evident, is that the average farmer was progressively choosing to tie more capital into more expensive slaves (as is postulated by Fourie (2011)), with the hope that they would deliver high returns in future, and less risk (in light of the 1713 smallpox outbreak). This description of slave prices reflects the sentiments of the VOC, whose administration was concerned with the large investments that settlers made in slaves, and whose future returns were not sure (given the large upfront premia for characteristics that were paid). Furthermore, because most slave acquisitions were made by smaller farmers, the risks were attenuated.

Given that smaller farmers were more likely to expand their slave labour force (see Table 2), it is necessary to understand whether they faced higher risks to their profitability by doing so. Up to this point, this study has investigated profitability for the average farmer. However, as noted above, farmers with larger farming operations were able to exploit economies of scale to realize higher returns to inputs. Separate VMP estimates according to the quintile of the total value of farmers' production are presented in Figure 4. It is evident that the VMP estimates of the middle quintile most closely correspond to those of the average farmer in Figure 3. Scale effects are clearly evident, with the VMP estimates for the top two quintiles following a similar evolution over time, but at a higher level until 1709. However, it appears that the large scale advantage falls dramatically after realized marginal productivity collapsed post 1719. Throughout, the smallest farmers did not achieve VMP that concur with either unconditional or hedonic price series, confirming that they did not profitably employ slaves. The prices they paid exceeded one year of marginal productivity – but, more extremely, were still excessive even once the value of lifetime returns

[14] One might note here that unobservables have been omitted from the model and are still captured by this series. However, if one assumes that the most important characteristics which buyers based their decisions on would not be omitted from the sale deeds, then most of the price formation process is captured by the included variables, apart from a premium for current productivity (which is what remains after exhaustive controls are introduced).

were discounted. Similarly, the second quintile farmers (while mostly achieving higher VMPs than the hedonic series), paid higher or equal unconditional prices than the VMP achieved by slaves. In this instance, their profitability decision was not based on only one year of productivity, but also on long-term returns. Together these observations suggest that profitability of slavery was certainly not realized for the smallest 20% of farmers, and by some criteria also not for the smallest 40% of farmers. However, as Fourie (2011) shows, slaves were amongst the first products that even the least wealthy farmers acquired. This underlines the concerns that the VOC had for farmers who had "over invested" in slaves. However, this picture suggests that farmers with high outputs were investing in slaves profitably (until 1719 at least), while the smallest farmers interpreted high slave populations of the rich as the secret to their success. Their slave buying behaviour mimicked large farmers unsuccessfully.

It is also apparent from Table 2 that small farmers attempted to emulate the production methods of larger farmers to attain wealth. The poorest quintile of farmers consistently derived large proportions of their production value from wine, as denoted by wine's share in total value often in excess of 10 or 15%. This pattern is not seen in any of the other quintiles. Paradoxically, this is also the product that has been attributed to the rise of an elite (Fourie & von Fintel, 2012), and is associated strongly with slave labour (Giliomee, 2004). However, the 5^{th} quintile achieves absolute wine yields that are consistently more than triple of those in the first quintile, with a consistently high factor difference in the average number of slaves employed. These figures point to the fact that larger farmers did not necessarily specialise their production, but that the smallest farmers tended to do so. However, the slave to wine ratio was highest in this lowest group and increased over time, indicating that they were disadvantaged by their small scale, despite attempting to specialise. Additional slaves did not result in substantially greater wine yields. The largest farmers had lower slave to wine ratios, despite this product constituting a smaller share in total production. Evidently large farmers had the benefit of not only exploiting scale economies, but also being able to use acquired slaves in multiple production processes. Muller (1983) notes that the correlation between slavery and wine output is strongest for those who also produced wheat, suggesting that slaves were put to work throughout the year in the various harvesting seasons of the multiple products. Hence, large farms producing multiple products could also achieve economies of scope. It is worth noting here, however, that the third and fourth quintiles were even more successful at producing wine with slave labour, as their slave to wine ratios were even lower. This is also evident in Figure 4, where the VMP of the fourth quintile exceeds that of the fifth in many instances.

Figures 5 to 7 provide selected snapshots[15] of the role of scale and scope in determining the value of slaves' marginal products VMP for each farmer is plotted against product diversity by the total marketable value (scale) quintiles, with the value of the price indices to indicate the profitability thresholds. The diversity measure, as described above, ranges from 0 (when total marketable

[15] A full set of figures is available on request.

value consists of only one product) to 1 (total marketable value is imperfectly concentrated). Across all years the smallest farmers were most likely to specialize in few products. By contrast, the largest farmers hardly registered diversity scores below 0.5. This confirms the findings from Table 2. The other constant across time, is that neither specialization nor diversification provides any productivity advantage for farmers in the lowest scale quintile Their small scale limits them, so that employing slaves is not economically viable, regardless of time or scope. A similar, but slightly more profitable picture emerges for quintile 2.

The figures also confirm previous analysis, which suggests that those from quintiles 3 to 5 consistently realize higher VMPs from slaves, regardless of scope. Nevertheless, within each of these groups, certain farmers deviated from the average, with VMP observations below the relevant price estimates. Scope, while generally an indicator of profitability, came with a fair bit of its own heterogeneity. The relationship between scope and productivity is less consistent over time for the largest scale quantiles. In some instances diversification was more favourable than specialisation, and vice versa. What is clear, however, is that scope of production was immaterial in determining slave productivity when scale was small.

Figure 8 offers the most compact summary of the VMPs across years, scale and scope[16]. Moving from left to right, the colour generally intensifies from pale to dark, suggesting that scale improved VMP in most of the rows of the matrix. However, in many instances, the fourth scale quantile has a higher VMP than the fifth. The many blank cells in the first column confirm that small farmers generally did not have very diverse product ranges. Even so, attempts at mild diversification did not yield meaningfully higher VMP. While a similar story is true during the earlier years for scope quintile two, it is evident that from 1705, falling in the higher diversity quintiles helped these farmers achieve VMP that was closer to those of the larger farmers. Hence, extending scope did have benefits for relatively small farmers, though this benefit disappeared by 1723. In the middle scale quintile, diversity had a non-linear impact on VMP throughout. Over time, it benefitted farmers' VMP to move from relative specialisation to relative diversification (until 1719). According to Table 2, shares of wine production in total value were relatively high in 1700, but declined over time, as total value increased in 1709 to similar levels to those of the fourth scale quintile in 1700. This suggests that medium size producers progressed in wealth by using slaves to progressively produce other goods.

For the fourth and fifth scale quintiles, the trend moved from high VMP associated with high diversity in 1700 to an association with higher specialisation in 1712. While these were the largest wine producers, wine production as a share of their total value remained stable over the entire period (Table 2), so that specialisation occurred towards stock rearing. This, however, may only

[16] The x axis denotes scale, with total production value quintiles from left to right. The y axis denotes years in chronological order from bottom to top, and within each year diversity quintiles from bottom to top. The areas of the blocks should not be interpreted quantitatively, but the intensity of the colour denotes higher VMPs, all in 1700 prices.

be a function of the depression of grain prices over the period, without large changes in actual volumes produced.

The composite picture outlined by these observations suggests that scale in total product value is always beneficial for marginal productivity of slaves; however, when productivity of slaves declines in relation to prices, large farmers weather the storm on the basis of diversification, while the opposite is true when slave productivity is high. Specialisation therefore appears to be the luxury of the largest farmers in the best of times (when slaves are relatively cheap).

7 Conclusions

This paper set out to assess whether slavery at the Cape was a profitable investment for local settlers. Shortly after the turn of the 18^{th} century, the VOC policy council debated whether it would be more economically viable to encourage European settlement or the importation of slaves to satisfy the labour demands of the expanding economy. Due to large tracts of settler poverty and the perceived low costs of slaves, the decision was made to substitute paid European with slave labour. However, Chavonne warned then already that this was dead money, and this was reflected in the VOC's concern at the large amounts of capital that settlers had invested in slaves as the 1800s approached. Nevertheless, it is clear that some (perhaps elite) farmers' success hinged on the use of slaves, particularly on large farms.

A simple aggregate price series would convince us that the shift in demand towards slaves drove the inflation in sale prices between 1705 and 1715. However, other factors are at play. The smallpox epidemic of 1713 (which depleted the source of Khoi labour) served as another shock that potentially raised the demand and prices of slaves in this period. Prices continued to rise steadily over time, suggesting that these single supply side shocks could not explain the steady inflation in buyers' willingness to pay for slaves. The hedonic model turns to supply side issues, and in particular to consider slave characteristics as determinants of slave price inflation. The resultant "purified" index shows that prices were fairly constant, suggesting that buyers paid primarily for long-term returns on slave characteristics. Farmers were willing to buy slaves with better characteristics (life expectancy) following the smallpox epidemic of 1713, which brought about the death of many at the Cape.

However, the fact that large portions of the expansion in slavery (following the 1717 decision to substitute European workers with slaves) occurred within the group of small farmers underlines the VOC concerns. The analysis shows that regardless of period, or whether specialisation was pursued, this group did not profitably employ slaves. Attempts to mimic the success of large farmers did not take into account the clear scale economies that they enjoyed, and which small farmers could not attain. Large farmers could use their scale advantages to branch out into other activities. Indeed, Fourie (2011) suggests that this was the only group that invested in capital equipment that in turn allowed the wealthiest farmers to embark on non-agricultural business ventures. However,

the results presented here show that for large farmers *agricultural diversity* had ambiguous impacts on the VMP and profitability of using slavery across years. However, the literature also indicates that farmers benefitted from using the same slaves producing by cultivating and harvesting various crops at different times. Regardless of this evidence, it is clear that slavery was an expensive cost to bear for small farmers, and that their attempts to mimic the production process of rich farmers by acquiring more slaves were unsuccessful in agriculture. The slave trade was unprofitable for small farmers, while it was (initially) highly profitable for large farmers. While no evidence is presented here to support the acquisition of *alternative* capital equipment for small farmers (which the rich did pursue), it is possible that these "more expensive" investments would have yielded higher returns than their failure at expanding their slave numbers. The VOC's concern that over-investment in slavery was rife was therefore directed at small farmers who were trapped in poverty by the slave trade. In contrast, richer farmers benefitted greatly from the exploitation of this source of labour. Conflicting reports of the Cape governors Chavonne and Janssens were therefore both true at the same time. However, while Chavonne was concerned with the impoverishment of the bottom of the wealth distribution by slavery, Janssens' remarks highlights that slavery at the Cape was indeed profitable for those who could afford many slaves.

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Table 1 OLS Hedonic Slave Price Function (Source: Own Calculations from Slave Sale Deeds)

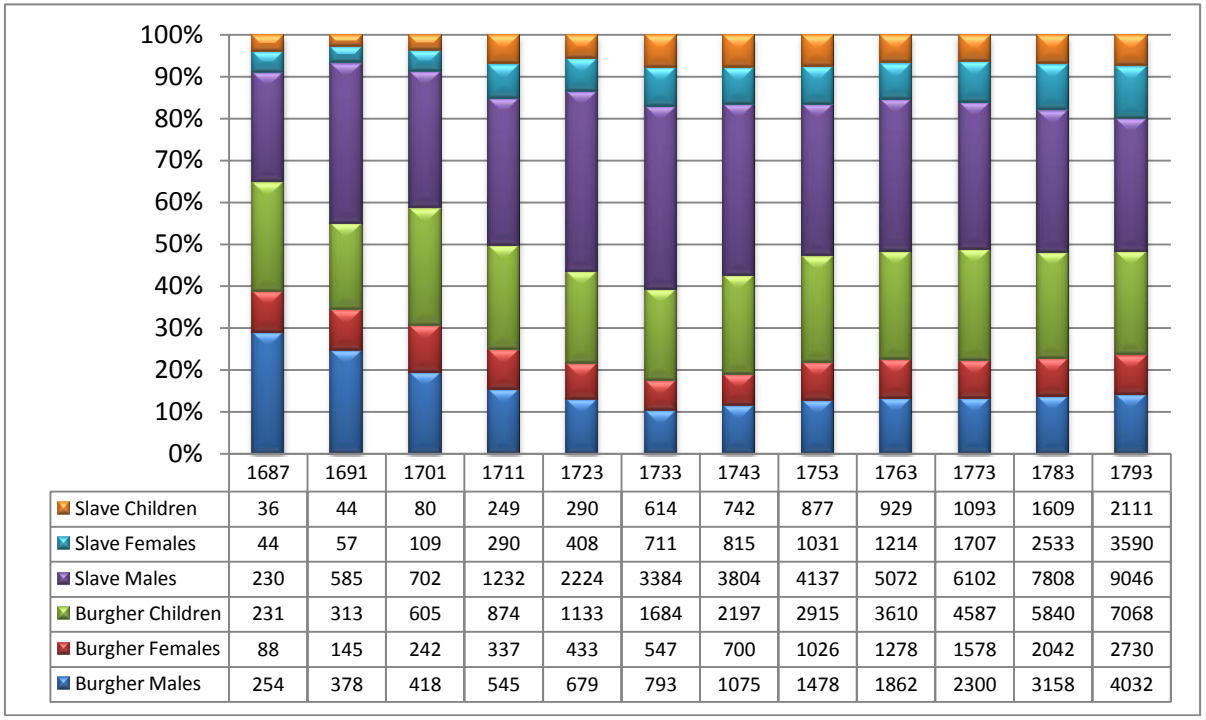
	Log(Real Prices)
Male	-0.027
Age	0.076***
Male x Age	0.013
Age Squared	-0.001***
Male x Age Squared	0.000
Origin: East Africa	*Reference*
Origin: Indi_Arc	0.129
Origin: Indi_S	0.111
Origin: Madagascar & Mauritius	0.002
Origin: Southern Africa	-0.030
Origin: West Africa	0.270
Seller Location: Batavia	Reference
Seller Location: Cape district	0.180**
Seller Location: Drakenstein	0.233**
Seller Location: Hottentots Holland	0.633***
Seller Location: Liesbeeck valley	-0.407***
Seller Location: Stellenbosch district	0.205**
Seller Location: Table valley	0.080
Seller Location: Transit-at sea	-0.030
Buyer Status: Farmer	*Reference*
Buyer Satus: Councillor	-0.029
Buyer Status: Justice	0.033
Buyer Status: Magistrate	-0.017
Buyer Status: Monsieur	0.230*
Buyer Status: VOC employee	-0.151***
Buyer Status: free black	-0.065
Buyer Status: Time expired convict	0.15
Constant	2.859***
Time Fixed Effects	YES
N	641
R-Squared	0.452

Table 2 Mean Share of Wine in Total Value; Mean Wine Yield in Leaguers and Mean Number of Slaves

		Total Value Quintile				
Year	Mean	1	2	3	4	5
1700	Total Value	49.08322	192.4767	412.905	802.8944	2276.112
	Wine (share of total value)	0.2596259	0.2054254	0.1012477	0.0861154	0.0714588
	Wine (leaguers)	1.02128	2.71739	3.34783	5.3913	12.1957
	Animals (share in total value)	0.7195275	0.4444208	0.3242613	0.2834935	0.3514398
	Slaves	0.8297873	1	1.152174	2.543478	11.47826
1702	Total Value	42.41239	155.6525	398.0752	836.4353	2270.967
	Wine (share of total value)	0.2304491	0.0737626	0.1022034	0.0421047	0.0528782
	Wine (leaguers)	0.960784	1	3.62745	3.19608	10.34
	Animals (share in total value)	0.7695509	0.7503632	0.50293	0.4135045	0.4679769
	Slaves	0.9019608	0.9019608	1.333333	2.431373	9.82
1705	Total Value	75.67242	228.6926	414.0315	763.2932	1810.369
	Wine (share of total value)	0.266362	0.1034345	0.0541974	0.0502979	0.0494054
	Wine (leaguers)	1.84091	2.97727	2.86364	4.61364	10.6977
	Animals (share in total value)	0.6308891	0.5235004	0.334644	0.3162688	0.4030023
	Slaves	1.454545	1.886364	1.159091	2.909091	10.74419
1709	Total Value	105.6262	400.6708	897.8566	1775.631	5723.44
	Wine (share of total value)	0.1455461	0.0830064	0.0442226	0.0204388	0.0204174
	Wine (leaguers)	0.732143	3.01786	3.32143	3.30357	10.9643
	Animals (share in total value)	0.8069102	0.6750376	0.4914811	0.4288205	0.4337473
	Slaves	1.535714	2	2.392857	4.375	16.71428
1712	Total Value	74.62198	289.3777	659.2718	1211.032	3085.915
	Wine (share of total value)	0.1719461	0.1047154	0.0817887	0.0689074	0.0447804
	Wine (leaguers)	0.733333	1.53448	2.91525	4.66102	8.28814
	Animals (share in total value)	0.7592978	0.6578181	0.5417039	0.5009001	0.4942592
	Slaves	1.483333	2.103448	2.305085	4.966102	17.72881
1719	Total Value	58.65974	218.0308	445.1033	899.3239	2218.263
	Wine (share of total value)	0.2768044	0.0589539	0.0516799	0.0607013	0.0611627
	Wine (leaguers)	0.893939	0.938462	1.71212	3.90909	9.89063
	Animals (share in total value)	0.6211538	0.7158448	0.7077016	0.6978793	0.6108103
	Slaves	2.560606	2.476923	3.848485	6.924242	17.03125
1723	Total Value	76.01333	252.344	483.04	949.3259	2697.297
	Wine (share of total value)	0.0708323	0.0717836	0.0603781	0.0457998	0.0523689
	Wine (leaguers)	0.236842	1.32857	2.20548	3.23288	11.0274
	Animals (share in total value)	0.8980076	0.8368722	0.7536144	0.6863942	0.5726691
	Slaves	3.328947	1.957143	4.273973	4.79452	17.75343

NOTES: Own calculations from *opgaafrollen.*

Figure 1 Changing Population Composition. Source: calculations based on Worden (1985:53)



	1687	1691	1701	1711	1723	1733	1743	1753	1763	1773	1783	1793
Slave Children	36	44	80	249	290	614	742	877	929	1093	1609	2111
Slave Females	44	57	109	290	408	711	815	1031	1214	1707	2533	3590
Slave Males	230	585	702	1232	2224	3384	3804	4137	5072	6102	7808	9046
Burgher Children	231	313	605	874	1133	1684	2197	2915	3610	4587	5840	7068
Burgher Females	88	145	242	337	433	547	700	1026	1278	1578	2042	2730
Burgher Males	254	378	418	545	679	793	1075	1478	1862	2300	3158	4032

Figure 2 Price Returns to Age and Gender (Source: Own calculations)

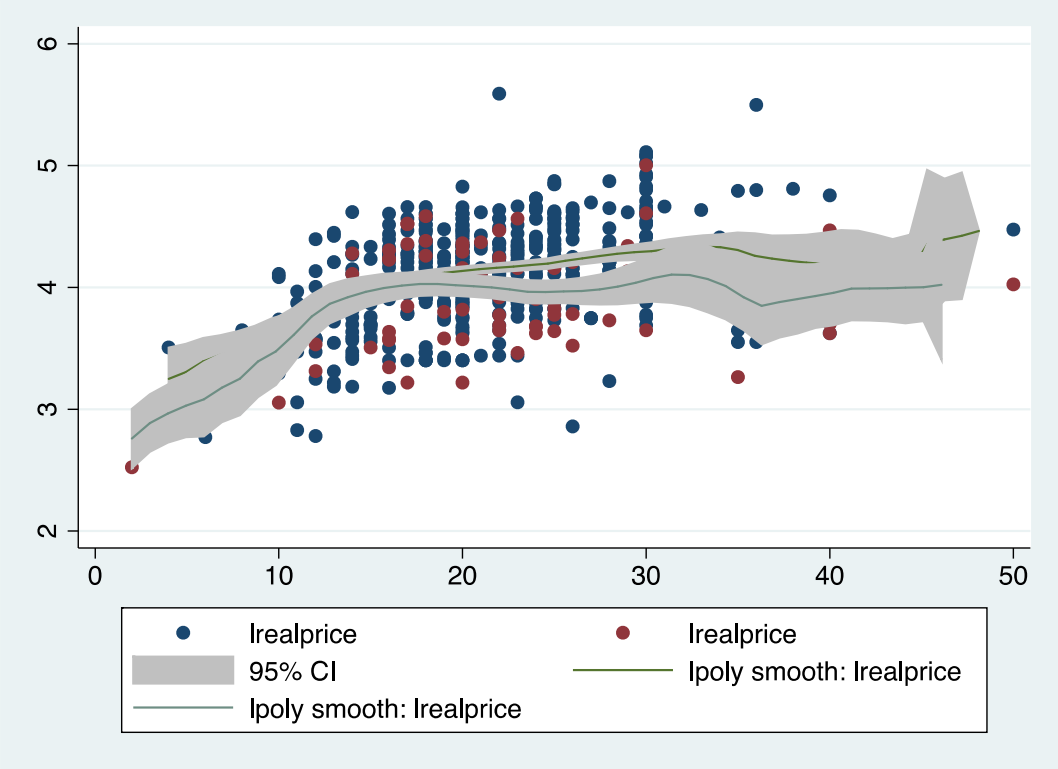
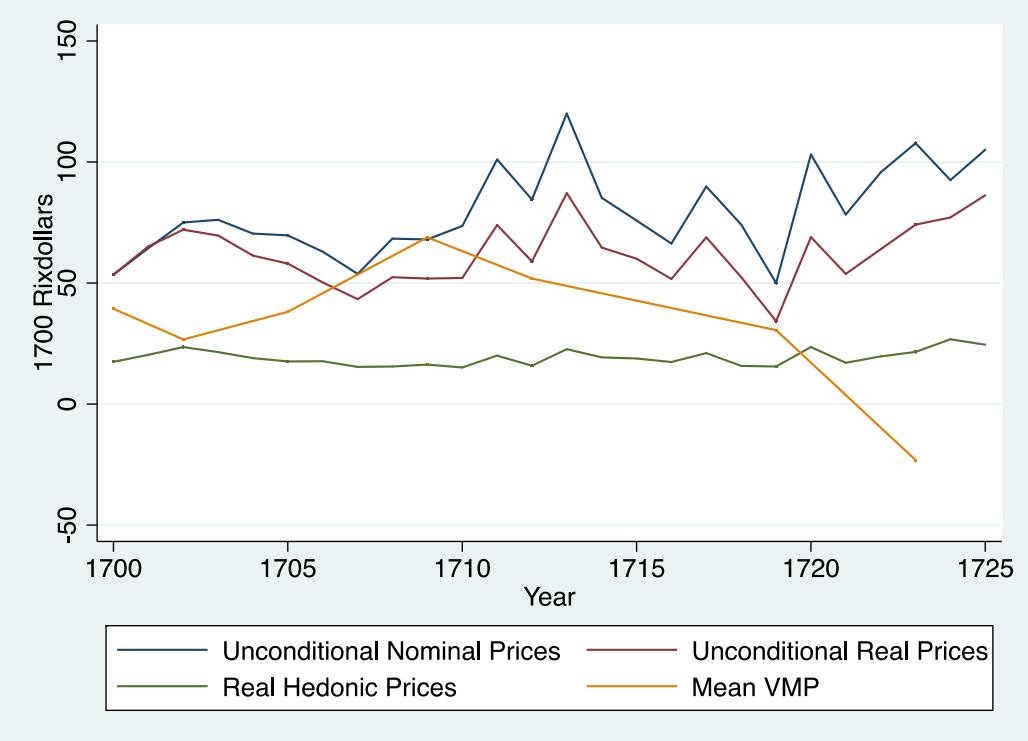
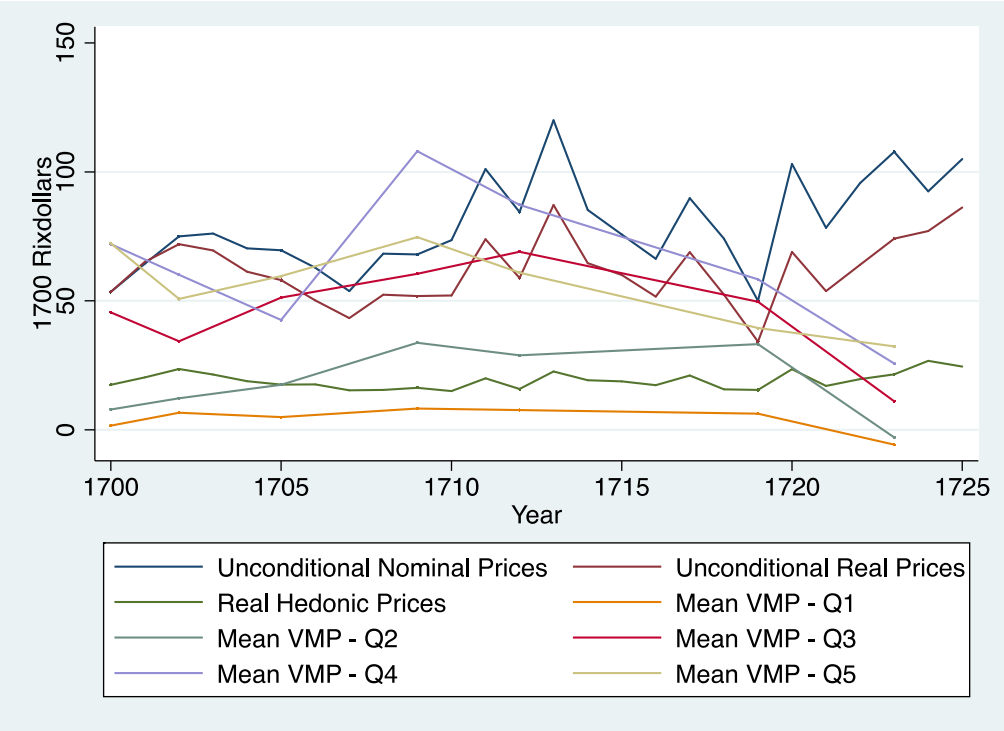


Figure 3 Prices and Value of Marginal Productivity



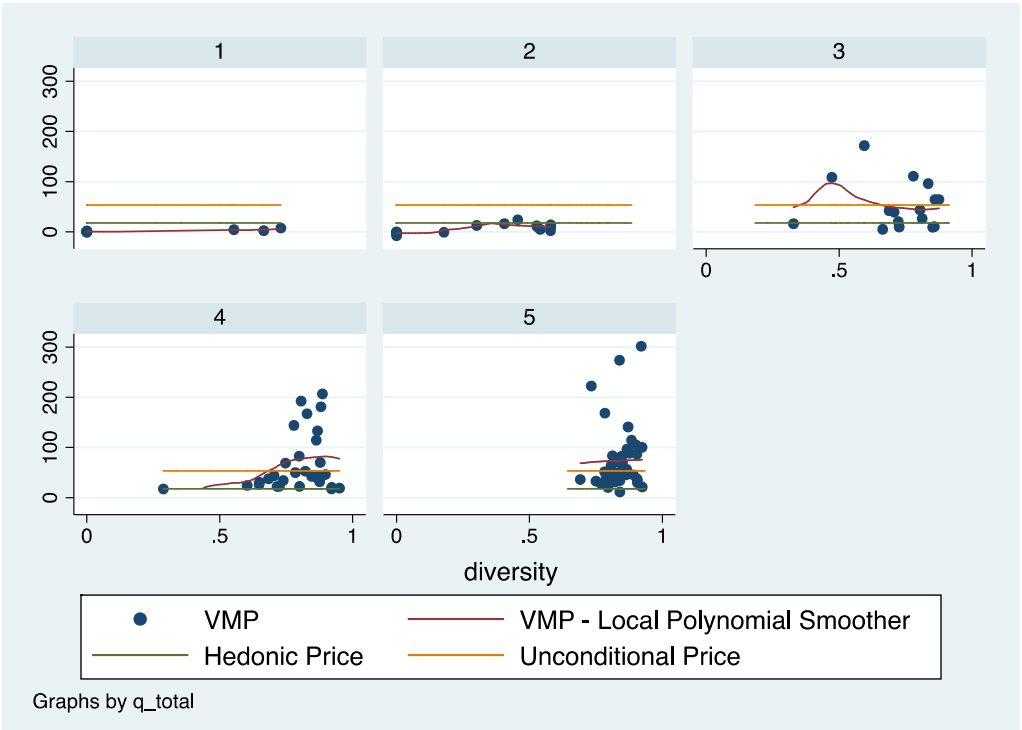
NOTES: Own calculations from *opgaafrollen* and *Changing Hands* databases. VMP is the average VMP of all farmers in a given year, derived from the Cobb-Douglas function without heterogenous slopes (see Table 3 in the appendix). Unconditional price series' are derived from time dummies of slave price models without controls. The Hedonic series is derived from a similar model, after the hedonic characteristics are controlled for.

Figure 4 Prices and Value of Marginal Productivity – by scale



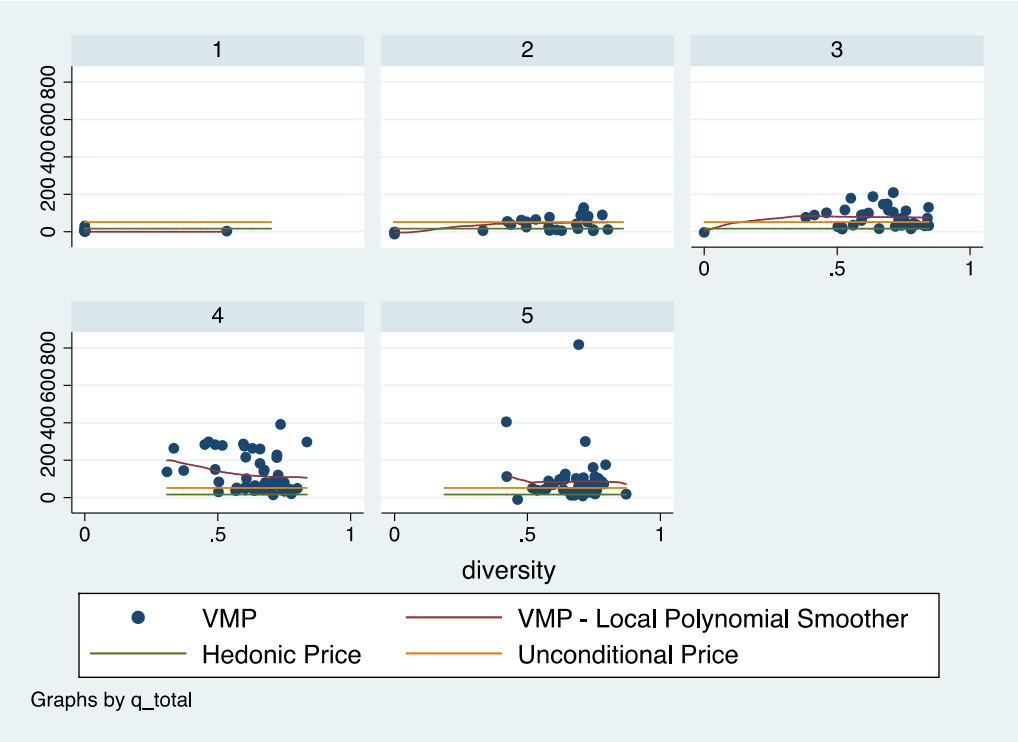
NOTES: Own calculations from *opgaafrollen* and *Changing Hands* databases. VMP is the average VMP of all farmers within their respective *TR* quintiles in a given year. These are derived from the Cobb-Douglas functions estimated by quantile regressions without heterogenous slopes (see Tables 4-6). Qutnile regressions weighted in intervals of 5 from 5 to 90 were estimated. Coefficients in the VMP calculations are assigned to observations in a 5 percentile interval centred about the quantile weight. Unconditional price series' are derived from time dummies of slave price models without controls. The Hedonic series is derived from a similar model, after the hedonic characteristics are controlled for.

Figure 5 VMP of Slaves and Product Diversity 1700 - by Scale



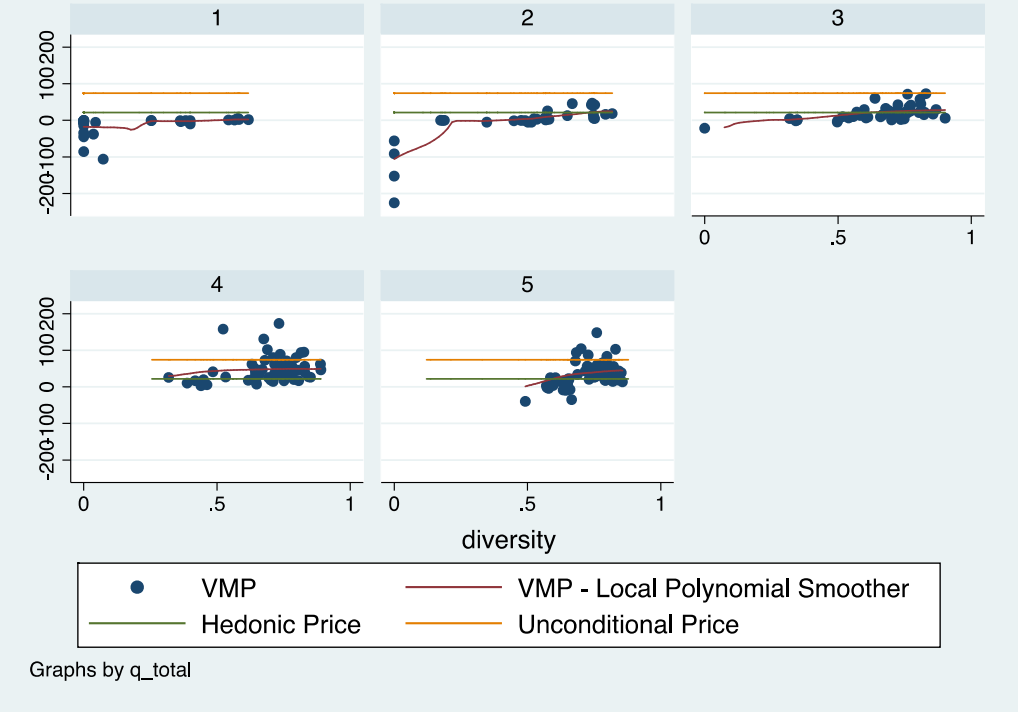
NOTES: Own calculations from *opgaafrollen* and *Changing Hands* databases. Unconditional price series' are derived from time dummies of slave price models without controls. The Hedonic series is derived from a similar, after the hedonic prices are controlled for. VMP is derived from Cobb-Douglas quantile regressions (see Tables 4-6), estimated at intervals of 5 percentiles from 5 to 90. For instance, all observations from the 2.5 to 7.5 range are assigned the coefficient of the 5th percentile regression in each year. This is multiplied by each observation's average revenue. This new VMP variable is averaged within total value quintiles to obtain the series presented here. Each sub-graph represents the quintile of the farmers' total value of production.

Figure 6 VMP of Slaves and Product Diversity 1709 - by Scale



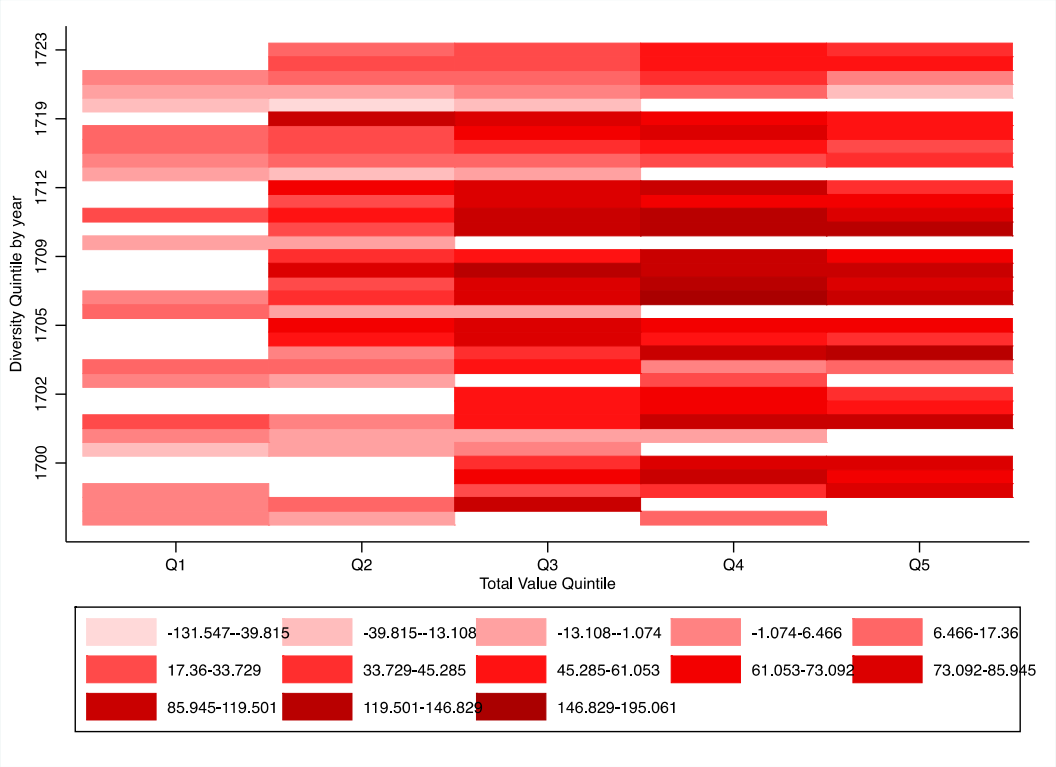
NOTES: Own calculations from *opgaafrollen* and *Changing Hands* databases. Unconditional price series' are derived from time dummies of slave price models without controls. The Hedonic series is derived from a similar, after the hedonic prices are controlled for. VMP is derived from Cobb-Douglas quantile regressions (see Tables 4-6), estimated at intervals of 5 percentiles from 5 to 90. For instance, all observations from the 2.5 to 7.5 range are assigned the coefficient of the 5th percentile regression in each year. This is multiplied by each observation's average revenue. This new VMP variable is averaged within total value quintiles to obtain the series presented here. Each sub-graph represents the quintile of the farmers' total value of production.

Figure 7 VMP of Slaves and Product Diversity 1723 - by Scale



NOTES: Own calculations from *opgaafrollen* and *Changing Hands* databases. Unconditional price series' are derived from time dummies of slave price models without controls. The Hedonic series is derived from a similar, after the hedonic prices are controlled for. VMP is derived from Cobb-Douglas quantile regressions (see Tables 4-6), estimated at intervals of 5 percentiles from 5 to 90. For instance, all observations from the 2.5 to 7.5 range are assigned the coefficient of the 5th percentile regression in each year. This is multiplied by each observation's average revenue. This new VMP variable is averaged within total value quintiles to obtain the series presented here. Each sub-graph represents the quintile of the farmers' total value of production.

Figure 8 VMP summary – by Product Diversity Quintile and Year and Total Value Quintile



NOTES: Own calculations from *opgaafrollen*. VMP is derived from Cobb-Douglas quantile regressions (see Tables 4-6), estimated at intervals of 5 percentiles from 5 to 90. For instance, all observations from the 2.5 to 7.5 range are assigned the coefficient of the 5th percentile regression in each year. This is multiplied by each observation's average revenue. This new VMP variable is averaged within total value and product diversity quintiles to obtain the grid presented here. The x axis represents the Total Production Value quintiles, which are equally spaced. The y axis is more finely distributed, with the black boxes delineating years and the smaller diversity quintiles within each year.

APPENDIX

Table 3 OLS Cobb-Douglas Regressions of Total-Value

		1700	1702	1705	1709	1712	1719	1723	1700	1702	1705	1709	1712	1719	1723
	log (Total Slaves)	0.149***	0.094*	0.151***	0.140***	0.195***	0.207***	-0.142**							
	log (Knechts)	0.004	0.077	0.059	0.067	0.003	-0.041	0.286***	0.017	0.053	0.064	0.111	0.079**	-0.013	0.231***
	log (Household Size)	-0.051	-0.099*	-0.136***	-0.146***	-0.058	-0.141*	-0.243***	-0.052	-0.074	-0.138***	-0.128***	-0.045	-0.177***	-0.168**
	log (Muids of Grain Sown)	0.621***	0.630***	0.525***	0.517***	0.529***	0.459***	0.531***	0.549***	0.481***	0.439***	0.424***	0.346***	0.251***	0.363***
	log (x1000 Vines Planted)	0.023**	0.02	0.006	-0.004	-0.004	-0.014	0.006	0.01	-0.004	-0.015	-0.021*	-0.015	-0.041***	-0.023**
	log (Horses)	0.148***	0.236***	0.191***	0.245***	0.095*	0.002	0.188***	0.107***	0.167***	0.174***	0.201***	0.043	-0.026	0.081**
log(Total Slaves) by Diversity Quintile	1								0.097	-0.135	0.036	0.011	-0.05	-0.115	-0.583***
	2								0.171*	-0.073	0.146**	0.174***	0.240***	0.138*	-0.001
	3								0.155***	0.245***	0.180***	0.193***	0.312***	0.217***	0.092
	4								0.215***	0.203***	0.179***	0.191***	0.228***	0.412***	0.192***
	5								0.200***	0.176***	0.242***	0.181***	0.241***	0.469***	0.214***
Diversity Quintile Dummies	1								-0.649***	-1.265***	-0.560***	-0.831***	-1.430***	-1.621***	-1.389***
	2								-0.06	-0.291**	-0.076	0.004	-0.199	0.072	0.470**
	3								-0.078	0.071	0.112	0.137	-0.258**	0.215	0.289*
	4								-0.074	0.027	0.028	-0.004	-0.024	0.104	0.085
	Constant	5.344***	5.572***	5.626***	6.075***	5.732***	5.702***	6.504***	5.651***	5.960***	5.830***	6.446***	6.399***	6.073***	6.380***
	N	231	254	219	280	295	327	365	231	254	219	280	295	327	365
	R-squared	0.887	0.761	0.814	0.8	0.756	0.485	0.509	0.901	0.811	0.837	0.832	0.841	0.689	0.726

NOTES: *Significant at 10% **Significant at 5% ***Significant at 1%. Own Calculations from *Opgaafrollen*. *Total Value* of marketable products is the number of leaguers of wine, muids of grain and number of sheep, cattle and pigs, each multiplied by their respective prices from the Master of the Orphan Chamber inventories, and deflated to 1700 prices by the overall price index of Du Plessis and Du Plessis (2009). Only 15% of total stocks are included in the quantity. Other quantities are measured in the units indicated, and are used to control for other production inputs. Coefficients on *log(Total Slaves)* are used to generate Values of the Marginal Product of Slaves for each individuals, as follows: $VMP_i^{slaves} = \beta^{\log(Total\ Salves)} * \frac{Total\ Value_i}{Total\ Slaves_i}$. The second half of the table estimates the coefficients separately for each quintile of product diversity and with fixed effects for these quintiles.

Table 4 Quantile Regressions of log(Total Value) - 1700

	Quantile	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95
	log(Total Slaves)	0.078	0.066	0.092*	0.074*	0.081**	0.110***	0.118***	0.119***	0.148***	0.170***	0.175***	0.183***	0.192***	0.182***	0.199***	0.199***	0.216***	0.229***	0.243***
	log(Knechts)	0.098	0.029	0.005	0.011	0.009	0.03	0.058	0.068	0.045	0.05	0.031	0.021	0.003	0.003	0.004	0.006	0.029	0.027	-0.009
	log(Household Size)	-0.112	-0.085	-0.095	-0.045	-0.037	-0.067	-0.066	-0.054	-0.048	-0.045	-0.032	-0.017	-0.029	-0.009	0.007	0.01	0.014	0.015	-0.006
	log(Muids of Grain Sown)	0.848***	0.819***	0.790***	0.725***	0.705***	0.689***	0.696***	0.653***	0.629***	0.633***	0.628***	0.608***	0.596***	0.610***	0.542***	0.525***	0.512***	0.473***	0.464***
	log(x1000 Vines Planted)	0.022	0.026**	0.024	0.034***	0.032***	0.034***	0.027***	0.028**	0.024*	0.021**	0.024***	0.024***	0.019**	0.015*	0.011	0.012*	0.011***	0.017**	0.013
	log(Horses)	0.042	0.107	0.129**	0.151***	0.148***	0.148***	0.138***	0.126***	0.129***	0.121***	0.111***	0.099***	0.100***	0.093***	0.100***	0.087***	0.070***	0.066*	0.073
	Constant	4.668***	4.655***	4.787***	4.870***	4.937***	5.078***	5.208***	5.301***	5.377***	5.473***	5.460***	5.490***	5.566***	5.607***	5.765***	5.822***	5.916***	5.963***	6.049***
	N	231	231	231	231	231	231	231	231	231	231	231	231	231	231	231	231	231	231	231
	With Diversity Interactions																			
	log(Total Slaves)	0.038	0.04	0.047	-0.036	-0.048	-0.024	-0.015	-0.056	-0.013	0.047	0.096**	0.146***	0.146***	0.125***	0.117***	0.215***	0.280***	0.207***	0.297**
	log(Knechts)	0.049	0.091	0.051	-0.001	0.005	-0.018	0.032	0.05	0.038	0.033	0.019	0.012	0.015	0.019	0.034	0.034	-0.002	-0.004	-0.009
	log(Household Size)	0.025	-0.154	-0.139**	-0.044	-0.077	-0.079*	-0.079	-0.092*	-0.065	-0.032	0.005	0.018	0.014	0.009	0.004	0.001	-0.007	-0.02	-0.03
	log(Muids of Grain Sown)	0.675***	0.683***	0.658***	0.612***	0.625***	0.632***	0.628***	0.640***	0.652***	0.638***	0.606***	0.610***	0.590***	0.553***	0.528***	0.524***	0.521***	0.483***	0.492***
	log(x1000 Vines Planted)	0.015	0.01	0.01	0.005	0.005	-0.003	0.004	0.003	0.008	0.015	0.026***	0.019***	0.020**	0.018**	0.016**	0.016***	0.015**	-0.004	-0.003
	log(Horses)	0.095	0.051	0.08	0.103**	0.102***	0.108***	0.105**	0.113***	0.113**	0.089**	0.095***	0.093***	0.087***	0.082***	0.083***	0.087***	0.075***	0.075***	0.069
log(Total Slaves)	2	0.096	0.482	0.801***	0.785***	0.773***	0.831***	0.772***	0.812***	0.841***	0.666***	0.672***	0.521***	0.631***	0.577***	0.596***	0.381***	0.425***	0.309***	0.19
	3	0.682	0.844**	0.863***	0.817***	0.767***	0.831***	0.808***	0.655***	0.417*	0.273*	0.183	0.075	0.169	0.258*	0.374***	0.196	0.307**	0.365***	0.231
	4	0.486	0.59	0.700**	0.804***	0.712***	0.738***	0.701***	0.683***	0.463*	0.350*	0.244*	0.136	0.223	0.301*	0.463***	0.279**	0.245*	0.277*	0.2
	5	0.575	0.772*	0.845***	0.913***	0.811***	0.884***	0.911***	0.775***	0.570**	0.415**	0.287**	0.166**	0.264*	0.354**	0.472***	0.274**	0.251*	0.298**	0.135
Diversity Quintile	2	-0.097	0.076	0.188	0.156	0.193**	0.166**	0.108	0.241**	0.327**	0.226**	0.246***	0.167***	0.215***	0.166**	0.136**	0.027	0.039	0.01	-0.086
	3	0.052	0.109	0.089	0.144**	0.145*	0.140*	0.116	0.150*	0.106	0.06	0.01	-0.039	-0.035	-0.006	-0.005	-0.098*	-0.055	0.035	-0.027
	4	0.107	0.181	0.171**	0.265***	0.274***	0.255***	0.266***	0.228***	0.184*	0.141**	0.100*	0.054*	0.053	0.075	0.066	-0.027	-0.07	0.027	-0.056
	5	0.138	0.183	0.160**	0.225***	0.256***	0.272***	0.225**	0.249***	0.192*	0.141**	0.099*	0.057*	0.072	0.091*	0.095**	0	-0.045	0.052	-0.042
	Constant	4.252***	4.524***	4.475***	4.425***	4.553***	4.569***	4.662***	4.856***	5.014***	5.128***	5.162***	5.318***	5.283***	5.341***	5.337***	5.551***	5.582***	5.812***	5.974***
	N	231	231	231	231	231	231	231	231	231	231	231	231	231	231	231	231	231	231	231

NOTES: *Significant at 10% **Significant at 5% ***Significant at 1%. Own Calculations from *Opgaafrollen*. Dependent Variable: log(*Total Value* of marketable products) is the number of leaguers of wine, muids of grain and number of sheep, cattle and pigs, each multiplied by their respective prices from the Master of the Orphan Chamber inventories, and deflated to 1700 prices by the overall price index of Du Plessis and Du Plessis (2009) and logged. Only 15% of total stocks are included in the quantity. Other quantities are measured in the units indicated, and are used to control for other production inputs. Coefficients on *log(Total Slaves)* are used to generate Values of the Marginal Product of Slaves for each individuals, as follows: $VMP_i^{slaves} = \beta^{\log(Total\ Salves)} * \frac{Total\ Value_i}{Total\ Slaves_i}$. The bottom half of the table estimates the coefficients separately for each quintile of product diversity and with fixed effects for these quintiles.

Table 5 Quantile Regressions of log(Total Value) - 1709

	Quantile	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95
	log(Total Slaves)	0.223	0.182***	0.163***	0.163***	0.130***	0.152***	0.137***	0.137***	0.138***	0.140***	0.155***	0.167***	0.147***	0.150***	0.133***	0.145***	0.162***	0.092	0.101
	log(Knechts)	0.121	0.07	0.061	0.071	0.057	0.061	0.043	0.048	0.062	0.084*	0.061	0.02	0.023	0.011	0.055	0.02	0.016	0.07	0.265
	log(Household Size)	-0.166	-0.054	-0.021	-0.06	-0.064	-0.091	-0.079	-0.068*	-0.076*	-0.089**	-0.086	-0.101*	-0.122**	-0.134**	-0.219***	-0.224***	-0.248***	-0.269***	-0.263
	log(Muids of Grain Sown)	0.762***	0.680***	0.661***	0.619***	0.590***	0.583***	0.577***	0.570***	0.504***	0.488***	0.485***	0.467***	0.466***	0.437***	0.463***	0.462***	0.433***	0.411***	0.444***
	log(x1000 Vines Planted)	-0.034	-0.029	-0.017	-0.012	-0.009	-0.008	-0.005	-0.008	-0.009	-0.004	-0.001	0.002	0.005	0.01	0.011	0.006	0.012	0.032**	0.011
	log(Horses)	0.1	0.204***	0.224***	0.235***	0.276***	0.223***	0.221***	0.220***	0.275***	0.258***	0.251***	0.232***	0.227***	0.215***	0.196***	0.185***	0.162***	0.192**	0.104
	Constant	5.346***	5.304***	5.320***	5.476***	5.533***	5.721***	5.774***	5.818***	5.951***	6.055***	6.054***	6.138***	6.234***	6.316***	6.568***	6.645***	6.758***	6.941***	7.587***
	N	280	280	280	280	280	280	280	280	280	280	280	280	280	280	280	280	280	280	280
	With Diversity Interactions																			
	log(Total Slaves)	0.259	0.134	0.069	0.154**	-0.009	-0.017	-0.028	-0.032	-0.039	-0.033	-0.095**	-0.088	-0.019	-0.037	-0.048	0.108	0.063	0.091	-0.118
	log(Knechts)	0.008	0.011	0.039	0.109	0.091	0.083	0.057	0.056	0.059	0.084	0.058	0.053	0.049	0.058	0.042	0.058	0.051	0.117	0.21
	log(Household Size)	-0.054	-0.109	-0.087	-0.07	-0.091	-0.087	-0.052	-0.045	-0.03	-0.053	-0.071*	-0.075*	-0.069	-0.098*	-0.121*	-0.170**	-0.241***	-0.247**	-0.297**
	log(Muids of Grain Sown)	0.364**	0.408***	0.430***	0.442***	0.451***	0.453***	0.462***	0.453***	0.457***	0.469***	0.415***	0.396***	0.366***	0.371***	0.383***	0.407***	0.378***	0.358***	0.368**
	log(x1000 Vines Planted)	-0.03	-0.028	-0.025	-0.028*	-0.019	-0.017	-0.020**	-0.016*	-0.018*	-0.015	-0.011	-0.01	-0.006	-0.01	-0.009	-0.001	0.003	0.023	0.031
	log(Horses)	0.288*	0.210***	0.187***	0.207***	0.215***	0.213***	0.217***	0.216***	0.223***	0.227***	0.226***	0.241***	0.220***	0.213***	0.206***	0.203***	0.189***	0.160*	0.082
log(Total Slaves) interacted with	2	1.38	1.243***	1.190***	0.981***	0.729***	0.723***	0.632***	0.796***	0.794***	0.693***	0.819***	0.843***	0.758***	0.769***	0.702***	0.411*	0.424**	0.391	0.907
	3	1.659	1.395***	1.200***	1.166***	0.811***	0.850***	0.871***	0.882***	0.888***	0.843***	0.953***	1.019***	0.871***	0.885***	0.802***	0.444*	0.466**	0.479	0.336
	4	1.361	1.272***	1.150***	0.933***	0.661***	0.616***	0.586***	0.647***	0.642***	0.586***	0.713***	0.757***	0.622***	0.837***	0.772***	0.506**	0.739***	0.59	0.509
	5	1.384	1.327***	1.189***	0.992***	0.573***	0.572***	0.515***	0.653***	0.677***	0.624***	0.643***	0.801***	0.756***	0.781***	0.771***	0.421	0.516**	0.586	0.39
Diversity Quintile Dummies	2	-0.044	0.103	0.117	-0.005	0.169*	0.167*	0.178**	0.265***	0.265***	0.244***	0.300***	0.288***	0.208***	0.218**	0.211*	0.018	0.081	0.064	0.073
	3	0.078	0.236**	0.281**	0.062	0.216**	0.211**	0.201***	0.217***	0.212***	0.192**	0.269***	0.246***	0.205***	0.214**	0.234**	0.066	0.128	0.081	0.32
	4	0.1	0.205*	0.202	0.101	0.260***	0.271***	0.267***	0.255***	0.260***	0.227***	0.301***	0.292***	0.251***	0.203**	0.256**	0.031	0.006	-0.022	0.237
	5	-0.01	0.031	0.129	0.052	0.223***	0.240**	0.264***	0.242***	0.227***	0.185**	0.295***	0.251***	0.170**	0.202**	0.194	0.062	0.125	0.041	0.389***
	Constant	3.992***	4.423***	4.656***	4.980***	5.294***	5.315***	5.342***	5.342***	5.354***	5.505***	5.505***	5.499***	5.678***	5.794***	5.891***	6.310***	6.452***	6.659***	7.070***
	N	280	280	280	280	280	280	280	280	280	280	280	280	280	280	280	280	280	280	280

NOTES: *Significant at 10% **Significant at 5% ***Significant at 1%. Own Calculations from *Opgaafrollen*. Dependent Variable: log(*Total Value* of marketable products) is the number of leaguers of wine, muids of grain and number of sheep, cattle and pigs, each multiplied by their respective prices from the Master of the Orphan Chamber inventories, and deflated to 1700 prices by the overall price index of Du Plessis and Du Plessis (2009) and logged. Only 15% of total stocks are included in the quantity. Other quantities are measured in the units indicated, and are used to control for other production inputs. Coefficients on *log(Total Slaves)* are used to generate Values of the Marginal Product of Slaves for each individuals, as follows: $VMP_i^{slaves} = \beta^{\log(Total\ Salves)} * \frac{Total\ Value_i}{Total\ Slaves_i}$. The bottom half of the table estimates the coefficients separately for each quintile of product diversity and with fixed effects for these quintiles.

Table 6 Quantile Regressions of log(Total Value) - 1723

	Quantile	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95
	log(Total Slaves)	-0.373	-0.291*	-0.192**	-0.072	-0.059	-0.008	-0.002	0.016	0.042	0.084***	0.088***	0.087***	0.058**	0.086***	0.140***	0.149***	0.167***	0.203***	0.177*
	log(Knechts)	0.494	0.284	0.330***	0.234**	0.216***	0.187**	0.214***	0.219***	0.199***	0.175***	0.215***	0.242***	0.250***	0.220***	0.203***	0.219***	0.213**	0.194**	0.232
	log(Household Size)	-0.095	-0.261	-0.209*	-0.138	-0.157**	-0.160*	-0.132***	-0.140**	-0.153***	-0.184***	-0.155***	-0.174***	-0.172***	-0.168***	-0.160***	-0.191***	-0.312***	-0.403***	-0.397
	log(Muids of Grain Sown)	1.056***	0.785***	0.702***	0.570***	0.507***	0.496***	0.497***	0.476***	0.448***	0.422***	0.401***	0.389***	0.378***	0.364***	0.317***	0.294***	0.303***	0.295***	0.286*
	log(x1000 Vines Planted)	-0.002	0.007	0.001	-0.008	-0.001	-0.007	-0.012	-0.013	-0.014	-0.007	-0.013	-0.019**	-0.021***	-0.014**	-0.017***	-0.014	-0.008	0.003	0.008
	log(Horses)	0.233	0.365***	0.277***	0.270***	0.274***	0.211***	0.178***	0.168***	0.154***	0.116***	0.107***	0.114***	0.130***	0.103***	0.088***	0.075*	0.022	-0.044	-0.086
	Constant	4.626***	5.254***	5.601***	5.703***	5.864***	6.004***	6.142***	6.231***	6.322***	6.398***	6.525***	6.689***	6.797***	6.791***	6.841***	6.983***	7.258***	7.508***	7.803***
	N	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365
	With Diversity Interactions																			
	log(Total Slaves)	-0.998***	-0.897***	-0.849***	-0.856***	-0.807***	-0.852***	-0.867***	-0.848***	-0.857***	-0.646***	-0.614***	-0.586***	-0.408***	-0.338***	-0.320***	-0.250***	-0.251***	-0.169***	0.073
	log(Knechts)	0.104	0.088	0.056	0.105	0.11	0.138**	0.123*	0.187**	0.168**	0.187***	0.195***	0.213***	0.185***	0.183***	0.172***	0.173***	0.184***	0.160**	0.302
	log(Household Size)	-0.121	-0.113	-0.077	-0.113	-0.130*	-0.123*	-0.125*	-0.105	-0.088	-0.083**	-0.078**	-0.099**	-0.144***	-0.123***	-0.120**	-0.172***	-0.151**	-0.148***	-0.15
	log(Muids of Grain Sown)	0.331	0.377***	0.417***	0.438***	0.470***	0.451***	0.390***	0.384***	0.384***	0.379***	0.379***	0.393***	0.377***	0.377***	0.375***	0.370***	0.368***	0.398***	0.399**
	log(x1000 Vines Planted)	-0.018	-0.012	-0.011	-0.017	-0.021	-0.025**	-0.021*	-0.02	-0.017	-0.015**	-0.014**	-0.013*	-0.014**	-0.016**	-0.01	-0.006	-0.002	0.005	0.015
	log(Horses)	0.265	0.230***	0.181***	0.172***	0.139***	0.139***	0.127***	0.108**	0.113***	0.096***	0.081***	0.084***	0.086***	0.041*	0.028	0.016	0.012	0	-0.067
log(Total Slaves) interacted with	2	2.053***	2.039***	2.207***	2.219***	2.317***	2.394***	2.198***	2.188***	2.066***	1.813***	1.806***	1.695***	1.378***	1.417***	1.318***	1.274***	1.401***	1.579***	1.497**
	3	2.186**	2.038***	2.142***	2.104***	2.056***	2.091***	2.115***	2.052***	1.910***	1.598***	1.598***	1.448***	1.076***	0.916***	0.735***	0.743***	0.833***	0.948***	0.606
	4	2.275*	2.071***	1.871***	1.921***	1.869***	1.931***	1.927***	1.857***	1.753***	1.443***	1.412***	1.239***	0.856***	0.711***	0.532***	0.435***	0.386**	0.19	-0.148
	5	2.370*	2.056***	1.743***	1.626***	1.566***	1.577***	1.553***	1.679***	1.471***	1.298***	1.253***	1.167***	0.727***	0.629***	0.421*	0.281	0.194	-0.04	-0.216
Diversity Quintile Dummies	2	0.832***	0.823***	0.819***	0.804***	0.805***	0.841***	0.848***	0.834***	0.828***	0.637***	0.622***	0.605***	0.427***	0.434***	0.415***	0.358***	0.312***	0.196***	-0.213
	3	1.131***	0.999***	0.937***	0.919***	0.863***	0.904***	0.953***	0.931***	0.930***	0.741***	0.706***	0.676***	0.516***	0.487***	0.469***	0.369***	0.300***	0.123	-0.177
	4	1.062***	1.030***	1.042***	1.035***	1.020***	1.007***	1.019***	1.004***	1.006***	0.792***	0.762***	0.733***	0.575***	0.544***	0.533***	0.475***	0.511***	0.438***	0.229
	5	1.033***	1.057***	1.089***	1.114***	1.086***	1.132***	1.192***	1.083***	1.145***	0.890***	0.862***	0.788***	0.636***	0.596***	0.589***	0.521***	0.507***	0.430***	0.152
	Constant	3.169***	3.468***	3.534***	3.796***	3.927***	4.061***	4.188***	4.379***	4.500***	4.868***	4.932***	5.166***	5.641***	5.796***	5.972***	6.200***	6.292***	6.446***	7.086***
	N	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365

NOTES: *Significant at 10% **Significant at 5% ***Significant at 1%. Own Calculations from *Opgaafrollen*. Dependent Variable: log(*Total Value* of marketable products) is the number of leaguers of wine, muids of grain and number of sheep, cattle and pigs, each multiplied by their respective prices from the Master of the Orphan Chamber inventories, and deflated to 1700 prices by the overall price index of Du Plessis and Du Plessis (2009) and logged. Only 15% of total stocks are included in the quantity. Other quantities are measured in the units indicated, and are used to control for other production inputs. Coefficients on *log(Total Slaves)* are used to generate Values of the Marginal Product of Slaves for each individuals, as follows: $VMP_i^{slaves} = \beta^{\log(Total\ Salves)} * \frac{Total\ Value_i}{Total\ Slaves_i}$. The bottom half of the table estimates the coefficients separately for each quintile of product diversity and with fixed effects for these quintiles.