ECONSTOR
Make Your Publications Visible.

A Service of

ZBW Leibniz-Informationszentrum Wirtschaft
Leibniz Information Centre for Economics

Martins, Igor

Working Paper

An Act for the Abolition of the Slave Trade: The Effects of an Import Ban on Cape Colony Slaveholders

African Economic History Working Paper Series, No. 43/2019

Provided in Cooperation with:
African Economic History Network (AEHN)

Suggested Citation: Martins, Igor (2019) : An Act for the Abolition of the Slave Trade: The Effects of an Import Ban on Cape Colony Slaveholders, African Economic History Working Paper Series, No. 43/2019, African Economic History Network (AEHN), s.l.

This Version is available at:
https://hdl.handle.net/10419/242672

Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

Terms of use:

Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.

WWW.ECONSTOR.EU

Mitglied der Leibniz-Gemeinschaft

AN ACT FOR THE ABOLITION OF THE SLAVE TRADE: THE EFFECTS OF AN IMPORT BAN ON CAPE COLONY SLAVEHOLDERS

African economic history working paper series

No. 43/2019

Igor Martins

Lund University

igor.martins@ekh.lu.se

ISBN 978-91-981477-9-7

AEHN working papers are circulated for discussion and comment purposes. The papers have not been peer reviewed, but published at the discretion of the AEHN committee.

The African Economic History Network is funded by Riksbankens Jubileumsfond, Sweden

For submissions, contact:
Erik Green
Department of Economic History
Lund University
P. O. Box 7083

An Act for the Abolition of the Slave Trade: The effects of an import ban on Cape Colony slaveholders*

Igor Martins†

Abstract

Few could have foreseen the consequences when the British Parliament, in 1807, passed the Slave Trade Act that sought to abolish slave imports into the British Empire. From population decreases in the British Caribbean to increased prices in the Cape Colony, historical evidence suggests that the effects of the Act were felt far and wide even though commercialization of slaves was still possible within colonial territories. Using newly digitized historical datasets covering more than 40 years in two different districts of the British Cape Colony, this paper measures changes in slave ownership and acquisition patterns from a longitudinal perspective. This approach allows me to tease out the effects of the Act on farmers with different types of agricultural outputs, most notably crop and livestock farming, agricultural types with very different labor demands. The results show that livestock farmers, surprisingly, were more inelastic to the import ban in comparison to crop farmers. These results suggest that slaveholders could extract rents from the enslaved in a multitude of ways beyond agriculture production and calls for a broader theory of slavery as capital investment.

Keywords. slave trade, supply shock, import ban, Cape Colony, labor demand.
JEL code J23, J47, N17, N37, N47, N57.

*Heinrich Nel kindly provided the dataset concerning the Stellenbosch district. This paper has benefited from comments by Garreth Austin, Jutta Bolt, Jeanne Cilliers, Dieter von Fintel, Johan Fourie, Erik Green, Ellen Hillbom, Klas Rönnbäck; seminar participants at the universities of Lund, Roskilde and Stellenbosch, and conference participants at the African Economic History Network 2017 (Stellenbosch), 2018 (Bologna), European Social Science History Conference 2018 (Belfast) and World Economic History Congress 2018 (Boston). This paper is part of the Cape of Good Hope panel project (P15-0159) funded by Handelsbanken's research foundation.

†Department of Economic History, Lund University. ✉igor.martins@ekh.lu.se

1 Introduction

In the early nineteenth century Britain was the biggest slave trader, accounting for 42% of all slaves transported from Africa to the Americas between 1801-1807 (Voyages Database 2009). The Slave Trade Act of 1807 prohibited all slave trade within the British Empire. British ship captains caught transporting slaves were to be fined £100 per slave, a significant amount. While the Slave Trade Act only made the import or transshipment of slaves illegal, the commercialization and possession of slaves was still allowed within colonial territories until the Slave Emancipation Act of 1834. The 1807 Act is usually deemed as the first political victory for the abolitionist movement in Britain.

The effects of the prohibition were immediate and widespread within the Empire. Evidence suggests, for example, that the slave populations of British Caribbean including the slave intensive plantation based economy of Jamaica experienced its first decline in centuries (Higman 1976; Higman 1984). The effects could even be felt in the periphery of the Empire, such as in Cape Colony, where slave prices rose steadily after the ban as supply declined and demand persisted (Worden 1985; Shell 1994; Dooling 2007).

These aggregate effects, however, provide limited insights into the dynamics of the shock at the individual level; few studies, for example, explore the effects that individuals' wealth, incomes and types of production had on determining the demand for coerced labor in slave-based economies. By understanding slavery as a system in which its emergence, persistence and abolition is intrinsically connected to land-labor ratios, it is possible to hypothesize that different slaveholders who were invested in different production types presumably required and employed labor – including slave labor – in different ways and with different purposes.[1] In other words, the demand for slave labor was not uniform across the distribution of slaveholders.

If one was to consider slaves only as a source of labor, from a theoretical perspective, one should expect that farmers who rely on labor-intensive activities – such as crop farming – are more inelastic to price fluctuations on the slave market since they are more depended upon slave labor for production. Land extensive activities such as animal husbandry require lower levels of labor per unit of output, making farmers invested in this economy more elastic to slave prices provided the existence of substitutes to slave labor.

Based on the the aforementioned premises, I investigate how and to what extent the 1807 Act influenced slave ownership patterns. How did different farming economies, on aggregate,

[1] For a thorough theoretical approach, see Nieboer (1900), Domar (1970), Engerman (1973), and Patterson (1977)

respond to a labor supply shock in a preindustrial economy? How did farmers, conditional on their agricultural produce or socioeconomic status, respond to a shock on labor supply? Does this response follows *a priori* theoretical expectations?

These are the questions this paper can answer. To do so, I rely on newly transcribed tax records produced for two different districts in the British Cape Colony between 1787 and 1828: Stellenbosch, where crop farming and viticulture were the most prevalent activities, and Graaff-Reinet, a frontier region, where most settlers were stock farmers. Together, these records allow to analyze more than 25,000 individuals over the course of 40 years, resulting in roughly 100,000 data points where information about labor, production types and family structure can be derived.

Aside from data availability and its remarkable detail, the Cape Colony offers many advantages as research setting. Firstly, due to its size and location, the Cape Colony had a wide range of agro-climatic variation (Cilliers and Green 2018). The implication is that farmers produced a wide variety of goods, with each production type requiring a different composition of capital and labor inputs. Secondly, the colony was also supplied through slave trading networks developed in the Indian Ocean, with lower costs, in contrast to the Atlantic slave trade (Van Welie 2008; Fenske and Kala 2017). Moreover , the co-existence of slave and paid labor on farms offer additional sources of substituting labor (Elphick 1977; Elphick and Malherbe 1989; Dooling 2007; Fourie and Green 2018b). Lastly, despite British annexation from 1795 to 1803, the Cape was from 1803 to 1806 under the auspices of the Batavian Republic. It is unlikely that the settlers could have anticipated the 1807 Act. The 1807 Act could thus be seen as an exogenous shock allowing causal inference.

The findings suggest that the prohibition hindered the ability of farmers to increase the number of slaves on their holdings regardless of whether they were invested in crop or livestock farming. While accumulation of slaves was still possible at the farm level, on the aggregate level the average number of slaves per farm is fairly stable – with a slight downward trend – in the period after 1807, confirming historical evidence that Cape Colony's slave trade went into decline post the 1807 Act (Ross 1988). Surprisingly, livestock farmers reacted similarly to their counterparts in crop farming even though it is assumed that land extensive activities that require less labor per unit of output would pressure farmers to shift from slavery into indentured or paid labor. While the *a priori* expectation was that livestock farmers would strongly move out from slavery and into indigenous paid labor and/or family labor, they reacted almost as if they were crop farmers.

A similar pattern between districts is also verified at the farm level. It is possible to observe

accumulation of slaves among the wealthiest cohorts in both types of economies, suggesting that wealth – and not crop or livestock type – was the most important factor behind the replacement of slaves who, over time, would either run away, die or be manumitted. The findings of this study are in agreement with the body of literature suggesting that slaves were also used as collateral for loans (Fourie and Swanepoel 2018), as assets in the lease market (Green 2014), as domestic servants (Fourie 2013b) and were even employed in economies of scope within farms (Fourie 2013a; Green 2014). Slaveholders, therefore, were arguably capable of extracting rents from the enslaved in many ways beyond their employment in agriculture. This study proposes that the study of slavery goes beyond its acknowledgement as an input for agricultural production and call for a broader theory of slavery as a capital investment.

The paper makes three important contributions. Firstly, it augments the Nieboer-Domar hypothesis, a staple of the literature on slavery. Similarly to Siegel (1945) and Patterson (1977) this study calls for its revision despite the disagreement that the Nieboer-Domar hypothesis is a "vulgar economic determinism" as proposed by Patterson (1977, p. 30). The hypothesis is still an useful tool to understand why slavery emerges in certain societies but, as Engerman (1973) rightly suggests, the causes for the emergence must not be the same causes for its persistence. Based on that understanding, this study suggest that the role of slaves as assets yielding returns outside the agricultural activity is paramount to reconcile seemingly counter-intuitive slave systems and advance towards a general framework that can explain not only the emergence of the system, but also its persistence and decline.

Secondly, the paper contributes to debates in the profitability of the slave economy. In the South African context, the profitability of the slave system has been a subject of debate since colonial times. Maurits Pasques de Chavonnes, who governed the colony between 1714 and 1721, argued that money spent on slaves was "dead money" (Chavonnes 1918, pp. 105-106). He was challenged at the time by the board of directors of the Dutch East India Company (VOC)[2] – the Heeren XVII – and given the widespread adoption of slavery in the colony in the subsequent years, it is assumed that governor de Chavonnes' ideas were ignored. Still, the reports he produced during his term prompted many scholars to evaluate the Cape's slave economy. While the evidence points towards the general profitability of the system (Shell 1994; Armstrong and Worden 1989; Giliomee 2003), modern studies present a more nuanced approach. Du Plessis et al. (2015), for example, approaches the issue by estimating a hedonic price function for slaves in the Cape Colony using their costs of maintenance and acquisition. They concluded that large landowners profitably employed slaves in agriculture but it was

[2]Vereenigde Oostindische Compagnie, in Dutch

unlikely that small farmers could recoup slave costs from agricultural production alone. Two possibilities arise from such findings. Either small slaveholders did not employ slaves profitably – and that would support de Chavonnes' claims that a considerable amount of capital would be locked up unprofitably into the slave system – or they profitably employed slaves *outside* agriculture. This paper provides evidence for the latter since I argue that the persistence of the slave economy at the Cape – especially in the colony's frontier – derived from farmers' demand for labor *and* capital, therefore, the opportunities for the employment of slaves outside agriculture should not be neglected when analyzing the overall profitability of the system.

Thirdly, the paper makes a significant contribution to the quantitative economic history of the early nineteenth-century Cape Colony. The last decade has seen economic historians combine the rich statistical sources in archives with stronger computing power and new statistical software to provide a more accurate picture of the economic lives of settlers, slaves and Khoisan in the Cape Colony. While most of these studies have been descriptive in nature, a few more recent studies have used innovative identification strategies and novel estimation methods in order to make causal inferences (Fourie 2018). This paper, using the exogenous shock of the 1807 Act to identify the impact on labor relations, adds to this literature. I explore these ideas below.

2 Historical Background

2.1 Ending the trade: legislation and enforcement

An Act for the Abolition of the Slave Trade, more commonly known as the Slave Trade Act 1807, received royal assent on 24 March, 1807. British captains caught transporting slaves were fined £100 per slave at the time of capture and, to ensure the enforcement of such legislation, the West Africa Squadron was established. The abolitionist movement enjoyed its first political victory 20 years after the creation of the Society for Effecting the Abolition of the Slave Trade in 1787.

Britain, however, was neither the first nor the only country to implement legislation to abolish slave trade. Denmark, for example, passed an act to abolish the slave trade in 1792 with its effects starting after a 10-year grace period. All Danish possession in the Caribbean – St. Thomas, St. John and St. Croix – experienced a decline in the slave population during the nineteenth century since its viability relied upon a constant flow of trafficked individuals out of Africa given the high levels of gender imbalance and slave mortality (Hall 1992). A

similar act passed by the United States Congress in 1807[3], however, "came very near being a dead letter" (Du Bois 2014, p. 109) since the continuance of the trade was unhindered despite legal efforts to suppress it.[4] France first abolished slavery in 1794 whereas the trade was only abolished in 1818. Enforcement, however, was presumably weak to the point of non-existence since French-flagged ships were still trading slaves intensively in the years afterwards and up to 1864 (Voyages Database 2009).

While one should not ignore that the enforcement of such ambitious legislation was a daunting task, it should also be noted that Britain did not resort solely on direct suppression. In 1812, for example, Britain and the USA agreed to work towards abolishing the trade in slaves. Two years later, in 1814, the Netherlands abolished its slave trade and agreed to establish a Mixed Commission Court composed of both Dutch and British officials responsible to dispatch naval vessels to patrol the African west coast. In 1815 and 1820, the British sought Portuguese and Spanish cooperation on the cessation of slave trade north of the Equator. Most of these agreements were later expanded to allow the West Africa Squadron to search and detain vessels of other nations (Sherwood 2007).

Did these diplomatic and naval endeavors successfully end the slave trade? Not as a whole, of course, but importing slaves into British overseas territories became considerably harder. Evidence suggests that the slave populations of British Caribbean such as in St. Kitts, Nevis, Antigua, St. Vincent, St. Lucia, Tobago and Demerara-Essequibo experienced its first decline in centuries. This trend was also observed in the slave intensive plantation based economy of Jamaica, where the biggest concentration of slaves within the Empire could be found (Higman 1976; Higman 1984). Even on the then remote Cape Colony at the southern tip of Africa, slave prices rose in response to the ban on slave imports (Worden 1985; Shell 1994; Dooling 2007), suggesting that the effects of British enforcement were felt far and wide.

Our knowledge of the economic consequences of this legislation is limited to country-level evidence. While the decline in slave populations is one immediate consequence of the ban on slave trade, it is unlikely that the effects of the prohibition were equally distributed among farmers regardless of their production type or level of wealth. Two plausible theoretical hypotheses can be identified: Firstly, that labor-intensive farming activities, on average, will employ more slaves than land extensive activities. Secondly, that the average number of slaves per farm will be more inelastic on labor-intensive farms. Using farm-level production output

[3]Not to be confused with the Slave Trade Act 1807 that was passed in the British parliament.

[4]Contributing to the perception of a legislation failure, the ability of North American slaves to produce population surpluses allowed the existence of an intra-colony slave market (Fogel and Engerman 1995, p. 78).

over more than 4 decades, this paper tests these hypotheses in the British Cape Colony. Its characteristics are briefly explained in the next subsection.

2.2 The slave economy of the Cape

Colonization of the Cape started in 1652 with the arrival of Jan van Riebeeck on behalf of the VOC to establish a refreshment station for passing ships on their journey to and from Asia. Initially, the settlement – first established on the foot of Table Mountain in what is today Cape Town – consisted of little more than a fort and a small garden where provisions such as fruits and vegetables could be produced and fresh water could be obtained.

European settlers, however, were far from being the earliest arrivals on the tip of Africa. The indigenous Khoisan already occupied the area from as early as 1000 BCE (Elphick 1977; Fourie and Green 2015). The socioeconomic activities performed by the Khoisan mostly comprised hunter-gathering or nomadic pastoral farming. The first settlers were advised to maintain an amicable relationship with the indigenous populations so trading links to supply the company with animal products could be established.

With a significant number of ships calling at the Cape, however, this setup was considered inadequate and plans for the expansion of the colony began (Boshoff and Fourie 2010). As the VOC liberated some of its employees to become free burghers and incentivized other Europeans to settle in the Colony, its borders rapidly expanded, aided by an imprecisely defined loan farm system after 1714 (Dye and La Croix 2018). This territorial expansion further displaced the indigenous population and deprived them of basic resources which, in turn, damaged their social structures as it forced them to abandon their nomadic pastoralist lifestyle. The Khoisan who did not migrate deeper into the drier interior, consequently, ended as farm laborers within the borders of the European settlement (Fourie and Green 2015). The importation of slaves happened simultaneously to the subjugation of the Khoisan given the Dutch East India Company's growing needs for agricultural output. Produce was purchased by the VOC at low predetermined prices while taking advantage of its monopsonistic power (Guelke 1976; Shell 2005).

As settlers moved eastwards, the town of Stellenbosch was founded in 1682 in the region known nowadays as the Cape Winelands. By 1687 the first group of French Huguenots arrived in the area while fleeing from religious persecution in Europe and found that their viticulture techniques were excellently suited for the western Cape's climate and soil (Fourie and Fintel 2014). Wine, together with wheat, barley, oats, and other labor-intensive agricultural produce soon dominated the landscape with Khoisan and slaves making up most of the working force

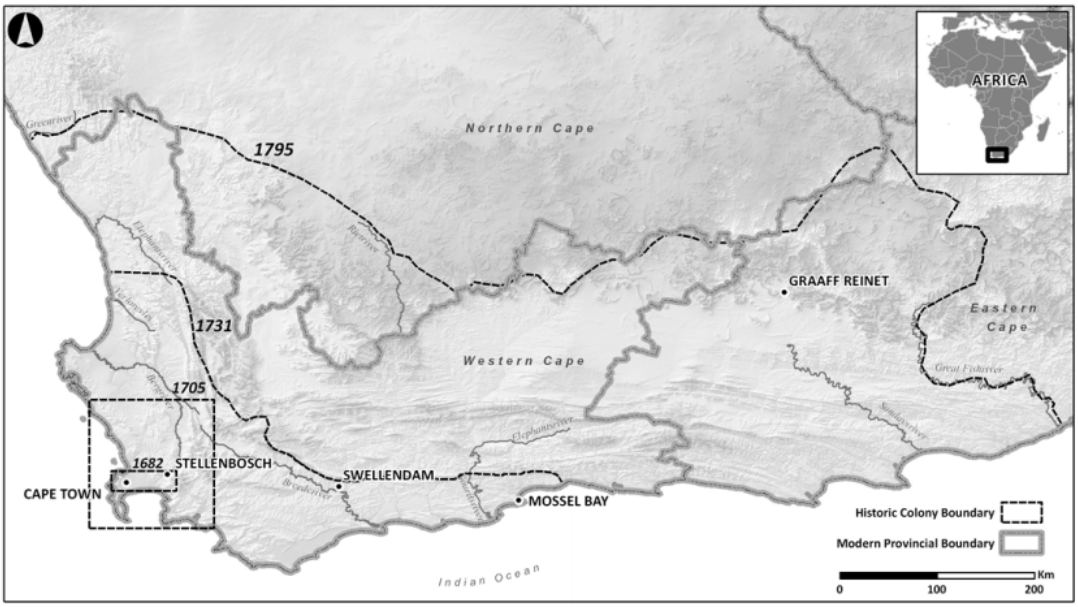

Figure 1: Expansion of the Cape Colony over time. Source: Guelke (1989a) with frontier projections added by Fourie (2013a).

(Elphick and Malherbe 1989; Armstrong and Worden 1989; Guelke and Shell 1983; Shell 1994). The expansion of colonial borders is illustrated on Figure 1.

As the number of settlers increased, so did the number of slaves. By 1711, as Figure 2 shows, slaves outnumbered the settlers. In some areas of the colony, such as in labor-intensive district of Stellenbosch, the ratio of slaves over settlers rose to nearly 2:1 in 1739 (Worden 1985). While these numbers do not place the Cape Colony on parity with the big plantation economies of the Americas and the Caribbean, it is clear that slaves were a major demographic force of the European settlement in southern Africa.

This system allowed some farmers to accumulate an extraordinary amount of wealth and soon the colonial society became stratified (Du Plessis and Du Plessis 2012; Fourie 2013b; Fourie and Fintel 2011). This process was further intensified after the 1713 smallpox outbreak that killed a considerable number of Khoisan and acted, indeed, as a supply shock on labor.[5] With a much smaller Khoisan population, slave labor grew in importance and soon the economic life of the colony became heavily depended upon slavery (Worden 1985; Ross 1986). The low prices the VOC paid for the agricultural produce, however, meant that slaves as an investment were not always profitable if used exclusively as inputs in the fields, specially among

[5]While it is possible to find scholars arguing that the Khoisan population had suffered a dramatic loss (Theal 2010; Marks 1972; Worden 1985; Fourie and Fintel 2012), reaching up to 90% of its population (Armstrong and Worden 1989), there are authors who are more willing to revise these numbers to less than 30% of the total native population (Ross 1977) or, at least, indicate that the smallpox effects could have been overestimated by the previous literature (Green 2014; Du Plessis et al. 2015).

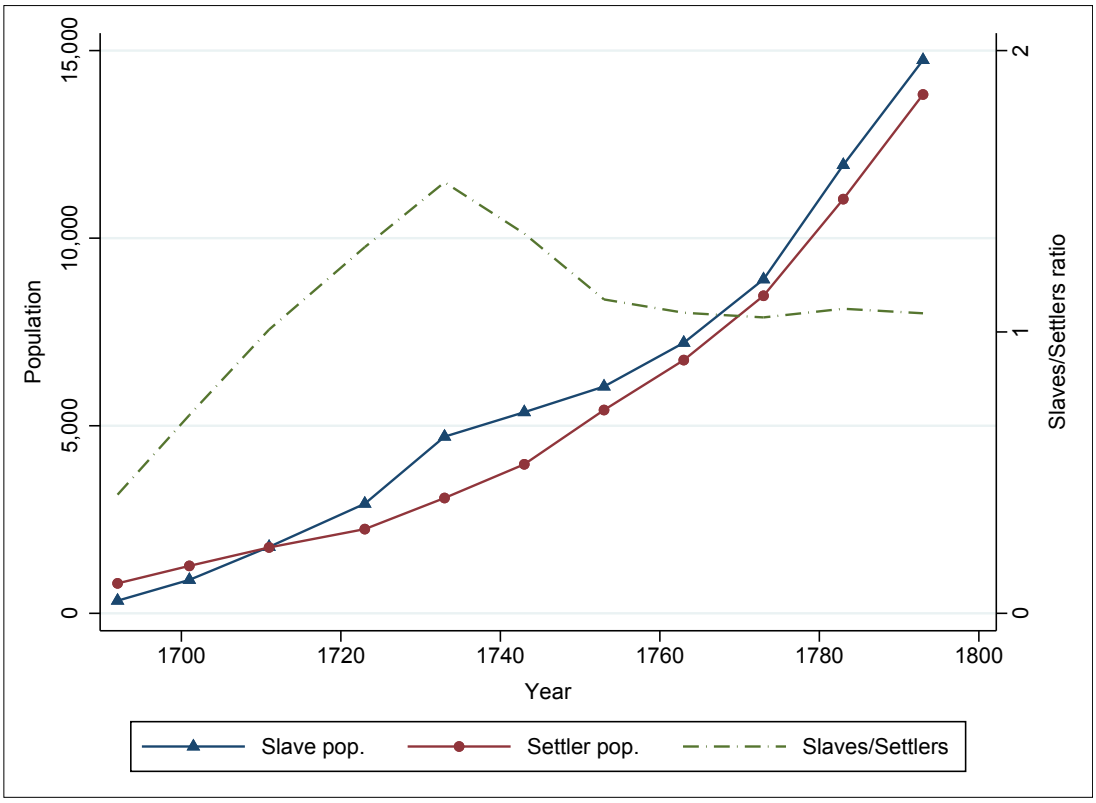

Figure 2: Population of slaves and settlers, 1692-1793. Source: Worden (1985, p. 11).

small-holding farmers (Fourie 2013a; Du Plessis et al. 2015). It has, therefore, been argued that slaveholders employed slaves in a collection of activities ranging from collateral for loans (Swanepoel 2017) to assets in the lease market (Green 2014), domestic labor (Fourie 2013b) and as semi-skilled and skilled staff on farms (Fourie 2013a; Green 2014) as means to obtain higher rates of return.

As the eighteenth century progressed, small farmers found it increasingly difficult to operate at a profit in a labor scarce market and under the monopsony of the VOC. Social stratification intensified as larger-scale farmers purchased the smaller and hardly profitable holdings to incorporate them into their estates. A social stratum composed of landless peasants whose subsistence was continually under pressure prompted other waves of migration eastwards resulting in the establishment of the Graaff-Reinet district in 1786 on the periphery of the Colony's eastern border (Smith 1974; Guelke 1989b).

In Graaff-Reinet, colonists adopted pastoral farming as means of subsistence since rainfall was scarcer when compared to Stellenbosch and, except from very small pockets of suitable soil, sheep and cattle farming became farmers' preferred choice. While poverty and lack of opportunities to establish independent farming units in Stellenbosch were the most important

push factors incentivizing colonists to move to the frontier, it is also possible to identify some pull factors into Graaff-Reinet. Firstly, land availability made the cost of establishing a farm considerably lower than in the more established districts close to Cape Town, requiring little initial investment. Secondly, the main agricultural output, cattle and sheep, could walk the significant distance to the Cape market, negating the need for transport infrastructure across the mountain ranges of the south-western Cape.[6]

Life in the frontier, however, was plagued with conflict and was not remotely as comfortable as life in Stellenbosch. Khoisan were settled in considerably greater numbers in Graaff-Reinet than in Stellenbosch, and the presence of the Xhosa, moreover, ensured that the already scarce access to water sources would remain constantly under pressure. A significant number of frontier wars marked the Cape's colonial expansion. Aside from these drawbacks, life in the frontier provided an opportunity for some newly-settled colonists to achieve the much-desired affluence in the colonial society and some frontiersmen accumulated wealth that enabled them to participate in the slave market (Du Toit and Giliomee 1983; Giliomee 1989; Giliomee 2003).

The contrasting agro-climatic differences between Stellenbosch and Graaff-Reinet provides us with a diversified range of factor endowments that, ultimately, influenced how colonists established, operated, and approached labor on their farms. An analysis of the effects of the Slave Trade Act of 1807 on different farming systems must account for these differences. This study proceeds with the description of the theoretical model that will allow the research questions of this paper to be explored.

3 Theory

Economic historians, inspired by the work of Nieboer (1900), have long adopted a factor endowments approach to explain the theoretical reasons for the existence of slavery in different societies. Departing from the assumption that slavery would not exist if there was not an economic value attached to it, Nieboer distinguish between open and closed-resource economies. In closed-resource economies where all land has been appropriated, a division between landed and landless individuals ought to appear with the latter owning nothing but their labor. While Nieboer recognizes that slavery can exist under such conditions, he argues that slavery as an industrial system is not possible. In other words, landlords can expand production without necessarily relying on coercive methods since there is a population who has nothing else to

[6] A debate between the prevalence of pull or push factors driving Cape settlers into the frontier exists among scholars. See Neumark (1957) for arguments in favor of the former and Guelke (1989b) for the latter.

offer but labor itself. Differently than closed-resource economies, open-resource economies are characterized by abundance of land. If land is abundant, the incentives for one to sell labor are reduced since one can always be self-employed so long as productive lands are available. If landlords want to expand production under these circumstances, coercion becomes necessary.

Nieboer's theory remained largely unexplored until Domar (1970) revised Nieboer's hypothesis aiming to develop a generalizable theoretical model. Domar assumes that in an open-resource economy where land and labor are the only factors of production, land quality is uniform and the average and marginal productivity of labor is constant, the development of coercive labor will only happen if non-working landowners exist. If the latter is not satisfied, an open-resource economy could develop into a family farming-based economy. Put differently, Domar (1970) proposes that between free land, free labor and non-working landowners only two elements out of the three can coexist. Free land, therefore, would not be sufficient to explain the emergence and the persistence of slavery over time.

Explaining the existence of slavery based solely on economic factors, however, has been the subject of much criticism. Siegel (1945), for example, claimed that the hypothesis lacked the inclusion of political and social elements. Patterson (1977, p. 30) follows the same line when proposing that the Nieboer-Domar hypothesis was "vulgar economic determinism" and suggests that economic factors were not as important as cultural ones to explain the existence of slavery. He does so by using the case of Ancient Greece between the 8^{th} and 5^{th} century BC while arguing that the negative attitude of the Greek peasantry towards manual labor ultimately forced landowners to employ slaves on their farms. Aside from the cultural factors, Patterson (1977) suggests that it was the ability of farmers to produce surpluses that defined the emergence of slavery but not land/labor ratios itself. Consequently, slavery would emerge if landowners were capable of producing agricultural surpluses so long there were cultural institutions enabling the social death – i.e individuals who are not accepted as fully human in a given society – of the enslaved.[7] Aside from these important contributions, they are mostly focused on the emergence of slavery. Yet, very little in the literature has been done to explain the *persistence* of slavery.

Engerman (1973), who defines slavery as an economic institution, is one of the exceptions. His framework, however, is not substantially different than the one proposed by Patterson. He recognizes the importance of both agricultural surpluses and economic institutions, however, he proposes that the factors behind the emergence and persistence of slavery are not necessarily the same. While the emergence of slavery might be more connected with land/labor ratios

[7]The relationship between slavery and social death is further explored in Patterson (1982).

– i.e. labor supply – these factors might play a lesser role in ensuring the continuity of the system. The idea is that once slavery is present in a given society, a set of institutions tends to preserve the slave-based economic system while preventing slaveholders' capital losses.

Still, most of the aforementioned analysis focused on slavery from a macro-level perspective. While land-labor ratios are useful to understand the emergence of slavery in a given context, they are not sufficient to explain the determinants behind slave ownership. Factors such as wealth and crop type are usually neglected when analyses are aggregated to a region or country level. Yet it is highly likely that different farmers who invested in different types of crops might demand labor for different purposes even if they are subjected to the same constraints in terms of labor supply. A similar concern was already expressed by Green (2014, p. 67) who argues that "the demand for various forms of labor depends on the possibility to generate a surplus, but also on the type of production, the available technologies, and the degree of control over the factors of production".

The determinants of individual-level demand for slaves are mostly unexplored. This article aims to fill this gap by adding crop types and wealth to the core of the analysis. I depart from the same premise as Domar (1970) where output in each farming unit is a function of land and labor employed by each farmer. I also assume, moreover, constant average and marginal productivity of labor and uniformity in land quality. The corollary is, therefore, that increases in output can only happen through the employment of more labor or the acquisition of more land. This article also concurs that agricultural surpluses determine the demand for slaves but argues that crop types and wealth will determine the intensity in which labor is demanded by each farmer. In labor intense farming units – i.e. crop farming – slaveholders are theoretically more inelastic to slave prices because their output is more dependent on the amount of labor employed. On the other hand, land extensive farming units should be more elastic to slave prices because the output is more closely connected with the amount of capital/land employed.

The 1807 Act increased the cost of labor in the Cape Colony since the availability of slaves in the market became considerably reduced. In a farming economy where income equals output, if labor costs increase slaveholders are left with three choices to retain the same level of income after the shock: (a) increase land usage to compensate potential labor losses, (b) shift to other agricultural production with higher aggregate value, or (c) adopt cheaper labor. Assuming that accepting a new equilibrium at a lower output level is the least desirable outcome, it will only be pursued if none of the aforementioned options can be satisfied.

Taking this theoretical framework and applying it to both districts of interest, this study is able to define some *a priori* expectations. Since the Stellenbosch district is characterized

by a closed-resource economy, increasing land usage imposed a heavy burden on farmers since land could not be occupied free of cost. Farmers could, however, specialize in crops with higher aggregate value. Crop types, therefore, are carefully considered – particularly wine[8] – as an important component of the analysis.

Another option for Stellenbosch farmers was to adopt cheaper labor, however, European labor – i.e. *knechts* – was considerably more expensive.[9] Khoisan labor, on the other hand, was not a reliable option for the colonists. Historical evidence from the beginning of the colonial period suggests that the Khoisan usually preferred to be employed on a temporary basis while many settlers regarded this behavior as "lazy" (Elphick 1977). This perception, however, changed over time as the Khoisan became more integrated within the colonial borders (Guelke and Shell 1992; Green 2014). Yet the VOC was by far the largest employer of Khoisan, which prompted many farmers to complain about labor shortages. Records show that as early as 1744, wheat farmers had to limit the size of their crops due to lack of labor (Worden 1985). Stellenbosch farmers, therefore, had limited options other than to accept a new equilibrium at a lower output level while occasionally replacing runaways, manumitted and deceased slaves by temporary Khoisan labor or purchasing slaves at a higher prices from other farmers while holding on to the slaves in their possession. This strategy could be potentially combined with crop specialization as a means to compensate higher labor costs. In other words, a closed-resource labor intensive district with a shortage of substitutes for slaves should be inelastic to the negative supply shock in the slave market.

The livestock farmers of Graaff-Reinet, on the other hand, found themselves in a much more flexible situation. Firstly, the main input to their agricultural production was land, not labor. Secondly, it was not until 1820 that Graaff-Reinet started to have the characteristics of a closed-resource economy (Cilliers and Green 2018; Links et al. 2018), meaning that expanding land usage in the short run was a viable option. Thirdly, the Khoisan population outnumbered the population of settlers and slaves combined, meaning that the cost to replace a slave for a Khoisan was not as high as it was in Stellenbosch. Lastly, most Khoisan belonged to clans that were historically pastoralists, meaning that cattle farming was an activity they were comfortable with and required little to no training in. In fact, Graaff-Reinet burghers had an explicit preference for Khoisan labor in comparison to the employment of slaves in their farms (Newton-King and Malherbe 1981; Dooling 1992). This scenario, therefore, creates an

[8] Viticulture was one of the main farming activities in the Stellenbosch district and a powerful element behind the formation of the first landed gentry at the Cape. See Fourie and Fintel (2012) and Fourie and Fintel (2014).

[9] It was commonly accepted that the a farmer could maintain four slaves for the cost of one *knecht* (Armstrong and Worden 1989).

incentive for ranchers to present a high degree of elasticity towards slave prices. In other words, if an import ban results in higher prices for slaves, Graaff-Reinet ranchers are more likely to shift out of slave labor and into Khoisan labor while not seeking to replace deceased, runaways and manumitted slaves to the same extent as their counterparts in Stellenbosch.

I will, therefore, model slave ownership as a function of labor available for substitution at the Cape, crop types harvested by each farmer and slaveholders' wealth. The Slave Trade Act of 1807 is modelled as an exogenous shock into the slave economy of the Cape which undeniably imposed a constraint on the labor supply experienced by all farmers in the colony. The results of the empirical strategy will ultimately be used to test the theoretical framework proposed in this paper. To do this, the sources of data are discussed in the next section.

4 Data

To analyze the effects of the 1807 Act on slave ownership patterns within the theoretical framework, this study relies on tax records – also known as *opgaafrollen* – collected by both Dutch and British colonial authorities between 1787 and 1829 for the Stellenbosch and Graaff-Reinet districts (Fourie and Green 2018a).

The tax records contain information on household size, agricultural output and related capital at the household level. More specifically, the records allow us to derive information on each household's number of sheep, oxen, cattle, horses, vines, wagons and carriages together with the amount of wheat, barley, rye and oats sown and reaped. The number of slaves possessed by each household and the number of Khoisan living on the farm are also recorded. Both variables are divided between men and women and further subdivided between adults and children. From these records, it is also possible to derive the size of the household in terms of family members since it does not only account for the head, but also for his/her partner and children.

The possibility of implementing a household-level panel comes from linkage the residents of both districts over time. The procedure consists of a classification problem that is addressed through Random Forests that uses time invariant information to generate a likelihood of linkage.[10] For Stellenbosch, the matching process yields 14,075 households across 36 years (1790-1829) and totals 56,508 observations. For Graaff-Reinet, it results in 12,628 households in 35 years (1787-1828) yielding 42,353 observations.

The dataset, despite covering a large period and possessing a substantial number of obser-

[10]This process is best explained in Rijpma et al. (2018).

vations, presents us with two immediate shortcomings: (1) the lack of reliable measurement of value – e.g. taxation paid or prices – covering all assets in both districts over time and (2) an unbalanced panel that is subject to demographic variations.

To address the first shortcoming, this study employed a Principal Component Analysis (PCA) to generate a comparable wealth index across households. Formally, the wealth index for household i is the linear combination:

$$y_i = \alpha_{i1}(\frac{x_{i1} - \bar{x}_1}{s_{i1}}) + \alpha_{i2}(\frac{x_{i2} - \bar{x}_2}{s_{i2}}) + \cdots + \alpha_{ik}(\frac{x_{ik} - \bar{x}_k}{s_{ik}}) \tag{1}$$

Where $x_{1,\cdots,k}$ represents each different asset, $\bar{x}$ represents its mean and s_k its standard deviation. The procedure denoted by $(\frac{x_{ik}-\bar{x}_k}{s_{ik}})$ produces the standardized form for each variable included in the PCA to avoid differences in scale distorting the estimates.[11] The coefficient α_{ik} represents the weight of each variable on the construction of the wealth index. The weights are derived from the eigenvectors of the covariance matrix and represent the largest possible amount of variation within the principal components – in this case, farmers stock, agricultural produce and related items – which is assumed to be a good proxy of the relative value of each asset.[12] The eigenvalues and the relative size of each component on the construction of the index are found on Appendix A.

It is important to note, however, that the PCA produces a *relative* wealth index, meaning that the results are not immediately comparable if calculated in both districts separately. I addressed this concern by merging residents of Graaff-Reinet and Stellenbosch in a single dataset and then calculating a pooled PCA. Consequently, a measurement of wealth that covering both districts simultaneously can be obtained. Figure 3 shows the evolution of the wealth index over time for both districts.

A visual inspection of Figure 3 confirms that farmers in Stellenbosch were on average wealthier than farmers in the frontier. Yet the differences are not so striking; in some years the wealth of frontier farmers seems to be on par when compared to the ones in Stellenbosch, specially at the end of the period. While this result looks counter-intuitive at first, there are at least three methodological reasons behind such phenomenon. Firstly, I am not able to account for differences in the quality of each farmers' stock and agricultural output, which

[11] The standardization refer to variables that have mean 0 and standard deviation 1. Therefore, instead of expressing the covariates in levels, they are expressed in terms of standard deviations from the mean. The idea is to avoid distortions from assets that are measured in different scales and have intrinsically different magnitudes (e.g. wheat vs. horses).

[12] While the PCA has some caveats, it has been shown that it provides reasonable estimates of wealth level effects and inequality. See Filmer and Pritchett (2001), McKenzie (2005) and Vyas and Kumaranayake (2006) for a thorough discussion.

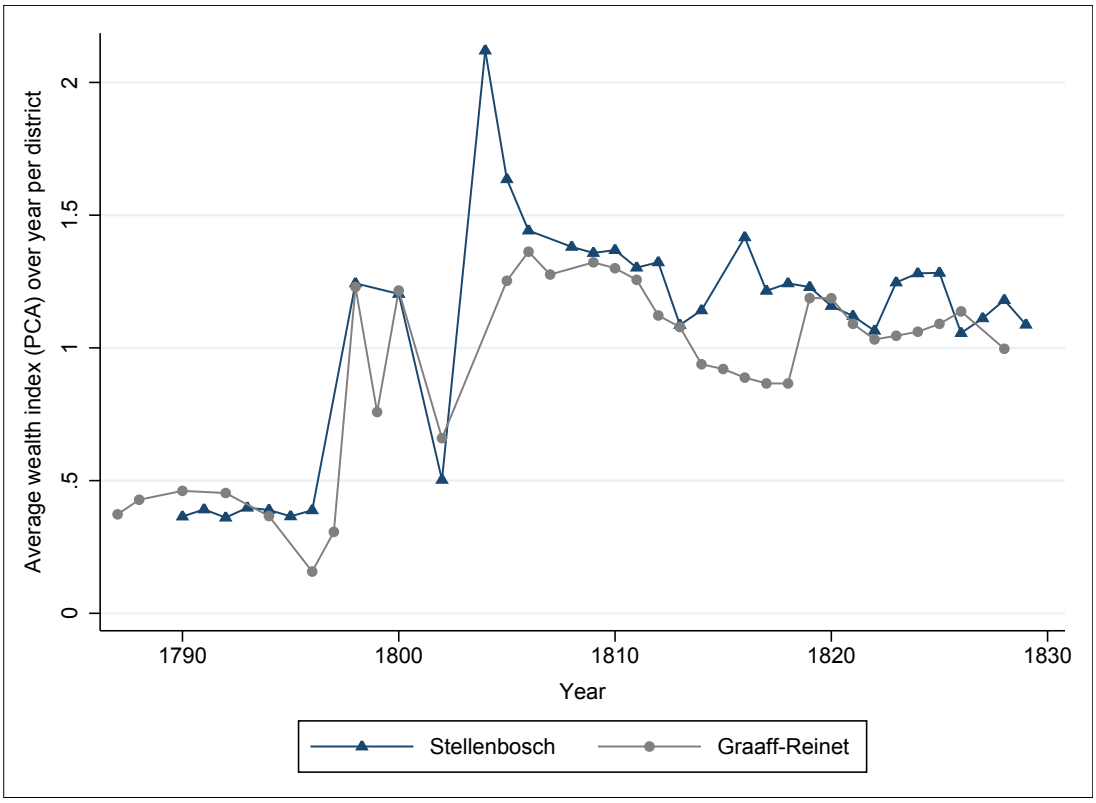

Figure 3: Average wealth index (PCA) over time per district

benefit large livestock farmers in Graaff-Reinet. Secondly, even though farm size is partially accounted for by including all farm related output when calculating the PCA, I am not able to include land values in the estimates. Considering that land in Stellenbosch district was of higher value, the model underestimates the wealth of farmers in that district when compared to their counterparts in Graaff-Reinet.[13] With that considered, results deriving from the PCA should be interpreted carefully despite providing a consistent relative measurement for the whole period of analysis.

The second shortcoming, as previously mentioned, comes from the unbalanced nature of the panel. The sample is, consequently, subject to demographic variations. While some of these variations can be assumed to be random across time and space, others call for a closer verification. One example of the former is migration.

A visual inspection of Figures 10, 11, 12 and 13 in Appendix B show a clear pattern where migrants – to and from both districts – on average possess fewer slaves and are poorer than individuals who were already established in any of the districts at any given year. It is imperative, therefore, to isolate sub-populations of interest in order to minimize and ultimately

[13] See Guelke (1976) for an interesting discussion on land values in the colony, and Dye and La Croix (2018) for a more recent discussion on property rights regime in the colony.

isolate migratory patterns.[14] This will be further addressed on Section 5.

With the aforementioned considerations properly addressed, the descriptive statistics for both districts are consolidated in Table 1 below.

Table 1: Descriptive statistics

Variable	Obs	Mean	Std. Dev	Min	Max
Stellenbosch					
Settler Men	56,507	0.85	0.35	0	11
Settler Women	56,508	0.62	0.48	0	5
Settler Children	56,508	1.61	2.31	0	57
Khoi	39,413	1.23	8.95	0	970
Slaves	56,508	4.88	8.77	0	140
Horses	56,508	6.57	13.32	0	520
Cattle	56,508	16.20	34.10	0	1,056
Sheep	56,508	53.94	265.81	0	30,000
Donkeys	56,508	0.04	1.15	0	200
Goats	56,508	7.98	81.82	0	18,024
Pigs	56,508	0.71	3.11	0	120
Wine	56,508	5.81	27.74	0	3,803
Brandy	56,508	0.30	1.12	0	87
Wheat reaped	56,508	19.30	70.76	0	1,766
Barley reaped	56,508	8.29	36.85	0	2,200
Rye reaped	56,508	2.86	245.50	0	50,000
Oats reaped	56,508	21.17	995.20	0	150,000
Wagons	56,508	0.58	1.32	0	63
Carts	56,508	0.13	0.43	0	20
Wealth (PCA)	56,508	1.07	2.06	0.03	45.36
Graaff-Reinet					
Settler Men	42,339	0.95	0.21	0	3
Settler Women	42,341	0.71	0.45	0	5
Settler Children	42,343	2.25	2.55	0	14
Khoi	34,508	4.09	6.78	0	78
Slaves	42,343	1.14	2.94	0	61
Horses	42,353	5.18	13.35	0	1,866
Cattle	42,353	44.66	72.74	0	2,813
Sheep	42,353	495.13	758.68	0	14,121
Donkeys	42,353	0.07	3.56	0	400
Goats	42,353	32.03	84.32	0	4,326
Pigs	42,353	0.04	1.05	0	120
Wine	42,353	0.09	1.00	0	74.37
Brandy	42,353	0.02	0.31	0	29.25
Wheat reaped	42,353	5.35	21.80	0	1,232
Barley reaped	42,353	2.99	16.13	0	1,150
Rye reaped	42,353	0.01	0.63	0	67
Oats reaped	42,353	0.00	0.59	0	80
Wagons	42,353	0.58	1.24	0	186
Carts	42,353	0.01	0.12	0	10
Wealth (PCA)	42,353	0.96	1.39	0.03	82.57

[Notes] Wheat, Barley, Rye and Oats are reported in muids, a South African dry measure of capacity equivalent to about 109 liters. Wine and Brandy are reported in leggers, equivalent to 516 liters.

Table 1 clearly shows how both districts have quite distinct outputs. By analyzing the averages of horses, cattle, sheep and goats it is possible to infer that livestock farming in

[14] While this can be problematic for a number of studies, it must be noted that the study of slavery is naturally biased towards wealthier individuals since slaves were expensive. The dataset used in this study reveals that of all 56,508 individuals observed in Stellenbosch between 1787-1828, 49.1% never possessed a slave. In Graaff-Reinet, out of 42,353 individuals observed between 1790-1829, the proportion reaches 72%.

Graaff-Reinet outperforms Stellenbosch. On the other hand, crop farming – as a compilation of wine and brandy production together with wheat, barley, rye and oats reaped – is far greater in Stellenbosch.

Another difference concern household composition. Graaff-Reinet has on average more men, women and children reported as residing in the household. The same applies to the average number of Khoisan, which is four times bigger in Graaff-Reinet when compared to Stellenbosch. The opposite is verified among slaves, who seem to have a larger presence within farms in Stellenbosch.

Some unlikely values also appear in Table 1 such as the maximum number of Settler Men and Settler Children in Stellenbosch households. Considering the large sample of more than 50,000 observations, it is unlikely that these values produce a severe bias. Nonetheless, these values will not be carried over to the estimates due to sample restrictions that will be further clarified in Section 5.

Finally, it is important to note that the number of observations that contain information on Khoisan is significantly smaller when compared to other variables. This happens because Khoisan numbers only start to be reported from 1798 and onwards[15] in Graaff-Reinet, and from 1803 and onwards in Stellenbosch.

5 Methods

This study aims to measure the effects of the 1807 Act on slave ownership patterns while exploring potential differences between the districts of Stellenbosch and Graaff-Reinet. To capture the dynamics of the slave market before and after the ban, the amount of slaves present in a given farm is modelled as a function of settlers' family size divided by settler men, women and children, wealth, number of Khoisan employed, number of vines[16] and a time trend. It follows the function presented by Equation 2 below:

$$y_{it} = \sum_{k} \beta_1 X_{kit} + \beta_2 X_{2it} + \beta_3 X_{3it} + \beta_4 X_{3it} + \beta_5 t + \beta_6 X_{4t} t + (\mu_i + \theta_t) \tag{2}$$

Where y_{it} represents the number of adult slaves, $\sum_k X_{kit}$ represents the covariates capturing settlers' family size within the range k of settlers, those being settler men, women and children. The number of Khoisan employed within each household is captured by X_{2it} while

[15] With exceptions in 1801 and 1803 where spouse name – one of the most important inputs during the record linkage process – is absent.

[16] Only for Stellenbosch since in Graaff-Reinet viticulture was virtually nonexistent

X_{3it} represents the household wealth index. X_{4t} captures the 1807 Act through a binary dummy assuming the value 0 before 1807 and 1 afterwards. The time trend is represented by t. μ_i and θ_t are respectively the individual and time-specific error terms.

It is important to note that the model specification does not estimate the effect of X_{4t} alone as a separate dummy since there was no apparent discontinuity on slave ownership patterns after the prohibition. While it is possible to hypothesize that slave prices increased after the supply shock, slave owners could still hold on to the slaves already in their possession and the effects of the Act are expected to gradually come into effect as replacement of slaves becomes harder.

With that considered, this article models the 1807 Act as an effect on the trend of slave ownership, but not on its level. This is captured by $\beta_5 t + \beta_6 X_{4t}$. Since $X_{4t} = 0$ before the shock, the trend effects are given by β_5. Alternatively, when $X_{4t} = 1$, the effects of the trend are given by $\beta_5 + \beta_6$. Equation 2 helps to establish whether the Act had any significant impact on the trend of slave ownership. When estimated across districts, it allows us to analyze patterns at a general level. Such a level of analysis, however, is limited if one is interested in a more nuanced approach such as the distribution of slaves between wealth cohorts. Slave prices rose after the ban, but intra-colony slave trade was not disallowed, meaning that slaveholders could still buy and sell slaves between districts. Wealth and slave concentration have already been verified in the Cape Colony after the 1713 smallpox outbreak that killed a considerable number of Khoisan creating a scenario of labor scarcity. Because the 1713 events prompted an intense social stratification, this study also explores the interaction effect of the Act on settlers' wealth – arithmetically represented by $\beta_4 X_{3it} X_{4t}$ – in further estimates deriving from Equation 2. The effects derived from viticulture[17] are also included through the standardized number of vines present in each farm using $\beta_7 X_{5it}$.

Equation 2 and other specifications deriving from it are estimated through a Poisson regression with fixed effects since the outcome y_{it} is a count variable.[18] An immediate caveat of this choice comes from the restrictive nature of Poisson distributions since it is assumed that its mean equals its variance. An inspection of Table 1 shows that the standard deviation of the dependent variable is roughly twice the mean – and it also applies when looking only into adult slaves – thus making the variance even bigger. [19]

[17] For Stellenbosch only.

[18] OLS regressions are not completely suitable as it allows for negative and/or continuous estimates. I do, however, estimate all specifications using OLS to check the direction and relative size of the coefficients that were obtained through Poisson regression models and find no significant difference.

[19] An alternative to estimate over-dispersed distributions is usually based on Negative Binomial regressions. There is, however, considerable evidence in the literature suggesting that Negative Binomial

The sample spans a long t – 35 years – but the panel is of an unbalanced nature. In fact, taking the total number of observations in each district and dividing by the total number of groups results to an average of 4.01 data points per individual in Stellenbosch and 3.35 in Graaff-Reinet. While this average is highly downward biased due to the high number of unmatched individuals – who, in turn, will only have one data point and will not be carried into most regressions – it does suggest that the incidental parameter problem is a potential source of bias if not properly addressed.

Alternatives within the Negative Binomial estimation strategy have been proposed by Allison (2005) and Greene (2007), however, these alternatives do not conclusively eliminate the incidental parameter problem, meaning that a fixed effects Negative Binomial approach does not produce reliable estimates (Cameron and Trivedi 2013). Fortunately, the Poisson regression is quite robust to over-dispersion and does not suffer from incidental parameters bias (Hahn 1997; Wooldridge 1999). While some problems with the maximum likelihood estimator might arise if the functional form is too complex (Silva and Tenreyro 2010; Silva and Tenreyro 2011), this is still the most robust model to deal with count variables in longitudinal datasets under fixed-effects estimation strategies. Given the nature of Poisson regressions, the results can be interpreted as the percentage change in y after a unit change in X. The results are discussed in the next section.

6 Results

Tables 2 and 3 contain the results concerning Stellenbosch and Graaff-Reinet districts respectively. Each table contain 6 different specifications that reflect several populations of interest. Because entries and exits in the dataset are shown not to be random,[20] the results are presented from the broadest population of interest to the narrowest one. These populations of interest are divided as: (1) the full sample, (2) individuals who appear both before and after 1807, (3) individuals who appear in the dataset at least 10 years prior to the shock – i.e. 1798 – and also remain in the district after 1807, (4) individuals who appear in the district no later than 1798 and remain there at least until 1815, (5) individuals who appear in the district no

regressions when applied to longitudinal data with fixed effects produce results suffering from an incidental parameters problem, especially in cases where t – the length of the panel – is small (Kalbfleisch and Sprott 1970; Allison and Waterman 2002; Greene 2004; Guimaraes 2008). This happens because coefficients calculated through Maximum Likelihood Estimators are obtained asymptotically, meaning that they require $t \to \infty$ to be consistent. For fixed t and $N \to \infty$, consistency is severely compromised as parameters to be estimated largely surpass t. For a technical description of the problem, see Heckman (1981).

[20] As explained in Appendix B through Figures 10, 11, 12 and 13.

later than 1798 and remain there at least until 1820 and, finally, (6) individuals who appear in the district no later than 1798 and remain there at least until 1828, which is the last year covered in the panel and represents 20 years after the Slave Trade Act 1807.

Before interpreting each district individually, it is important to note that Tables 2 and 3 reveal estimates that are robust throughout different populations of interest. There are no substantial differences between specifications (1) and (6) regardless of the district. A visual representation of the estimates can be found in Figures 14 and 15 of Appendix C. There I show that the estimates on the average number of slaves per farming unit – i.e. the predicted values of the model – follow the same trend and have the same scale as the values found in the *opgaafrollen*, suggesting that the models can capture slave holding dynamics satisfactorily. While all specifications possess analytical value, the interpretation is focused on specification (6) for both districts since they do not possess biases arising from migratory effects.

6.1 Stellenbosch

Starting with Stellenbosch, the direction of the coefficients on family labor – settler men, women and children – are in line with expectations. Larger families with a greater number of kids and adult women were, unsurprisingly, more likely to have larger numbers of slaves. On the other hand, the more adult men in the household, the fewer slaves are needed, presumably because a certain degree of substitution can take place. Another interpretation is also likely. Single, female-headed households (with no adult men) may simply have been indicative of the presence of widows and thus older household who would have had time to amass a greater amount of wealth and larger number of slaves.

Interestingly, no degree of substitution between Khoisan and slaves is found as the positive coefficients suggest a degree of complementarity in their relationship. It must be noted, however, that the coefficients are small. This is similar to results, using more elaborate methods, by Links et al. (2018). Positive coefficients are also found on the relationship between slave labor and viticulture, which is in line with the literature produced for the Cape Colony in that regard (Armstrong and Worden 1989; Fourie and Fintel 2012; Fourie 2013a).

The coefficients concerning wealth also follow the expected pattern. Individuals belonging to wealthier quintiles, on average, have more slaves when compared to their poorer counterparts. This did not change dramatically after 1807 as was expected from the labor intensive district of Stellenbosch. If labor is the most important input in the production function, then farmers in this district were expected to be more inelastic towards slave prices while assuming that slaves are primarily used as inputs in the agricultural activity.

Table 2: Regression output for Stellenbosch - Total Slaves

y=Total Slaves	**(1)** **Full Panel**	**(2)** **Bf/Af**	**(3)** **bf.1798**	**(4)** **1798-1815**	**(5)** **1798-1820**	**(6)** **1798-1828**
Settler Men	-0.092^{***}	-0.079^{***}	-0.079^{***}	-0.070^{***}	-0.069^{***}	-0.051^{*}
Settler Women	0.596^{***}	0.507^{***}	0.530^{***}	0.541^{***}	0.533^{***}	0.552^{***}
Settler Children	0.039^{***}	0.032^{***}	0.041^{***}	0.043^{***}	0.042^{**}	0.037^{**}
Khoe	0.012^{***}	0.013^{***}	0.008^{***}	0.008^{***}	0.012^{***}	0.017^{***}
Vines	0.021^{***}	0.017^{***}	0.014^{***}	0.013^{***}	0.014^{***}	0.008^{***}
Wealth Quintile						
1	ref	ref	ref	ref	ref	ref
2	0.019	−0.029	0.203^{*}	0.282^{**}	0.364^{**}	0.713^{***}
3	0.439^{***}	0.445^{***}	0.516^{***}	0.547^{***}	0.583^{***}	0.566^{***}
4	0.903^{***}	0.889^{***}	0.980^{***}	0.872^{***}	0.928^{***}	0.990^{***}
5	1.216^{***}	1.239^{***}	1.297^{***}	1.351^{***}	1.410^{***}	1.513^{***}
Wealth Quintile * Shock						
1	0.624^{***}	0.794^{***}	0.734^{***}	1.032^{***}	1.306^{***}	1.655^{***}
2	0.597^{***}	0.767^{***}	0.338	0.545^{*}	0.752^{**}	0.770^{*}
3	0.650^{***}	0.793^{***}	0.660^{***}	0.914^{***}	1.190^{***}	1.598^{***}
4	0.559^{***}	0.653^{***}	0.429^{**}	0.821^{***}	1.082^{***}	1.455^{***}
5	0.660^{***}	0.770^{***}	0.622^{***}	0.883^{***}	1.146^{***}	1.463^{***}
Time Trend	0.069^{***}	0.074^{***}	0.061^{***}	0.081^{***}	0.099^{***}	0.121^{***}
Time Trend * Shock	-0.046^{***}	-0.053^{***}	-0.041^{***}	-0.061^{***}	-0.078^{***}	-0.100^{***}
Observations	22,518	12,285	6,665	5,488	4,966	3,484
Groups	2,634	1190	723	429	368	232
F-Test	0.000	0.000	0.000	0.000	0.000	0.000

*p<0.10; **p<0.05; ***p<0.01

The time trend also reflects how Stellenbosch farmers held on to their slaves after 1807. The trend can be interpreted as the rate of slave accumulation on a yearly basis. In other words, if everything else remained constant, the number of total slaves in a given farming unit before 1807 would increase 0.12 log of expected counts, or put differently, 0.12% if one approximates the logarithm into percentage points. After 1807 this rate decreases considerably to 0.02% – an 82% reduction if taking equation (6) as reference – but still remains positive, meaning that the import ban did not prevent slaveholders of Stellenbosch from accumulating slaves even after the British blockade enforcing the end of slave trade. This is not to say, however, that the total number of slaves in the district kept increasing. The findings suggest that the 1807 Act *per se* was not a force strong enough to prevent slave accumulation, but certainly strong enough to change the trend in which farmers could accumulate slaves.

The interpretation of the results concerning Stellenbosch, therefore, provide some evidence that slave ownership remained roughly unaltered in the years after 1807, although its growth was depressed because of the prohibition on slave imports. This is in line with *a priori* expectations. Farmers invested in labor intensive activities indeed appear to be inelastic to an

import ban that ultimately influenced slave availability and prices.

6.2 Graaff-Reinet

Concerning Graaff-Reinet, the estimates are presented on Table 3. Similarly to Stellenbosch, the direction of the estimates are consistent between different populations of interest. However, the statistical significance and the size of the estimates is not always consistent. The comparison of equations (5) and (6), for example, provides substantially different estimates concerning wealth quintiles.

Table 3: Regression output for Graaff-Reinet - Total Slaves

y=Total Slaves	**(1)** **Full Panel**	**(2)** **Bf/Af**	**(3)** **bf.1798**	**(4)** **1798-1815**	**(5)** **1798-1820**	**(6)** **1798-1828**
Settler Men	−0.005	−0.022	−0.018	−0.045	−0.003	0.099
Settler Women	1.343***	1.308***	1.125***	1.083***	1.124***	0.923***
Settler Children	0.054***	0.042***	0.033***	0.020***	0.017**	0.016**
Khoe	0.013***	0.014***	0.014***	0.017***	0.017***	0.019***
Wealth Quintile						
1	ref	ref	ref	ref	ref	ref
2	1.291***	1.553***	1.323***	1.645***	2.027***	0.894
3	1.660***	2.106***	1.525***	2.465***	2.903***	1.135
4	1.662***	2.032***	1.645***	2.403***	2.888***	1.527
5	1.989***	2.032***	1.645***	2.403***	2.888***	2.201*
Wealth Quintile * Shock						
1	1.088***	1.235***	0.652***	1.160**	1.600**	0.199
2	0.618***	0.760***	0.579***	0.942**	1.076***	1.002***
3	0.636***	0.605***	0.838***	0.591***	0.713***	1.083***
4	0.873***	0.978***	0.989***	0.943***	0.969***	0.923**
5	0.844***	0.852***	0.989***	0.830***	0.871***	0.720***
Time Trend	0.084***	0.084***	0.088***	0.084***	0.088***	0.082***
Time Trend * Shock	−0.046***	−0.047***	−0.054***	−0.049***	−0.053***	−0.042***
Observations	12,745	7,838	4,889	3,305	2,844	1,693
Groups	1,461	670	504	236	193	96
F-Test	0.000	0.000	0.000	0.000	0.000	0.000

*p<0.10; **p<0.05; ***p<0.01

Despite the aforementioned differences, some conclusions concur with the Stellenbosch results, such as the positive relationship between settler women and children and the number of slaves in the household. The number of Khoisan is also positively associated with the average number of slaves evidencing the complementary relationship between the two.

The estimates on wealth, however, are not completely consistent across different samples, suggesting that migratory movements might be behind the statistical significance of the coefficients across equations (1) to (5). Focusing on equation (6), it becomes clearer that the only

group of individuals that possessed slaves in the district to a significant degree before 1807 were the wealthiest ones. All the other wealth quintiles are not significantly associated with slave ownership in the period before the Slave Trade Act 1807. These results are consistent with anecdotal evidence of the period that deemed the frontier population as mostly ranchers employing either themselves or the readily available Khoisan population that dominated the landscape prior the European arrival (Smith 1974; Giliomee 1981; Giliomee 1989; Cilliers and Green 2018).

What is important is the changes observed after 1807. Virtually all cohorts, except the poorest ones, significantly increase the number of slaves in their possession. This result is counter-intuitive since in a pastoral district where labor yields low returns and could be obtained through the employment of indigenous Khoisan, it seems unlikely that farmers will increase the number of slaves in their possessions after an import ban that resulted in higher slave prices. It is, moreover, important to note the estimates concerning the time trend. Taking equation (6) as the reference, the coefficient fell roughly 50% – from 0.082 to 0.042 – suggesting that the trade in slaves was not as intense as before. However, when compared to the reduction of 82% verified in Stellenbosch, it suggests that farmers in Graaff-Reinet were affected to a lesser extent by the British policy to end the slave trade. The effects in Graaff-Reinet, therefore, are similar to the ones verified in Stellenbosch where the 1807 Act was not sufficient to impose a negative rate on accumulation of slaves. In other words, Graaff-Reinet's findings mirror the findings for Stellenbosch, the only difference being the intensity.

In the next section, I combine these findings with the average output per farming unit in both districts. Farmers used a variety of coping mechanisms in order to keep their farms profitable. One of these was to adjust the type of production. The analysis of output-related variables, therefore, is imperative to understand farmers' behavior after the Act of 1807.

7 Analyzing output post the 1807 Act

The theoretical framework adopt in this paper postulates that one potential strategy for farmers to mitigate the increasing labor costs after the 1807 Act was to gear their production towards output of higher aggregate value. For that reason, it is imperative to closely inspect output levels in both districts for those that remained in the district throughout the whole period of analysis.

Figure 4 presents average crop production per farming unit in Stellenbosch. The vertical line represents the year 1807. It is possible to observe a negative trend on wheat production

while oats, rye and barley do not present significant changes. In light of these results, it is important to verify if livestock production has replaced some of the wheat production that has been lost specially in the period after 1807. Figure 5 allows this verification.

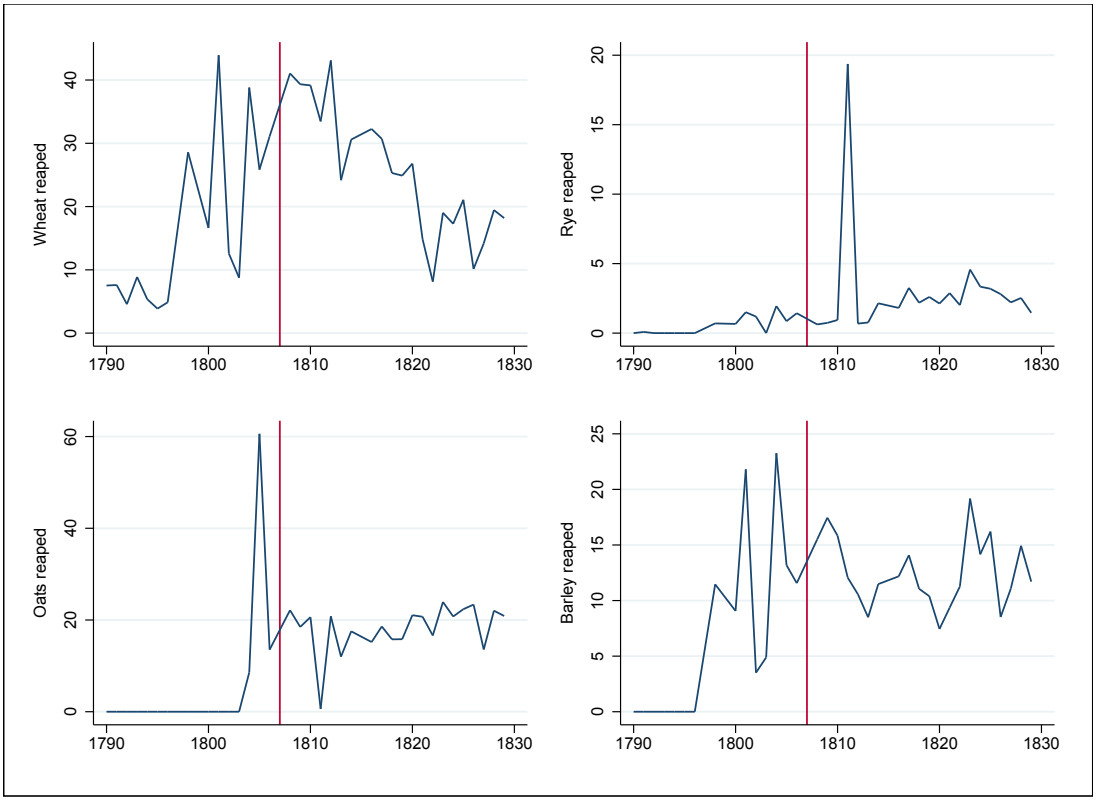

Figure 4: Average agricultural output in muids, Stellenbosch

Despite strong fluctuations in the number of cattle and a relatively stable trend on the mean number of goats per farm, the numbers of sheep and horses fall over time. It suggests that farmers in Stellenbosch were not switching from crop farming into livestock farming. This is presumably because, in closed-resource economies, switching the type of farm production in the short run is relatively difficult.

Another important source of revenues for Stellenbosch farmers was wine. Viticulture, introduced in the district as early as the seventeenth century, flourished with the arrival of the French Huguenots (Fourie and Fintel 2014). Figure 6 captures the average wine output per farming unit and suggests that wine production increased steadily during the entire period of analysis.

The output trajectory remains positive after 1807. While it is not possible to claim any sort of causal relationship based on Figures 4, 5 and 6 alone, they provide a useful comparison to the estimates from Section 6. The 1807 Act hindered the ability of farmers to acquire new

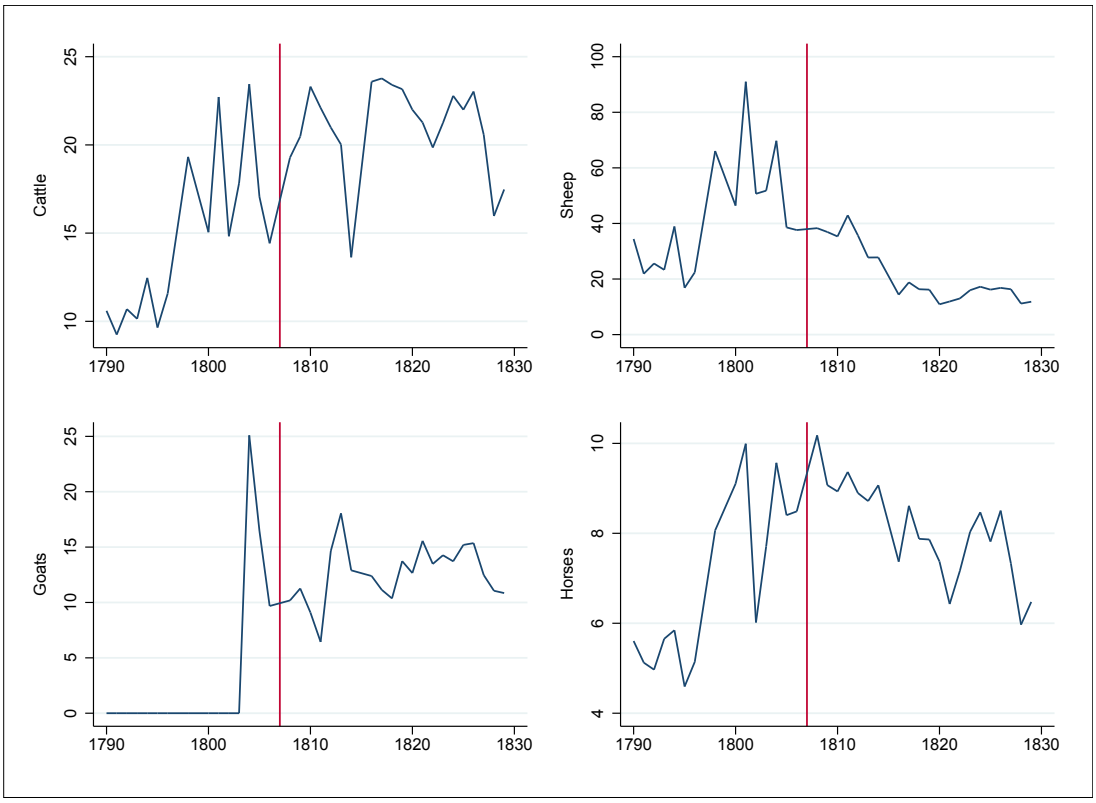

Figure 5: Average livestock output in units, Stellenbosch

slaves but did not cause Stellenbosch farmers to shift away from slavery. Instead, production of wheat steadily declined in the period post 1807 period while wine production – also labor intensive but of higher value – increased.

In Graaff-Reinet, surprisingly, it is not possible to observe an increase in either crop or livestock as Figures 7 and 8 suggest. The average number of cattle, sheep, goat and horses steadily declined in the district in the period after 1807. No degree of substitution is seen out of livestock farming and into crop farming as the numbers concerning wheat and barley also experience a declining trend while oats and rye were hardly produced to a substantial scale in the district.

A general impoverishment of the farmers is, therefore, observed. Interestingly enough, the estimates on Section 6 suggest that the Slave Trade Act 1807 was not sufficient to account for a decline on slave ownership in the district. For an open-resource economy with readily available paid labor and livestock farming activities these results are counter-intuitive since a shift away from slave labor was expected much more strongly when compared to the labor intensive district of Stellenbosch, which is not the case.

This study proposes, therefore, that the scenario verified in Graaff-Reinet can only be

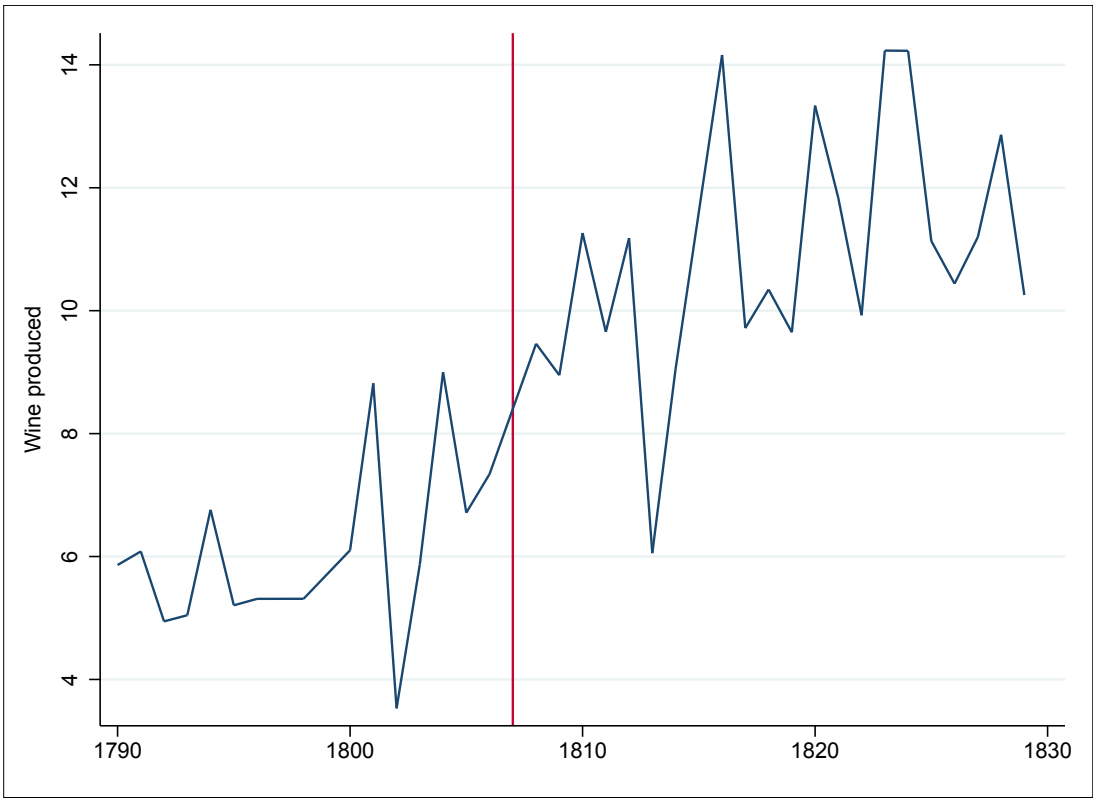

Figure 6: Average wine output in leggers, Stellenbosch

explained by the understanding that slaveholders were capable of extracting rents from their slaves outside the agricultural sector. Swanepoel (2017) suggests that slaves in the Cape Colony were used as collateral for loans. The credit market in the Cape Colony, despite the absence of banks during the period of interest of this paper, was well developed. Furthermore, the use of slaves as collateral for loans was not a practice specific to southern African context. In a recent study from González et al. (2017), it has been shown that the possession of slaves in the United States had a causal relationship with the creation of new business. The authors argue that the decline on the opening of new business after the American emancipation of slavery was caused, in part, by the impossibility to use slaves as collateral. Leasing slaves has also been suggested in the works of Fourie (2013a) and Green (2014). All these activities place slaves as inputs going beyond purely agricultural work. This study provides evidence favorable to such findings as I have shown that a framework emphasizing the role of slaves exclusively as labor fails to explain the dynamics of this institution after a significant shock in the slave market.

The perception of slavery exclusively as labor, therefore, is not wrong but it is also not complete. The role of slavery in the Cape must also be understood as a capital investment or, in a more general way, as an asset. The persistence of this institution even in areas where

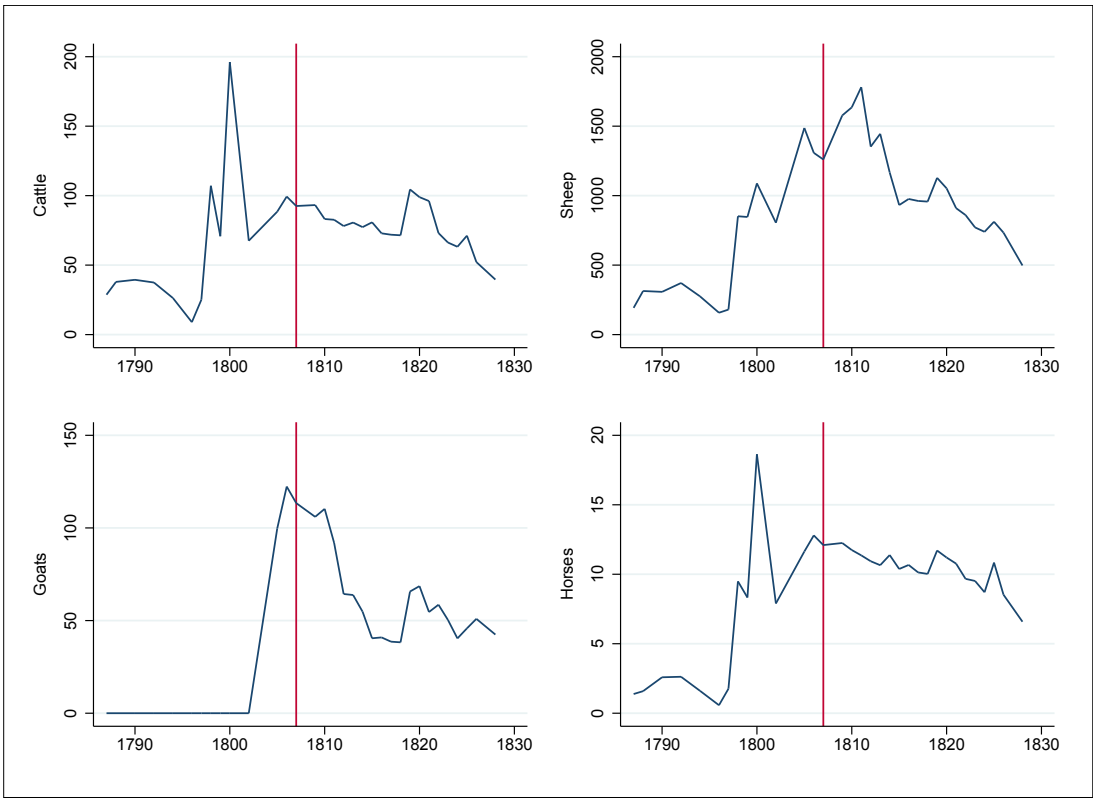

Figure 7: Average livestock output in units, Graaff-Reinet

its maintenance seems counter-intuitive is the most compelling evidence prompting a revision of the existing theories on labor coercion. The last two sections showed that in the colony's frontier, the persistence of slavery after 1807 cannot be explained by the slaveholders' demand for labor alone, but instead, it can only be explained by incorporating their demand for capital as well.

The corollary of such findings speak directly with the profitability of the slave economy at the Cape. Recent studies have demonstrated that large slaveholders could profitably employ slaves in agriculture but, for small scale holders, this was not true considering the costs of acquisition and maintenance of slaves. It is suggested, then, that small scale holders had to extract rents from their slaves through their employment in activities outside the direct agricultural work (Du Plessis et al. 2015). By providing evidence that the persistence of slavery – specially in the colony's frontier – is directly tied with the farmers' demand for capital, this study provides evidence to the hypothesis that small scale holders indeed employed slaves outside the direct agricultural work and could, therefore, extract rents from the enslaved to justify their investment. The contributions of the present study to the literature on slavery are discussed in the concluding section below.

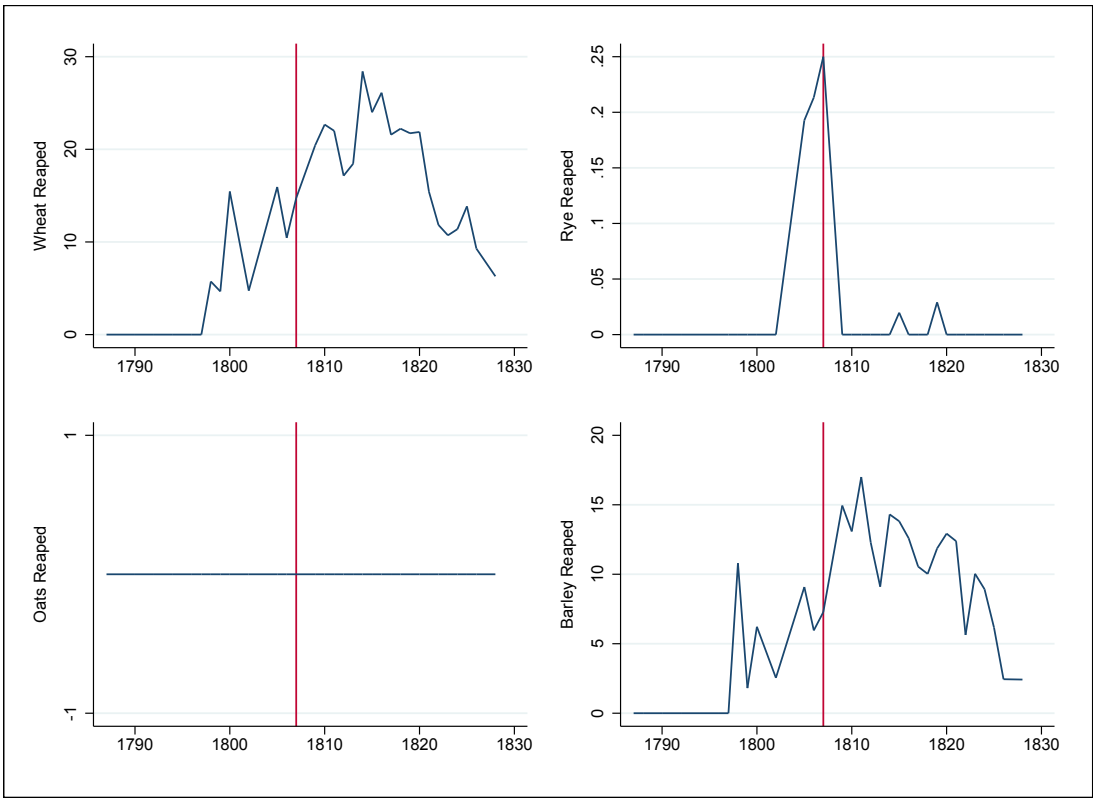

Figure 8: Average agricultural output in muids, Graaff-Reinet

8 Conclusion

This paper sought to analyze the effects of the Slave Trade Act 1807 in two different districts of the Cape Colony. I concluded that the Act did not affect crop farmers significantly different than livestock farmers. Since the findings did not corroborate with *a priori* expectations, a revision of the role of slavery in this colonial society became necessary.

The internal slave market was not outlawed by the terms of the 1807's Act, however, the slave population at the Cape – similarly to other slave populations in the Americas – was not capable to produce surpluses and slaves' prices rose. Based on the assumption that slave labor was primarily used as an agricultural input, the proposed theoretical model postulated that labor intensive farming units would show more resilience – i.e. be more inelastic – to the import ban. This article verified that the 1807's Act alone would not prevent the district of Stellenbosch to accumulate slaves even if in smaller rates. These findings do corroborate with the theoretical framework proposed by Nieboer (1900) and Domar (1970) since the economy of Stellenbosch was historically under-supplied with labor and, given its agricultural activity highly based on viticulture and grain production, labor coercion found grounds to emerge and

to be sustained even when the slave market was faced with an exogenous supply shock. Among the farmers who could be observed in the district between the entire period of analysis, it is possible to verify that their grain and livestock production experienced declining trends after 1807 while wine saw a consistent increase on production. This study speculates that when faced with higher labor costs, Stellenbosch farmers compensated by specializing on farming activities with higher aggregate value while still maintaining the labor composition of their farming units.

In Graaff-Reinet, however, the situation of the labor market was considerably less dire. Ranchers, given the land extensive nature of their business, did not demand labor to the same extent as did crop farmers. Labor demands from the ranchers could be met among the large Khoisan community that inhabited the district of Graaff-Reinet. In fact, many scholars pointed that the ranchers of Graaff-Reinet preferred to employ Khoisan as herders and that slave labor was not the dominant form of labor in the district (Smith 1974; Newton-King and Malherbe 1981; Dooling 1992; Green 2014).

Still, it is possible to observe that ranchers in Graaff-Reinet were affected in a remarkably similar way when compared to the crop farmers of Stellenbosch, calling for a revision of the theoretical framework that seeks to explain how slavery emerges and persists over time. This revision must include the role of slaves as capital investments if we are to advance towards a general framework that can explain the emergence, persistence and decline of the slave system in a comprehensive manner.

The paper, therefore, makes three important contributions. Firstly, to the Nieboer-Domar hypothesis where I suggest it should be augmented to incorporate the role of slaves as capital investments so it can better explain the persistence of slavery over time. The role of slaves as assets yielding returns outside the agricultural activity is paramount to reconcile seemingly counter-intuitive slave systems and advance towards a general framework that can explain not only the emergence of the system, but also its persistence and decline.

Secondly, as a corollary of the previous contribution, this study also provides further evidence contributing to the puzzle of the slave system's profitability in the Cape Colony. While it has been suggested that large slaveholders could employ slaves profitably solely through returns from agriculture, the profitability of small scale holders has been subject of debate (Du Plessis et al. 2015). The findings of the present study, by expanding the understanding of how slaveholders could extract rents from the enslaved, contribute to the understanding of slaves as capital investments and profitable assets outside the agricultural sector.

Finally, the paper makes a significant contribution to the quantitative economic history

of the early nineteenth-century Cape Colony by using a novel estimation and identification strategy derived from a newly-digitized longitudinal database covering more than 100,000 data points over 40 years of the colony's history during the XVIII and XIX centuries. This study adds to the cliometric literature using an institutional change as an exogenous shock to infer causal relations that can contribute to long-standing debates in economic history.

References

Allison, P. D. (2005). *Fixed effects regression methods for longitudinal data using SAS*. Cary: SAS Institute.

Allison, P. D. and R. P. Waterman (2002). "Fixed-Effects Negative Binomial Regression Models". In: *Sociological methodology* 32.1, pp. 247–265.

Armstrong, J. C. and N. Worden (1989). "The Slaves, 1652-1834". In: *The shaping of South African society, 1652-1840*. Ed. by R. Elphick and H. Giliomee. Middletown: Wesleyan University Press, pp. 109–162.

Boshoff, W. H. and J. Fourie (2010). "The significance of the Cape trade route to economic activity in the Cape Colony: a medium-term business cycle analysis". In: *European Review of Economic History* 14.3, pp. 469–503.

Cameron, A. C. and P. K. Trivedi (2013). *Regression analysis of count data*. Vol. 53. Cambridge: Cambridge university press.

Chavonnes, M. P. de (1918). *The Reports of Chavonnes and his Council, and of Van Imhoff, on the Cape.* Cape Town: The Van Riebeeck Society.

Cilliers, J. and E. Green (2018). "The Land–Labour Hypothesis in a Settler Economy: Wealth, Labour and Household Composition on the South African Frontier". In: *International Review of Social History*, pp. 1–33.

Domar, E. D. (1970). "The causes of slavery or serfdom: a hypothesis". In: *The Journal of Economic Hsitory* 30.1, pp. 18–32.

Dooling, W. (1992). "Slavery and Amelioration in the Graaff-Reinet District, 1823–1830". In: *South African Historical Journal* 27.1, pp. 75–94.

— (2007). *Slavery, emancipation and colonial rule in South Africa*. Vol. 87. Athens: Ohio University Press.

Du Bois, W. E. B. (2014). *The Suppression of the African Slave-Trade to the United States of America*. Oxford: Oxford University Press.

Du Plessis, S. and S. Du Plessis (2012). "Happy in the service of the Company: the purchasing power of VOC salaries at the Cape in the 18th century". In: *Economic History of Developing Regions* 27.1, pp. 125–149.

Du Plessis, S., A. Jansen, and D. von Fintel (2015). "Slave prices and productivity at the Cape of Good Hope from 1700 to 1725: Did everyone win from the trade?" In: *Cliometrica* 9.3, pp. 289–330.

Du Toit, A. and H. Giliomee (1983). *Afrikaner Political Thought: 1780-1850*. Berkeley: University of California Press.

Dye, A. and S. La Croix (2018). "Institutions for the taking: property rights and the settlement of the Cape Colony, 1652–1750". In: *The Economic History Review*.

Elphick, R. (1977). *Kraal and castle*. London: Yale University Press.

Elphick, R. and V. C. Malherbe (1989). "The Khoisan to 1828". In: *The shaping of South African society, 1652-1840*. Ed. by R. Elphick and H. Giliomee. Middletown: Wesleyan University Press, pp. 3–50.

Engerman, S. L. (1973). "Some Considerations Relating to Property Rights in Man". In: *The Journal of Economic History* 33.01, pp. 43–65.

Fenske, J. and N. Kala (2017). "1807: Economic shocks, conflict and the slave trade". In: *Journal of Development Economics* 126, pp. 66–76.

Filmer, D. and L. H. Pritchett (2001). "Estimating wealth effects without expenditure data—or tears: an application to educational enrollments in states of India". In: *Demography* 38.1, pp. 115–132.

Fogel, R. W. and S. L. Engerman (1995). *Time on the cross: The economics of American Negro slavery*. Vol. 1. New York: WW Norton & Company.

Fourie, J. (2013a). "Slaves as capital investment in the Dutch Cape Colony, 1652-1795". In: *Agricultural Transformation in a Global History Perspective*. Ed. by E. Hillbom and P. Svensson. New York: Routledge, pp. 154–177.

— (2013b). "The remarkable wealth of the Dutch Cape Colony: measurements from eighteenth-century probate inventories". In: *The Economic History Review* 66.2, pp. 419–448.

— (2018). "Cliometrics in South Africa". In: *Studies in Economics and Econometrics* 42.2, pp. 1–13.

Fourie, J. and D. von Fintel (2011). "A history with evidence: Income inequality in the Dutch Cape colony". In: *Economic History of Developing Regions* 26.1, pp. 16–48.

— (2012). "The fruit of the vine? An augmented endowments-inequality hypothesis and the rise of an elite in the Cape Colony". In: *The Role of Elites in Economic Development*. Ed. by A. H. Amsden, A. DiCaprio, and J. A. Robinson. Oxford: Oxford University Press, pp. 88–119.

— (2014). "Settler skills and colonial development: the Huguenot wine-makers in eighteenth-century Dutch South Africa". In: *The Economic History Review* 67.4, pp. 932–963.

Fourie, J. and E. Green (2015). "The Missing People: Accounting for the productivity of indigenous populations in Cape Colonial History". In: *Journal of African History* 56.2, pp. 195–215.

— (2018a). "Building the Cape of Good Hope Panel". In: *The History of the Family* 23.3, pp. 493–502.

— (2018b). "Wage Labour and Slavery on the Cape Frontier: The Impact of the Abolition of Slave Imports on Labour Relations in the Graaff-Reinet District". In: *Colonialism, Institutional Change, and Shifts in Global Labour Relations*. Ed. by K. Hofmeester and P. De Zwart. Amsterdam: Amsterdam University Press, pp. 265–291.

Fourie, J. and C. Swanepoel (2018). "'Impending Ruin'or 'Remarkable Wealth'? The Role of Private Credit Markets in the 18th-Century Cape Colony". In: *Journal of Southern African Studies* 44.1, pp. 7–25.

Giliomee, H. (1981). "Processes in development of the Southern African frontier". In: *The shaping of South African society, 1652-1840*. Ed. by L Lamar H. & Thompson. New Haven: Yale University Press, pp. 150–156.

— (1989). "The Eastern Frontier, 1770-1812". In: *The shaping of South African society, 1652-1840*. Ed. by R. Elphick and H. Giliomee. Middletown: Wesleyan University Press, pp. 291–337.

— (2003). *The Afrikaners: Biography of a people*. Charlotesville: University of Virginia Press.

González, F., G. Marshall, and S. Naidu (2017). "Start-up Nation? Slave Wealth and Entrepreneurship in Civil War Maryland". In: *The Journal of Economic History* 77.2, pp. 373–405.

Green, E. (2014). "The economics of slavery in the eighteenth-century Cape Colony: Revising the Nieboer-Domar Hypothesis". In: *International Review of Social History* 59.1, pp. 39–70.

Greene, W. (2004). "The behaviour of the maximum likelihood estimator of limited dependent variable models in the presence of fixed effects". In: *The Econometrics Journal* 7.1, pp. 98–119.

— (2007). "Functional form and heterogeneity in models for count data". In: *Foundations and Trends in Econometrics* 1.2, pp. 113–218.

Guelke, L. (1976). "Frontier settlement in early Dutch South Africa". In: *Annals of the Association of American Geographers* 66.1, pp. 25–42.

— (1989a). "Blanke boere en grensbewoners, 1652-1840". In: *'n Samelewing in Wording, 1652-1840*. Ed. by R. Elphick and H. Giliomee. Cape Town: Maskew Miller Longoman, pp. 67–109.

Guelke, L. (1989b). "Freehold farmers and frontier settlers, 1657-1780". In: *The shaping of South African society, 1652-1840*. Ed. by R. Elphick and H. Giliomee. Middletown :Wesleyan University Press, pp. 66–108.

Guelke, L. and R. Shell (1983). "An early colonial landed gentry: land and wealth in the Cape Colony 1682–1731". In: *Journal of Historical Geography* 9.3, pp. 265–286.

— (1992). "Landscape of conquest: frontier water alienation and Khoikhoi strategies of survival, 1652–1780". In: *Journal of Southern African Studies* 18.4, pp. 803–824.

Guimaraes, P. (2008). "The fixed effects negative binomial model revisited". In: *Economics Letters* 99.1, pp. 63–66.

Hahn, J. (1997). "A note on the efficient semiparametric estimation of some exponential panel models". In: *Econometric Theory* 13.4, pp. 583–588.

Hall, N. A. (1992). *Slave society in the Danish West Indies: St. Thomas, St. John, and St. Croix*. Århus: Aarhus Universitetsforlag.

Heckman, J. J. (1981). "The incidental parameters problem and the problem of initial conditions in estimating a discrete time-discrete data stochastic process and some Monte Carlo evidence". In: *Structural Analysis of Discrete Data with Econometric Applications*. Ed. by C. Manski and D. McFadden. Cambridge: MIT Press, pp. 179–197.

Higman, B. W. (1976). *Slave population and economy in Jamaica, 1807-1834*. Cambridge: Cambridge University Press.

— (1984). *Slave populations of the British Caribbean, 1807-1834*. Baltimore: Johns Hopkins University Press.

Kalbfleisch, J. D. and D. A. Sprott (1970). "Application of likelihood methods to models involving large numbers of parameters". In: *Journal of the Royal Statistical Society. Series B (Methodological)*, pp. 175–208.

Links, C., E. Green, and J. Fourie (2018). "Was Slavery a Flexible Form of Labour? Division of Labour and Location Specific Skills on the Eastern Cape Frontier". In: *African Economic History Working Paper Series 42/2018*.

Marks, S. (1972). "Khoisan resistance to the Dutch in the seventeenth and eighteenth centuries". In: *The Journal of African History* 13.1, pp. 55–80.

McKenzie, D. J. (2005). "Measuring inequality with asset indicators". In: *Journal of Population Economics* 18.2, pp. 229–260.

Neumark, S. D. (1957). *Economic influences on the South African Frontier, 1652–1836*. Stanford: Stanford University Press.

Newton-King, S. and V. C. Malherbe (1981). *The Khoikhoi rebellion in the eastern Cape (1799-1803)*. 5. Cape Town: Centre for African Studies, University of Cape Town.

Nieboer, H. J. (1900). *Slavery as an Industrial System: Ethnological Researches*. Vol. 1. The Hague.

Patterson, O. (1977). "The structural origins of slavery: a critique of the Nieboer-Domar hypothesis from a comparative perspective". In: *Annals of the New York Academy of Sciences* 292.1, pp. 12–34.

— (1982). *Slavery and social death*. Cambridge: Harvard University Press.

Rijpma, A., J. Cilliers, and J. Fourie (2018). "Record linkage in the Cape of Good Hope Panel". In: *Lund Papers in Economic History. Population Economics. 2018:17*.

Ross, R. (1977). "Smallpox at the Cape of Good Hope in the eighteenth century". In: *African Historical Demography*, pp. 416–428.

Ross, R. (1986). "The origins of capitalist agriculture in the Cape Colony: A survey". In: *Putting a Plough to the Ground: Accumulation and dispossession in rural South Africa, 1850-1930*. Ed. by W. Beinart, P. Delius, and S. Trapido. Johannesburg: Ravan Press, pp. 56–100.

— (1988). "The last years of the slave trade to the Cape Colony". In: *Slavery and Abolition* 9.3, pp. 209–219.

Shell, R. (1994). *Children of bondage: A social history of the slave society at the Cape of Good Hope, 1652-1838*. Hanover: Wesleyan University Press published by University Press of New England.

— (2005). "Immigration: The Forgotten Factor in Cape Colonial Frontier Expansion, 1658 to 1817". In: *Safundi: The Journal of South African and American Comparative Studies* 6.2, pp. 1–38.

Sherwood, M. (2007). *After abolition: Britain and the slave trade since 1807*. London: I.B. Tauris.

Siegel, B. (1945). "Some Methodological Considerations for a Comparative Study of Slavery". In: *American Anthropologist* 47.3, pp. 357–392.

Silva, J. S. and S. Tenreyro (2010). "On the existence of the maximum likelihood estimates in Poisson regression". In: *Economics Letters* 107.2, pp. 310–312.

— (2011). "poisson: Some convergence issues". In: *The Stata Journal* 11.2, pp. 207–212.

Smith, K. W. (1974). "From frontier to midlands: a history of the Graaff-Reinet district, 1786-1910". PhD thesis. Grahamstown: Rhodes University.

Swanepoel, C. (2017). "The private credit market of the Cape Colony, 1673-1834: wealth, property rights, and social networks". PhD thesis. Stellenbosch: Stellenbosch University.

Theal, G. M. (2010). *History and Ethnography of Africa South of the Zambesi: The Portuguese in South Africa from 1505 to 1795*. Vol. 2. New York: Cambridge University Press.

Van Welie, R. (2008). "Slave trading and slavery in the Dutch Colonial Empire: A global comparison". In: *New West Indian Guide/Nieuwe West-Indische Gids* 82.1-2, pp. 47–96.

Voyages Database (2009). *Voyages: The Trans-Atlantic Slave Trade Database*. URL: http://www.slavevoyages.org (visited on 05/30/2018).

Vyas, S. and L. Kumaranayake (2006). "Constructing socio-economic status indices: how to use principal components analysis". In: *Health policy and planning* 21.6, pp. 459–468.

Wooldridge, J. M. (1999). "Distribution-free estimation of some nonlinear panel data models". In: *Journal of Econometrics* 90.1, pp. 77–97.

Worden, N. (1985). *Slavery in Dutch South Africa*. Vol. 44. Cambridge: Cambridge University Press.

Appendix A - Principal Component Analysis

The Principal Component Analysis is an interesting tool that can be used to consolidate a range of variables into a concise index. In the case of the present study, the PCA was used to consolidate a range of assets into a wealth index due to the absence of a consistent price series covering both district during the period of analysis.

In other words, the PCA works as a replacement for prices, meaning that the goal was to construct an index where the relative weight of each asset could be inferred. These weights were represented by the α in Equation 1. Once this is achieved, the wealth of each individual is easily obtained by the sum of all assets weighted by their own α.

The results produced by the PCA are called principal components and are obtained by projecting all data points into a scatter plot in order to obtain the maximum variance while minimizing the projection error. Out of all principal components generated by this procedure, the first one is always the range of weights that best explain the variance in the projected data. Mathematically speaking, these weights are the eigenvalues of the eigenvector that explains the biggest variance among the principal components. This first component is usually used for the construction of wealth indexes and, in this paper, yielded the results presented on Figure 9.

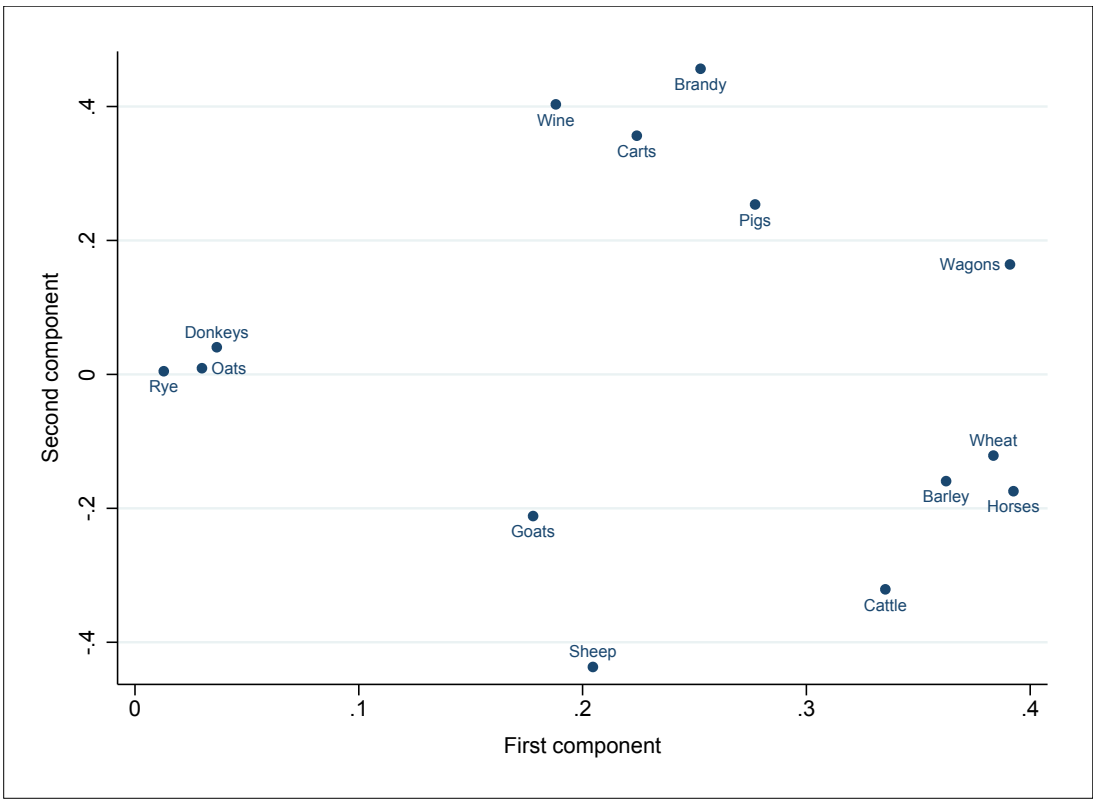

Figure 9: List of assets according to eigenvalues produced by the 1st and 2nd components of the PCA analysis.

Figure 9 should be read through the x-axis. The bigger the value for the 1^{st} component, the more valuable the asset was deemed in the calculation of the index. Ultimately, horses, wagons, wheat, barley and cattle were the items that received the biggest eigenvalues. In other words, they were considered to be the most valuable assets within the range of principal components included in the analysis. Therefore, large scale cattle farmers – i.e. ranchers – will be relatively richer than farmers who are invested on sheep, goats, oats or rye farming. While the wealthiest individuals had usually a well diversified range of assets, Figure 9 help us identify what variables were key to determine the wealth index calculated in this paper.

Appendix B - The effects of migration

The dataset used in this paper stems from a record linkage strategy where several individuals were linked over time. While machine learning enables the construction of historical datasets and allow us to investigate historical sources in a systematic manner, it possess some caveats. Most notably concerns the construction of longitudinal datasets when they are derived from a collection of cross-sections. The implication, therefore, is that entries and exits in the dataset are not random and are likely to be the result of in and outward migration.

Migration is not a problem if it is random, otherwise, estimates will be biased. Analyzing trends in a scenario where migratory movements are not random – and it is always likely that they are not – becomes increasingly hard since it is not possible to distinguish between trends that resulted from the movement of people and trends that are caused by the phenomenon of interest. The Figures below, therefore, are used to show that entries and exits from the dataset are not random and that isolating a population of interest that remained in each respective district was important to ensure the credibility of the analysis deriving from it.

Figure 10, for example, shows that individuals entering Stellenbosch and Graaff-Reinet possessed, on average, fewer slaves than individuals already established in the district in almost every given year. In Stellenbosch, more specifically, the differences become more accentuated over time possibly due to the effect of the Slave Trade Act 1807. A similar pattern is also observed on Figure 11 when comparing the wealth of entrants versus the wealth of non-entrants. In both districts, the differences are clear throughout the entire period of analysis.

The patterns on exiting districts are not so evident when compared to the entries, mostly because exits are not function exclusively from outward migration but also mortality affecting individuals well established in the district. It is possible to verify in Figure 12 that in Stellenbosch, for example, it is not until 1820 that the difference in the average number of slaves of individuals exiting becomes significantly smaller compared to individuals who did not exit the district in the given year. The analysis can be similarly extended when observing Figure 13.

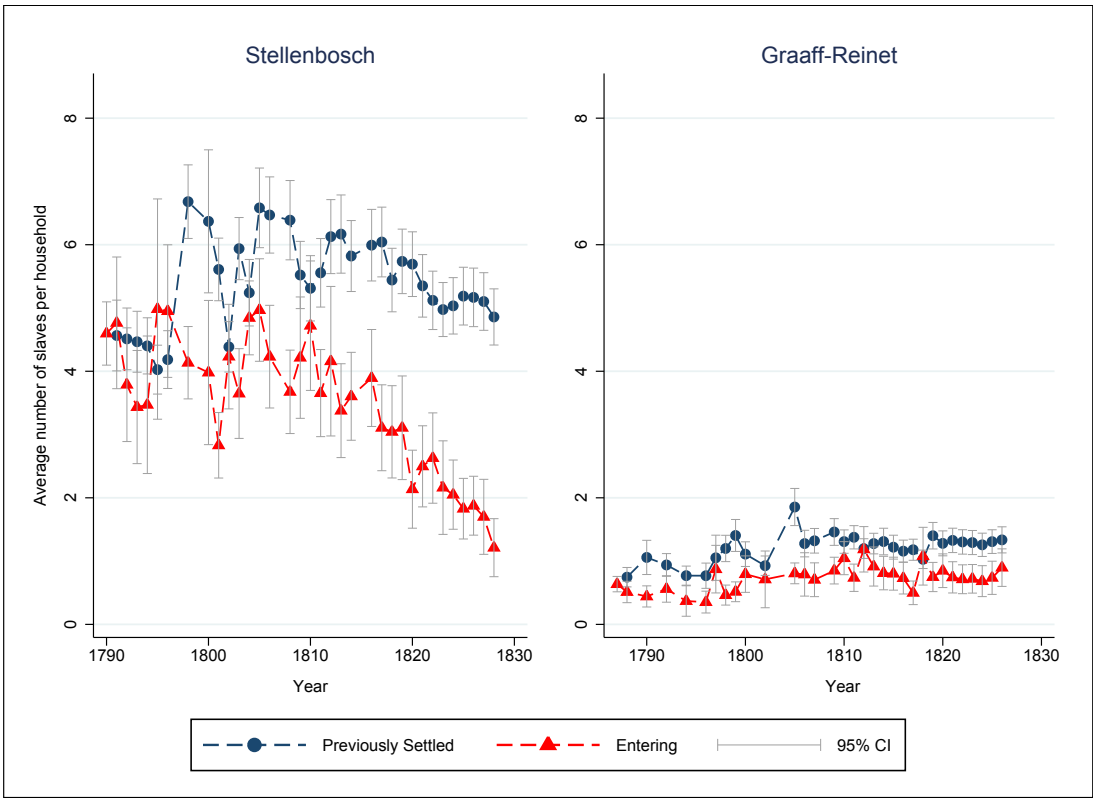

Figure 10: Impact of year of arrival on average number of slaves - Individuals previously settled vs. Individuals entering each respective district.

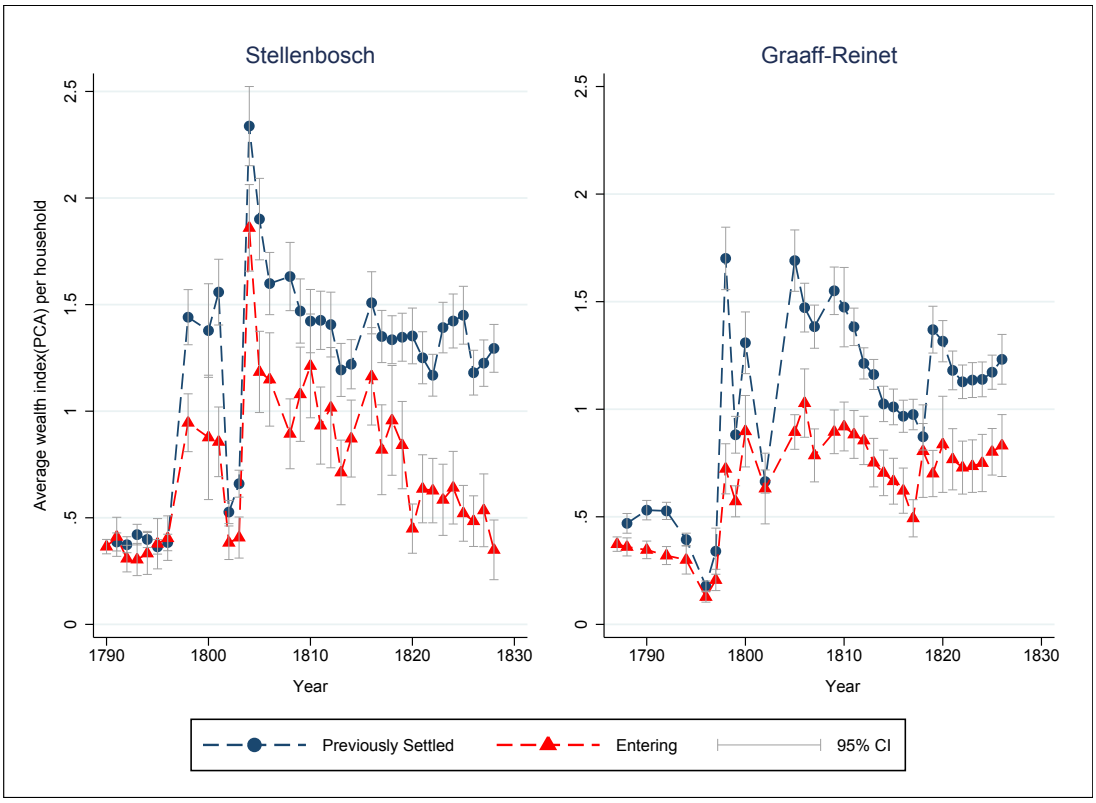

Figure 11: Impact of year of arrival on average wealth (PCA) - Individuals previously settled vs. Individuals entering each respective district.

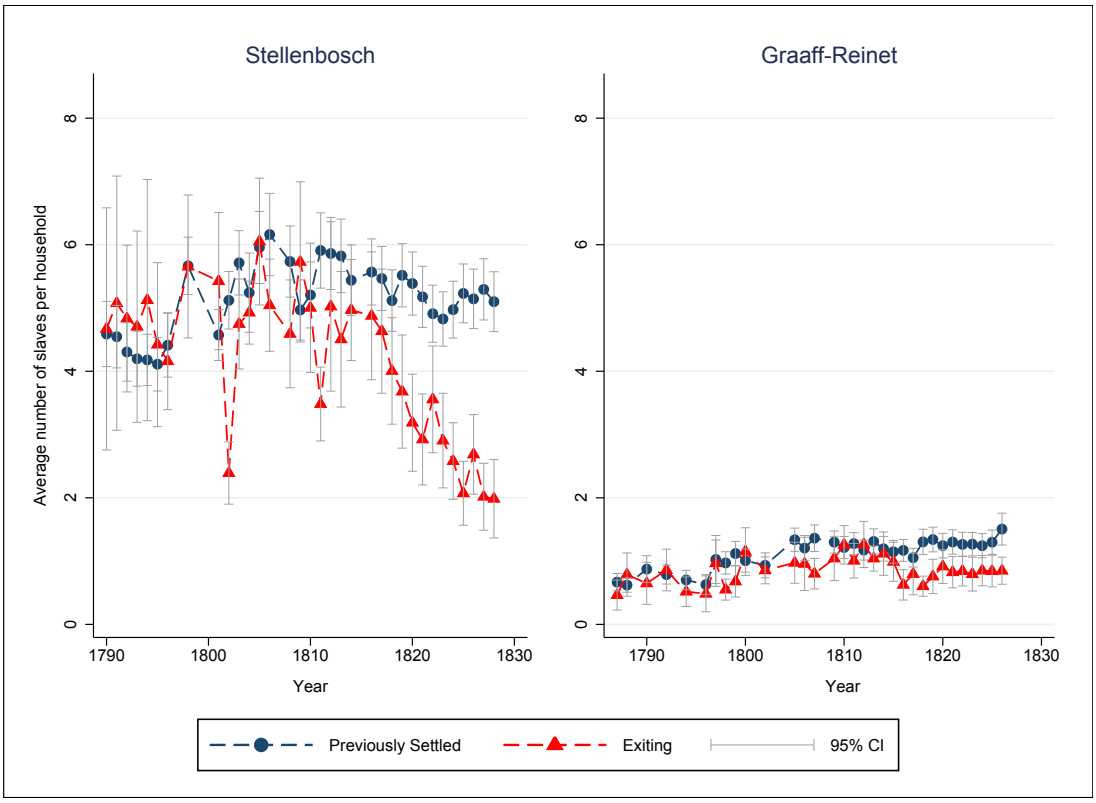

Figure 12: Impact of year of arrival on average number of slaves - Individuals previously settled vs. Individuals exiting each respective district.

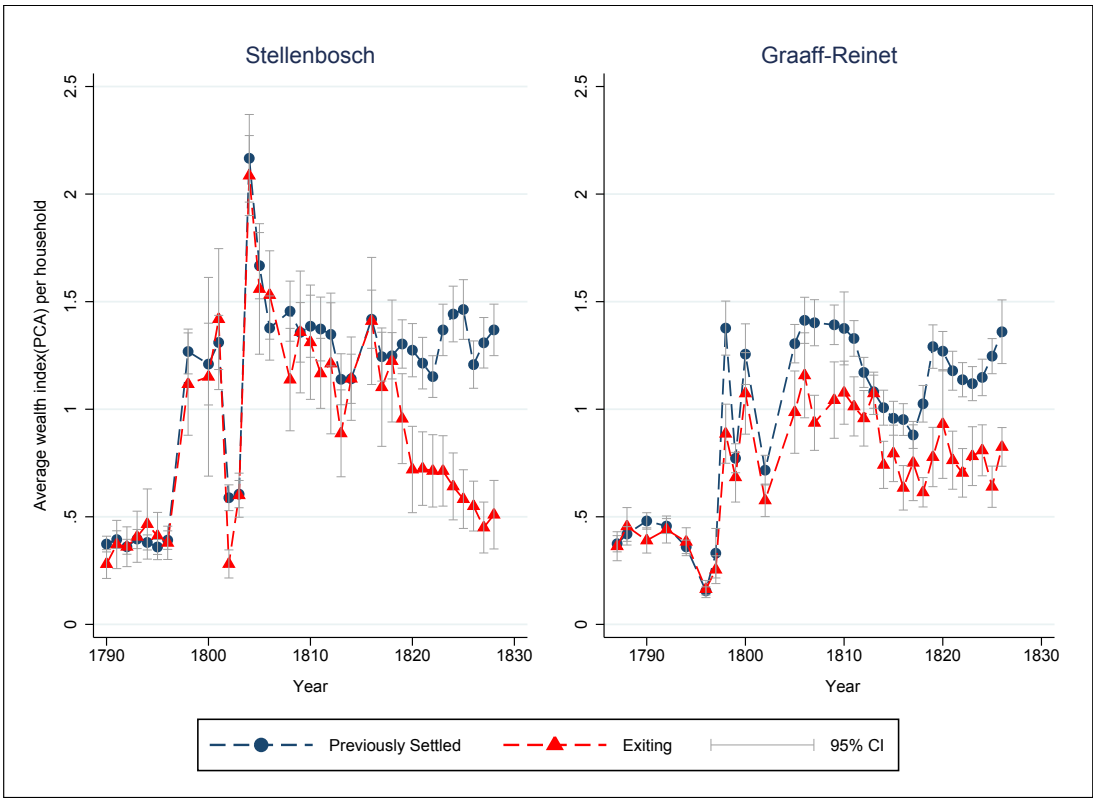

Figure 13: Impact of year of arrival on average wealth (PCA) - Individuals previously settled vs. Individuals exiting each respective district.

Appendix C - Actual Values vs. Predicted Values

Figures 14 and 15 are visual representations of the estimates discussed on Tables 2 and 3 respectively. For a better visualization of the results, the graphs below do not consider Khoisan in the Predicted Values since the *opgaafrollen* does not account the Khoisan population until 1803 in Stellenbosch and until 1798 in Graaff-Reinet.

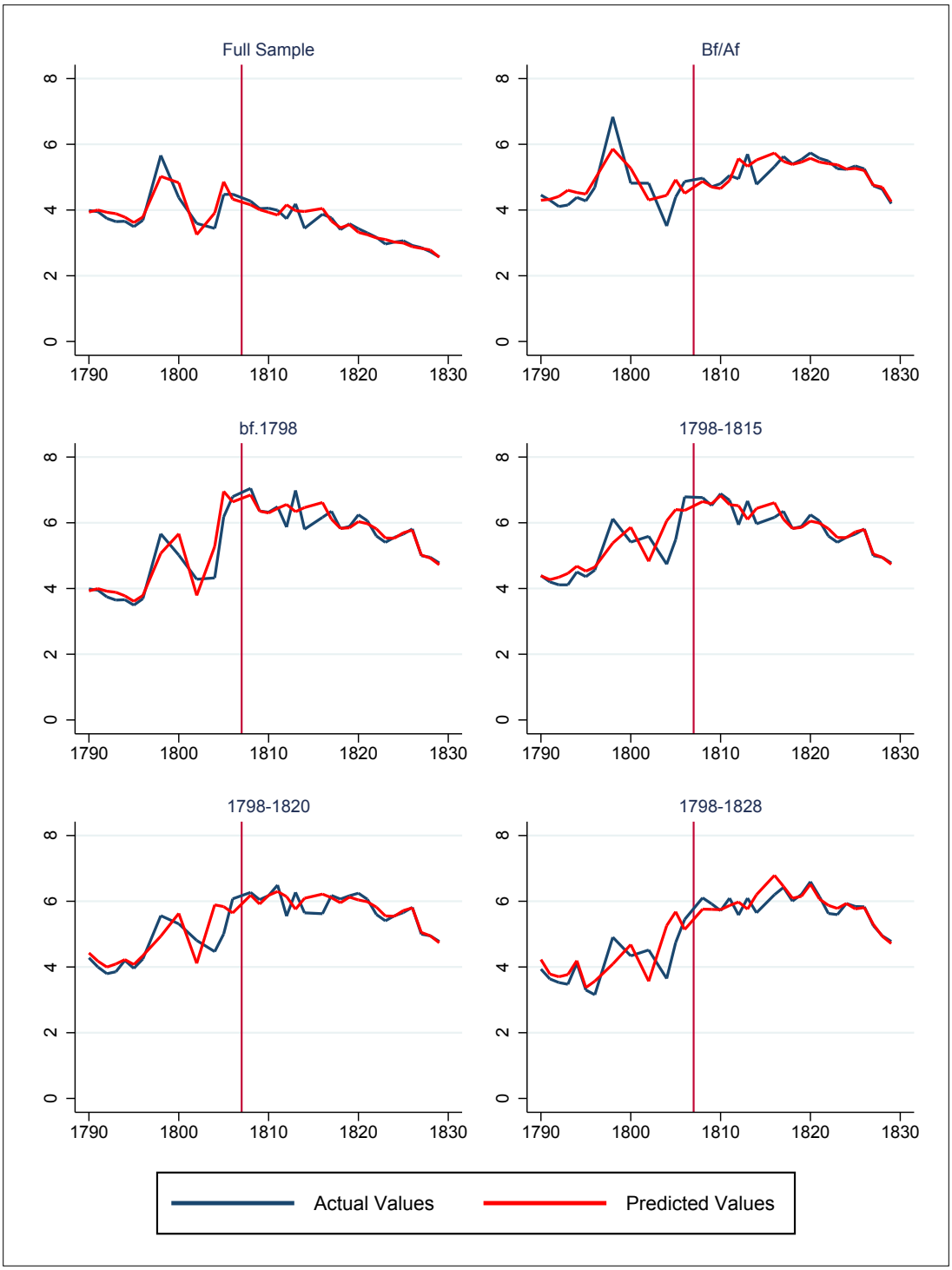

Figure 14: Average number of adult slaves per household, actual vs. predicted, Stellenbosch

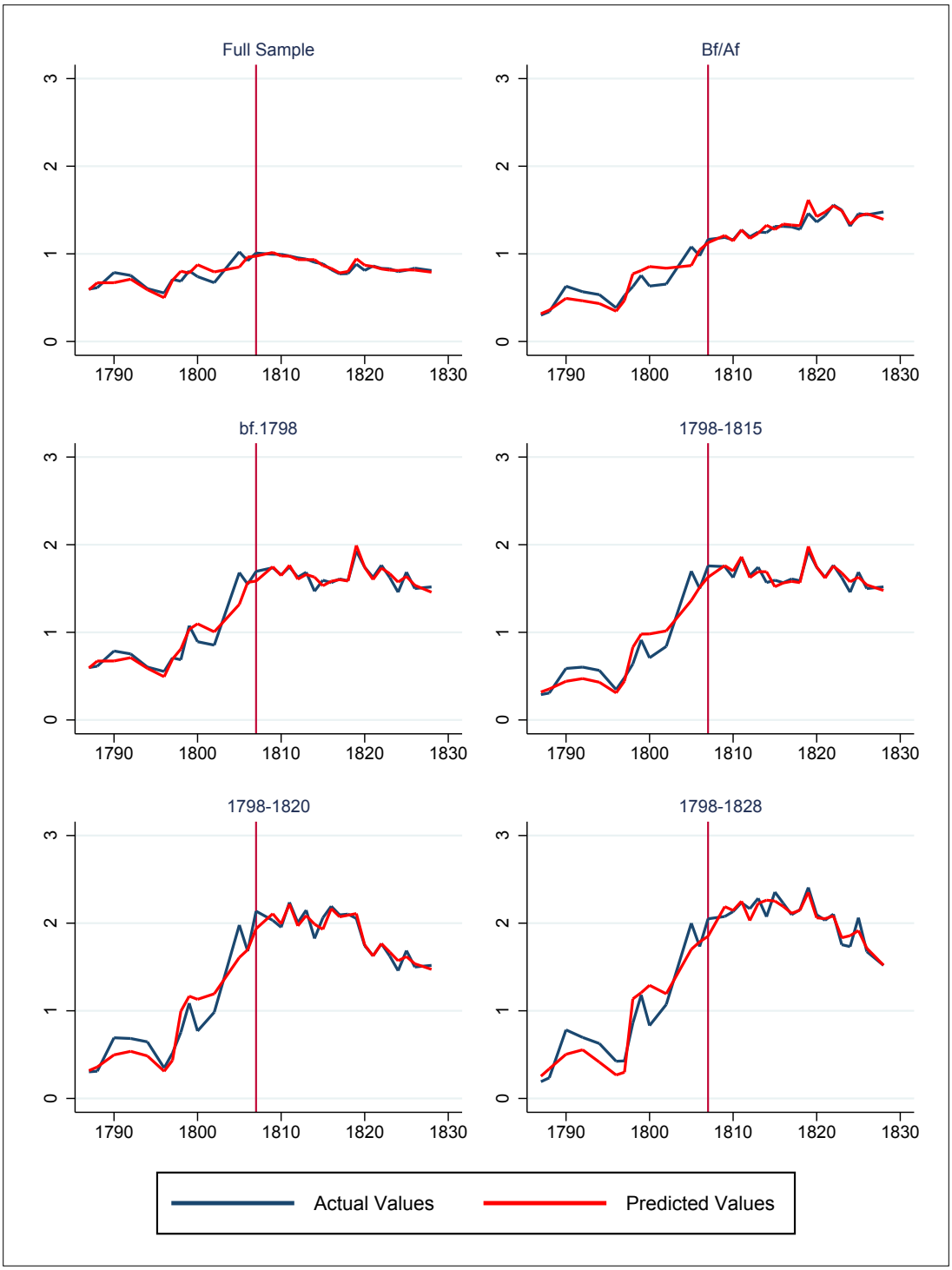

Figure 15: Average number of adult slaves per household, actual vs. predicted, Graaff-Reinet