

# Was slavery a flexible form of labour?

## Division of labour and location specific skills on the Eastern Cape Frontier

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### 1. Introduction

Slavery's persistence as an economic institution for millennia, serves as a testament to its success in adapting to different settings across time and space (Acemoglu et al. 2001; Acemoglu et al. 2002; Nunn 2007; Engerman 1986). According to scholars, one of the paramount benefits of slave labour was its relative flexibility when compared to other forms of unfree as well as free labour (Engerman 1986; Anderson & Gallman 1977). It was relatively inexpensive to retrain and repurpose slaves since above subsistence level the slave-owner could extract earnings over the entire lifetime of the slave and its offspring. Meanwhile, slave labour could quickly be mobilised for a wide range of different activities, which made this form of labour especially suitable for agriculture enterprises where 'time is of the essence' (Berry 1993). Achieving this level of return, flexibility and labour supply security from other types of labour was almost unattainable, despite the argument that hunger outweighs coercion (free labour productivity trumps coerced effectiveness).

This flexibility of slave labour as an economic institution has often been assumed as a given. Naturally, some capital investment is necessary to retrain novice slaves but essentially they could be substituted for any other form of labour after this initial "training" period is completed. Having said that, the almost canonical substitutability assumption seems to be refuted by many cross-sectional studies, performed especially on American slave data which have found that slave and free labour are essential two very different production inputs and cannot be assumed to be substitutes. The fact that these cross-sectional studies by nature largely ignores time and the evolution of labour characteristics leaves the debate on the adaptability of slavery largely open (Field 1988; Schmitz & Schaefer 1978).

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The district of Graaff Reinet in the Cape Colony at the close of the eighteenth century presents an opportunity to test the flexibility of slave labour theory. The district was located on the open eastern frontier of the Cape colony. Following the sociological definition of open frontier societies this means that a clear hierarchical order had not yet been established. The fluidity of the social organisation in early 19<sup>th</sup> century Graaf-Reinet has been noted in the abundant literature on the recurrent frontier wars in which white settlers and indigenous populations entered into violent conflicts. For the settler farmers - who were mainly engaged in pastoral farming and relied significantly on the employment of the indigenous Khoe population – the frontier wars meant increasing difficulties in obtaining sufficient access to workers. Theoretically since this society was pastoralist in nature slavery as a source of labour would not have existed (Domar 1970). However; a small but wealthy group of slave-owning farmers were very much present in Graaff Reinet and could theoretically respond to this exogenous shock by substituting the loss in the indigenous labour force with slave labour. In this paper we analyse to what extent the indigenous labour was actually substituted by slave labour, i.e. to what extent did slave labour constituted a flexible form of labour that could be used to cope with the exogenous shocks caused by the recurrent frontier wars.

The availability of transcribed Cape colonial datasets such as the Dutch East India Company (VOC) *Opgaafrollen* or tax census data and the MOOC8-series probate inventories, give the added ability to empirically assess the relationship between different types of labour in this open frontier society. Since free settlers, khoe and slave labour is included in this tax census data, this study is uniquely able to incorporate more forms of labour in the agricultural production process. Hicksian elasticity of complementarity coefficients are calculated for each year of the 21-year combination of cross-sectional tax datasets (1805 to 1828) to assess the relationship between slave, settler and Khoe labour over time. The elasticities of complementarity are calculated by estimating Transcendental Logarithmic (Translog) production functions for each year of the study (Berndt & Christensen 1973). We find that Khoe, settler and slave labour remain strong complements over the period of the study. Insofar as the settler and slave labour relationship goes, the results confirm that the master-servant dynamic was already in place. This fact by itself lends some credence to the finding that at least slave and settler family labour may be two completely different inputs in the agricultural production process.

The results pertaining to the relationship between slave and Khoe labour is somewhat surprising since it would be natural to assume that at least these two forms of labour would be

easily substitutable. Yet Khoe and slave labour remain complements throughout the frontier period, largely dispelling the notion that slave labour at Graaff Reinet was a reasonably flexible labour source over time. We argue that the lack of substitutability was due to the need of the settlers to acquire labour with location specific skills. Herding in Graaf-Reinet required knowledge about the environment and climate. These were skills that Khoe labourers already possessed due to their long tradition of engaging in pastoral farming practices. They knew the environment very well and how herds needed to be moved throughout the season in order to access high quality grazing lands. Slaves on the other hand needed to be trained in order to reach the same level of efficiency. Training in these location specific skills were costly and time consuming and slaves were therefore mainly employed for domestic work. In times of shortages of Khoe labour, employing slaves as herders were not an option as long as they lacked the location specific skills.

This paper is organised as follows. In section two we discuss what explains the resilience of slavery as an economic institution. Section 3 examines the state of the eastern Cape frontier at the advent of the nineteenth century, whereas section four discusses the sources of labour employed at Graaff Reinet for the period. Section five gives an overview of the data sources along with the method employed in this paper. Section six presents the results obtained from the Translog analysis and Hicksian elasticity of complementarity coefficients. Section seven discusses the context specific preference for labour at Graaff Reinet and the division of labour in the livestock rearing process. Finally, section eight makes concluding remarks.

## 2. What explains the resilience of slave labour as an economic institution?

A powerful and popular argument – famously known as the Nieboer-Domar hypothesis - is that slavery as an economic institution arises in an open frontier environment with abundant land and scarce labour (Nieboer 1900, Domar 1970, Engerman 1986). In this setting, coercion, in the presence of elite pressure, is needed to force otherwise free labour to produce agricultural staple outputs. In essence, the sheer absence of willing and able labourers in the face of vast tracts of land for agricultural undertakings creates the necessity to enslave. In a closed frontier setting where land is scarce and labour numerous, unfree labour arrangements would dissipate

as a landless wage-earning labour class would be readily available to perform the work formerly performed by slaves. By virtue of this argument the American Civil War appears to have been a futile undertaking since slavery would have disappeared naturally as land became more scarce. Engerman (1986) specifically notes that the Nieboer-Domar theory on the origins of slave labour provides no time facet as to when this slavery-free or scarce land point would be reached and very seldom if ever has any system of enslavement spontaneously disintegrated. Unfree labour arrangements, if anything, continues to be persistent and yields significantly more economic benefits to its benefactors than merely being a temporary placeholder for more efficient free labour (Engerman 1986; Russel 1941).

In contrast to free labour, slaves are a stable cheap source of readily available labour for the slave-owner (Gray 1930). Often the immense distance between the slave's place of origin and their eventual destination of work made large-scale desertion an almost insurmountable task. Additionally, unlike free labour, slaves were less prone to organise strikes or lockouts due to pay disputes since there was no need to compensate a slave above subsistence levels. In a foreign, far away land, slaves had no choice but to stay with their masters; therefore, being available for tasks anytime at their master's leisure. Gray (1930) also found that slaves were particularly profitable for the production of staple crops such as sugar, cotton and tobacco but not for general farming. This was largely due to the economies of scale which can be gained from large scale staple crop cultivation by a large labour force as opposed to small scale general farming operations.

Perhaps the most important direct benefit to slaveholding came through its relative inexpensiveness when compared to other forms of unfree labour. Since slave prices reflects, among many things, the lifetime labour benefit of the slave and their offspring, purchasing indentured labour for a similar amount, in principle, would be relatively more costly (Nash & Flesher 2005; Gray 1930). This is primarily due to the fact that indentured labour by its very nature may be contractually bound for a pre-specified time. Investing in the training of a slave therefore becomes less costly since the appropriable period of service stretches across most of the slave's lifetime and that of their offspring, whereas indentured service does not have this benefit – at some point the contractual labour benefit ends. Ultimately, slave labour is much less expensive than indentured workers to retrain as farming needs change (Gray 1930). This relative inexpensiveness when compared to other forms of labour exhibited by slavery makes it extremely flexible.

This inherent flexibility of slave labour in open frontier communities implies that with some investment in training slave labour could effectively perform any type of work at great benefit to the slave-owner (Gressley 1958). Engerman (1986) notes that it is precisely due to the economic success and the great flexibility of slavery in the Antebellum Southern United States that, there were no signs of the economic demise of slavery, despite heavy political opposition during the 1830s. Slave labour was essentially substitutable with any type of other labour should the slave-owner have need of it.

A significant amount of literature on the economics of American slavery assumes the near perfect substitutability between free and slave labour (Domar 1970; Engerman 1986; North & Thomas 1971; Fenoaltea 1984). However, this matter is questioned by Field (1988) since she finds that slave and free labour in the Antebellum South are complements or considered to be entirely different inputs in the agricultural production process. Slaves performed the hard gang labour on these cotton plantations and free labour played a managerial role. On the larger plantation farms, Negro slaves would work under the supervision of overseers and on smaller farms under the direct eye of the slave master themselves (Zeichner 1939). A later study conducted by Schmitz and Schaefer (1978), utilising a CES-production function analysis also conclude that free and slave labour are quantitatively different inputs in the agricultural production process (Schmitz & Schaefer 1978:6). These conclusions suggest that slave labour may not be as easily substitutable as is commonly assumed. However, these studies employ cross-sectional datasets taken in one specific year effectively giving a static picture of the substitutability between various types of labour.

It might intuitively appear as if the type of work performed by enslaved people and their free counterparts are fundamentally different. In major slave societies, enslaved people have typically performed the tasks that free labourers deem too strenuous or too costly to perform. Historians have continuously noted that English legislators, on the eve of the abolition of the slave trade, were quite concerned about the preference for leisure which free slaves exhibited. In fact, many anti-abolitionists in the United States attributed the slow Postbellum Southern economic recovery to the reluctance of emancipated slaves to work with the same intensity as their forebears on cotton and sugar plantations (Engerman 1976). Aside from the fact that these arguments may have been used as a racist qualification for Postbellum economic sluggishness, it completely ignores the fact that no elite or government pressure was sufficiently present to support labour coercion (Domar 1970).

Ultimately, the Cape colony offers the ability to study a slave society outside of the Americas, which may be useful in testing the robustness of some of the general conclusions made on slave labour. Graaff Reinet in particular offers the unique ability to test the slave labour flexibility assumption in a pastoral setting. This is especially unique since despite the fact that most economic theories on the origin of slavery, claim that slavery or serfdom would not arise in a pastoralist setting, Graaff Reinet settler farmers made use of both slaves and indentured indigenous labour. The Cape colony in its many idiosyncratic facets confirms that very few slave societies were similar and it is often a convoluted exercise to attempt to develop any general theories applicable to these economies.

### 3. The state of the Cape eastern frontier at the advent of the nineteenth century

Initially the Cape Colony was governed by the Dutch East India Company (VOC) from 1652 to 1795 before gradually coming under British control. The VOC's strategic interest in the Cape primarily stemmed from the need for a refreshment station for its passing ships en route to the east. As the allure of the Cape outpost grew over time and settler family fertility expanded, the number of European inhabitants increased steadily and by the early 18<sup>th</sup> century the Cape had established itself as a settler colony (Fourie & von Fintel 2010; Shell 2005). Most European farmers settled in the southwestern part of the Cape, where they engaged in wine and wheat farming but as immigration continued more and more European settlers moved further into the eastern and northern frontier regions.

The Graaff-Reinet district, on the eastern frontier of the Cape Colony, was established in 1786 to accommodate the growing need for land by newly arrived Europeans (Newton-king 1988). By the advent of the 19<sup>th</sup> century the levels of wealth inequality in this district were even for Cape Colony standards strikingly high, and while a small group were doing very well a majority of farmers were hardly making ends meet (Netwon-King 1992, Cilliers and Green 2017). Differently from the southwestern Cape, pastoral farming was by far the dominant economic activity in Graaff-Reinet. Stock-farming was not new to the area. On the contrary, the area had been an area utilised for stock farming for more than 2,000 years (Keay-bright & Boardman 2006). Although not being isolated from the rest of the Cape economy, trade with the commercial southwestern Cape was limited primarily to the livestock trade because of long-distances and rough weather conditions (Beinart 2003: 10).

Although we lack precise estimates, scattered evidence shows that land was in abundance while labour was scarce in Graaff Reinet by the early 19<sup>th</sup> century (Cilliers and Green 2017). Following the Nieboer-Domar hypothesis it seems plausible to assume that various forms of coercion were needed for the Europeans to access adequate supplies of labour (Nieboer 1900, Domar 1970). While various forms of coercion were applied, it was less common to use it in its most extreme form – slavery – compared to the southwestern Cape. This may be explained by the combination of the average farmer being relatively poor and the dominance of pastoral agricultural activities. The Nieboer-Domar framework notes that slavery or serfdom will not take root in a pastoral agricultural society since it is a labour saving agrarian practice, so assuming the scarce labour and abundant land in an open livestock rearing frontier setting may not be applicable (Conning 2004). Having said that, it is far from easy to make a clear distinction between free and unfree labour. Most farmers were depending on a combination of both. Wealthier farmers utilised slaves side by side with ‘free’ Khoer wage labourers and indentured labour, while poorer households combined family labour with wage and indentured labour. Given that Graaff Reinet was an open frontier marked by a fluid social organisation with a changing balance of power one could argue that the advantageous of relying on different forms of labour all depended to which degree they were substitutes or not. Before we turn to that question it is essential to discuss to what extent it is valid to conceptualise Graaff Reinet 1805-1828 as an open frontier.

There is in the literature two different approaches to conceptualise an open and closed frontier. In the economic and economic history literature an open frontier is characterised by low population densities, low levels of urbanisation and limited market access (see McInnis 1977 for an overview). For the purpose of this paper we are however more interested in the sociological definition of an open frontier. In that regard Giliomee (1971) provides a useful framework within which to evaluate the frontier closure process. The entire frontier closure process is denoted by closure on the political, economic and social front. Economic closure is characterised by the increased scarcity of land, a shift from subsistence to commercial agricultural practises and growing control over the factors of production by a dominant group. A politically closing frontier is signified by the rise of a single source of authority and finally, social subjugation entails the stratification of society based on criteria such as race or wealth. When these three process are complete the society cannot be considered an open frontier any longer (Giliomee 1971; Penn 1986). Closure on these fronts often is accompanied by periods of intense violence as one group attempts to achieve supremacy above another.

Cilliers and Green (2017) show that Graaf Reinet over the 1800-30 period was a closing but not a closed frontier in the economic sense of the term due to increased population pressure causing the continuous establishment of new district boarders. The frontier closure in the political sense was also far from complete since no supreme colonial authority had been established by the period of this study. Ultimately, Graaff Reinet frontier closure would be considered complete if the colonial powers had succeeded by then to establish themselves as the singular hegemonic authority (Giliomee 1971).

Scholars like Newton-King (1980) argue that the frontier was already closed in the political sense by late 18<sup>th</sup> century as the colonists had already gained the upper hand in the struggle for the eastern frontier at Graaff Reinet. However, fig. 2 indicates that Newton-King is neglecting to account for the tremendous fluctuation in Graaff Reinet population numbers. This was a clear indication that no clear political dominance had yet been established by the colonial authority. The settler population numbers at Graaff Reinet varied substantially over the 1805 to 1828 period, indicating a society still very much in flux and far from hegemonic. The major declines in the number of settler households at Graaff Reinet coincided with major frontier events.

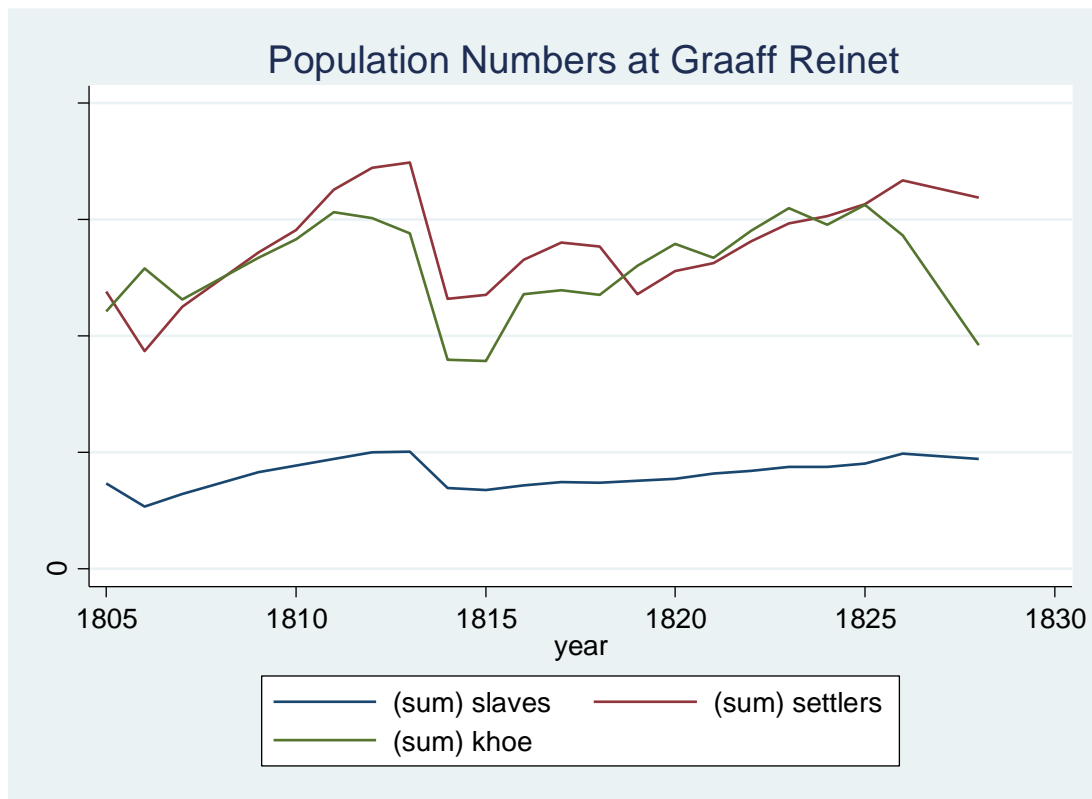
Figure 1 shows the size of the settler, slave and Khoe population at Graaf Reinet over the 1805-28 period. It clearly shows that settler, slave and Khoe numbers were contracting and recovering throughout the period. To some extent this pattern can be explained by administrative changes. For example, one of the first significant settler population declines in Graaff Reinet occurred around 1806. Not only was this the first year of the second British occupation at the Cape but it was also the year after the formation of the Tulbag district. These two significant changes meant that colonial boundaries were considerably altered, with some settlers previously categorised in the greater Graaff Reinet *landdrost*, now finding themselves in the newly established Tulbag sub-district (Legassick 1970; Freund 1972). Moreover, the incentive for accurate or at least credible record-keeping was also much lower during the time of handover from the Batavians to the English.

Having said that, the major subsequent declines in the settler and Khoe population was not caused by administrative changes but social and political conflicts. During what is now known as the Third Frontier War during 1799 to 1803, Xhosa chiefs and heavily armed Khoe virtually destroyed the eastern frontier economy forcing many settler families to flee from the company loan-farms that they occupied (Freund 1972). Not only was this a tumultuous time for the



Graaff Reinet region, but for the entire Cape. At the time, control of the colony briefly shifted to the British during the Napoleonic Wars prior to the conclusion of the Treaty of Amiens in 1802, where after control of the Cape reverted back to the Batavian Republic. This weakness in colonial authority was effectively capitalised on by the Xhosa and Khoes as the Batavians were forced to agree to leave the Xhosa in the Zuurveld and the eastern colonial border unchanged (Legassick 1970). The decline in 1814 occurred immediately after the conclusion of the Fourth Frontier War (1811 to 1813). In addition to the loss of life related to the conflict, the colonial authorities actively campaigned for settlers residing in Graaff Reinet and Uitenhage to relocate to the Zuurveld after the Xhosas had been expelled. This move was encouraged so that the likelihood of the Xhosas returning to the Zuurveld area would be reduced substantially. As a natural consequence population numbers fell steeply since the disillusioned settlers moved further east in search of greener pastures. It is also not imprudent to assume that the settler farmers relocated with their slaves and cattle. The Fifth Frontier war which occurred from 1818 to 1819 also led to decline in settler numbers at Graaff Reinet albeit to a smaller extent, since the then governor of the Cape, Lord Charles Somerset, encouraged resettlement to the area between the Fish and Keiskamma rivers (Legassick 1970). The advancement further east clearly indicates that economic closure was also by no means complete.

**Figure 1: Khoe and Slave numbers in Graaff Reinet *Opgaaffrollen* 1802 to 1823**



Had social stratification set in to the degree that the eastern Cape frontier could be considered closed in the social sense over the 1805-28 period? Social stratification had already set in by the early 19<sup>th</sup> century when looking at the treatment of the indigenous Khoe and Xhosa, by European settlers. Legislative coercion measures such as the *Inboekstelling* – a pass system which severely inhibited the movement of Khoe who did not carry the right papers – in 1775, was a one of the first official measures utilised to impose settler hegemony upon the indigenous people (Penn 2005). In the early 19<sup>th</sup> century the English made further attempts to formalise indigenous subjugation through indenturing Khoe labour to European settler farmers by implementing the Caledon Code in 1809. The traditionally nomadic Khoe now had to show proof of a fixed place of abode which had to be approved by a local colonial government official. Additionally, this legislation deliberately lacked explicit recognition of Khoe property rights, denigrating the indigenous population to a landless-labour class (Legassick 1970; Eldredge 1994). However; the presence of often successful indigenous revolts in the form of at least two frontier wars over the period of the study paints the picture that settler hegemony and social stratification, although growing in extent, was also vehemently challenged (Mason 1994; Cornwell 2003). Although social stratification, despite being challenged by the indigenous population, had already taken hold the eastern frontier was open on political and

economic grounds presenting a considerable challenge for European farmers in maintaining a stable indigenous labour force.

Since Khoe labour still had the opportunity to opt out of working for settlers at Graaff Reinet, it is natural to assume that settler farmers would prefer household and slave labour as an alternative workforce. Theoretically, slave and household labour would be much easier to mobilise and the enforcement costs of inducing the necessary work would be much lower than would be the case with the Khoe, especially in the turbulent open frontier setting. If a sufficient number of slave and family labour is available, it would always be preferable to utilise less of the rebellious Khoe.

#### 4. Labour on the eastern frontier region of Graaff Reinet

The main sources of labour that were available to the Graaff Reinet pastoralist economy during the 1805-28 period were slaves, Khoe and family labour. The services of knechts (i.e. European wage workers) were also utilised on farms; however, their contribution to the pastoral eastern colonial economy remained negligible. Table 1 shows that the average settler household at Graaff Reinet had a sheep flock size of around 496 and had 44 heads of cattle. Graaff Reinet frontier households also had 3 family labourers, 4 Khoe and 1 slave available on average. However; these figures obscure wealth inequality at the frontier and may not be a true reflection of the labour distributional Graaff Reinet over the period of the study.

	Average	Std. Dev	Min	Max
Sheep	496.8189	759.92425	0	14121
Cattle	44.73262	72.83999	0	2813
Family Labour	3.927484	2.835763	0	16
Khoe	4.095743	6.780244	0	78
Slaves	1.149111	2.953827	0	61

Since the eastern frontier had the appeal of so-called social mobility for poorer settlers, many flocked to the Graaff Reinet hinterland in search of greater fortune (Mitchell 2009). Dooling (2005) notes that the poorer eastern frontiersmen were primarily dependent upon family labour in order to tend to what little planting and livestock was available to them. Frontier settlers were also the offspring of northern European, German, Baltic and Dutch artisans that were forced into the service of the VOC by poverty. So in addition to being pastoralists many of the frontiersman also possessed artisanal skills passed down to them from their parents (Newton-

king 1988). The artisanal trades included masonry, shoemaking, carpentry, tailoring and saddle-making. The poorer frontiersmen would therefore employ a mix of economic activities (plying their trade and rearing some livestock) in order to survive.

As settler flocks grew over the decades so they would employ the services of indigenous labour to tend to livestock. Despite these fortuitous prospects for settlers, Penn (2005) argues that the open frontier presented a significant challenge for the migrant settlers. Vast tracts of land were available for grazing and raising large flocks, yet labour was scarce. Historians concur that labour shortages were acutely felt by settler households on the eastern frontier by the turn of the 18<sup>th</sup> century (Penn 1986; Penn 2005; Newton-King 1980; Mason 1994). Indigenous labour was not only in short supply, but remained highly unreliable. Figure 1 above clearly indicates the extreme volatility in Khoe numbers, especially during and after the Fourth Frontier War (1811-14 period).

It is widely known that slavery at the Cape was initiated at the behest of the VOC. As such, Cape slavery originated as an urban phenomenon, motivated through the demand of the VOC for labour to complete amongst many other tasks its various infrastructural endeavours (Green 2014:47; Fourie & von Fintel 2011; Shell 2005). As wheat and wine production expanded over the course of the 18<sup>th</sup> century – largely due to the arrival of the French Huguenots in 1689 – so the utilisation of slave labour grew amongst the free settler farmers. In theory however; slavery would not arise in the pastoralist eastern frontier environment, particularly due to the fact that cattle and sheep rearing activities are labour saving. Yet slave labour became an integral part of Cape society, even on the fringes of the colonial borders. Wealthier frontier farmers at Graaff Reinet made extensive use of slaves in their pastoral farming practices and homestead, albeit to a noticeably smaller extent than wheat and wine farmers at the fertile south-western Cape (Fourie 2011). This is also evident from Figure 1, since slaves were present in settler households throughout the period of this study.

In order to deal with the scarce and volatile labour supply experienced by settler farmers at Graaff Reinet and since the Cape was already a slave based economy, the flexibility of slave labour should have made it easy for settlers to merely purchase slaves and have them retrained to do the necessary work. Yet Graaff Reinet was peculiar in that Khoe labour (indentured or free) was always preferred to slave labour.

Yet the critical question remains as to why eastern frontier settler households did not merely rely on slave labour to a greater degree when indigenous labour was such a volatile labour

source? If the risk of the Khoe simply deserting farms or stealing cattle was great and it was relatively more expensive to utilise indigenous labour it would seem that the least risk and cost would be incurred by purchasing imported slave labour which would easily be able to adapt to the pastoral farming environment. However, the journey to the Graaff Reinet frontier exceeded 600 km in distance and would often take weeks to complete, since no navigable rivers were present. Purchasing at least one slave in Cape Town and transporting that slave to the interior would be a vast expense for the relatively poor frontiersmen (Lovejoy & Ross 1985). It was therefore significantly less costly to capture and maintain Khoe indentured labour than to purchase slaves (Freund 1972). Figure 2 clearly illustrates that the use of slave labour was highly concentrated in wealthier households. Over the entire 1805 to 1828 period the poorest 25% of households only had access to an average 0.2 slaves (virtually no slaves at all). In contrast the wealthiest 10% of households at Graaff Reinet had access to an average of 4.3 slaves over the period of the study. Slave use was highly concentrated in wealthier households.

Figure 2:

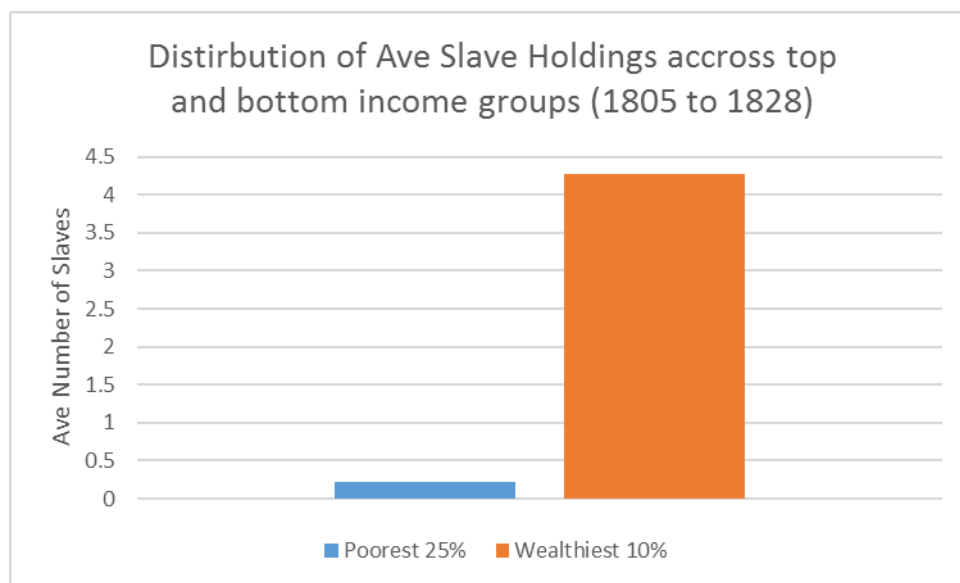
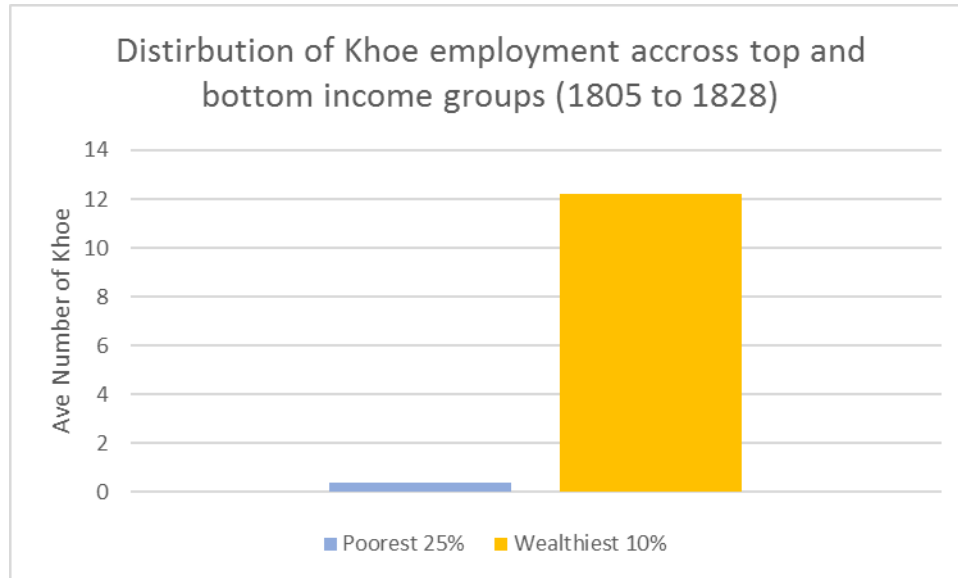


Figure 3 shows how the poorest 25% of settler households had access to around an average of 0.4 Khoe labourers over the entire period of the study (this also virtually counts as zero). The wealthiest households naturally had access to an even greater pool of Khoe labour. The top 10% of wealthy households at Graaff Reinet had access to an average 12.2 Khoe labourers over the period of the study, once again confirming that Khoe labour was more widely utilised. Poorer households generally could chiefly rely on family labour but were much more likely to make use of Khoe labour than slave labour (this fact is somewhat obscured by the average figures).

Figure 3:



Mason (1994) also confirms the fact that the settler population at Graaff Reinet had always favoured the use of cheaper (indentured and free) Khoe labour to slaves. More important, the Khoe possessed location specific skills for stock farming in the eastern frontier district that was critical for any successful farming endeavour. The indigenous Khoe had the exact knowledge of the most appropriate watering holes, the types of predators and their general locations, the most prevalent diseases, the distribution of edible vegetation and the rainfall patterns of the area. This vast toolkit of knowledge regarding sheep and cattle farming had been accumulated across the centuries as the Khoe had been pastoralists themselves. During much of the latter half of the eighteenth century, Khoe labour constituted around 40% of the farming labour force of settlers on the eastern frontier (Scogings 2004).

## 5. Data sources and Method

### a. Data

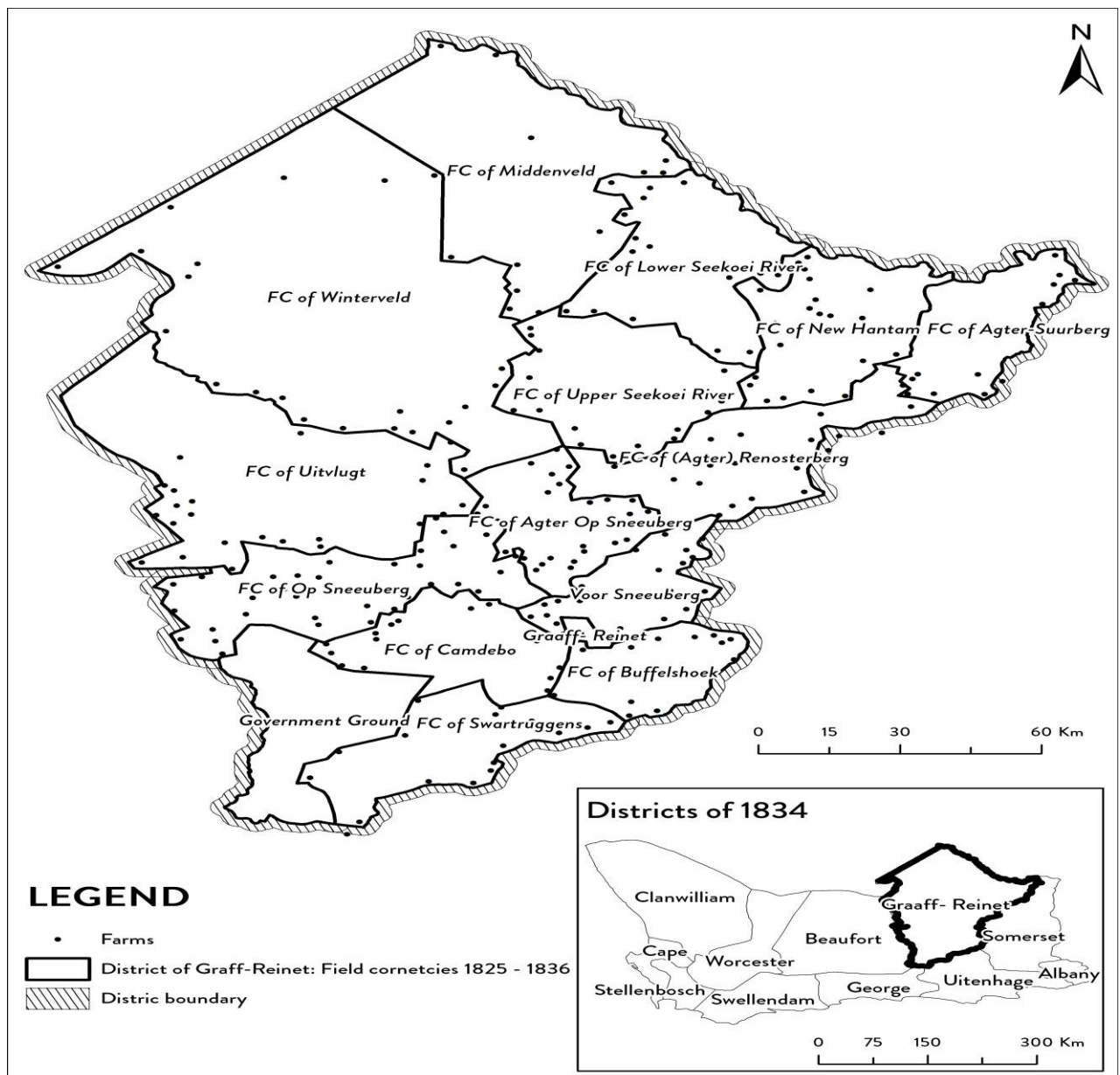
The main data component employed in this analysis comes from the transcribed Graaff Reinet VOC *Opgaafrollen* for the 1805 – 1828 period. This data combines a series of cross sectional

information sets for settler farming families in different areas<sup>2</sup>, recording their holdings for a given year so that their tax liability could be determined by company officials. Figure 2 exhibits a map outline of the various sub-districts (Feld Cornetsies) of Graaff Reinet. These holdings included amongst other things the number of Khoe labour, slave labour, the amount of livestock kept, the number of wagons, the number of vines, the amount of wine produced as well as the amount of crops sown and reaped. One of the major shortcomings of the dataset is that it does not include information for the years 1804, 1808 and 1827.

**Figure 4: Feld Cornetsies at Graaff Reinet in 1834**

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<sup>2</sup> These areas included Graaff Reinet town, Agter op Sneeuwberg, the Agter op Rhinocerberg, the Zuurberg, Buffelshoek, the Camdeboo, Zwartuggens, Ghoup, Nieuweveldt, the Lower and Upper Zeekoei rivier, the Hantam, Zwartberg, the Winterveldt, Uitvlug and Swaggershoek, collectively termed the Graaff Reinet district for the puposes of this study.



Include source for map

The data employed also limits the scope of this study to the eastern frontier population recorded in the VOC *Opgaafrollen*. This essentially means that our analysis falls prey to the “population under European influence” problem (Fourie & von Fintel 2011). The dataset also includes information on Khoe labourers working for settler farmers on the eastern frontier. However; no distinction is made between indentured and free Khoe labour. Figure 1 shows that on average, Khoe labourers at Graaff Reinet outnumbered slaves by four to one, which effectively proves that Khoe labour was always more important on the eastern frontier than slaves. Settler and Khoe labour were also roughly equally represented in the Graaff Reinet tax



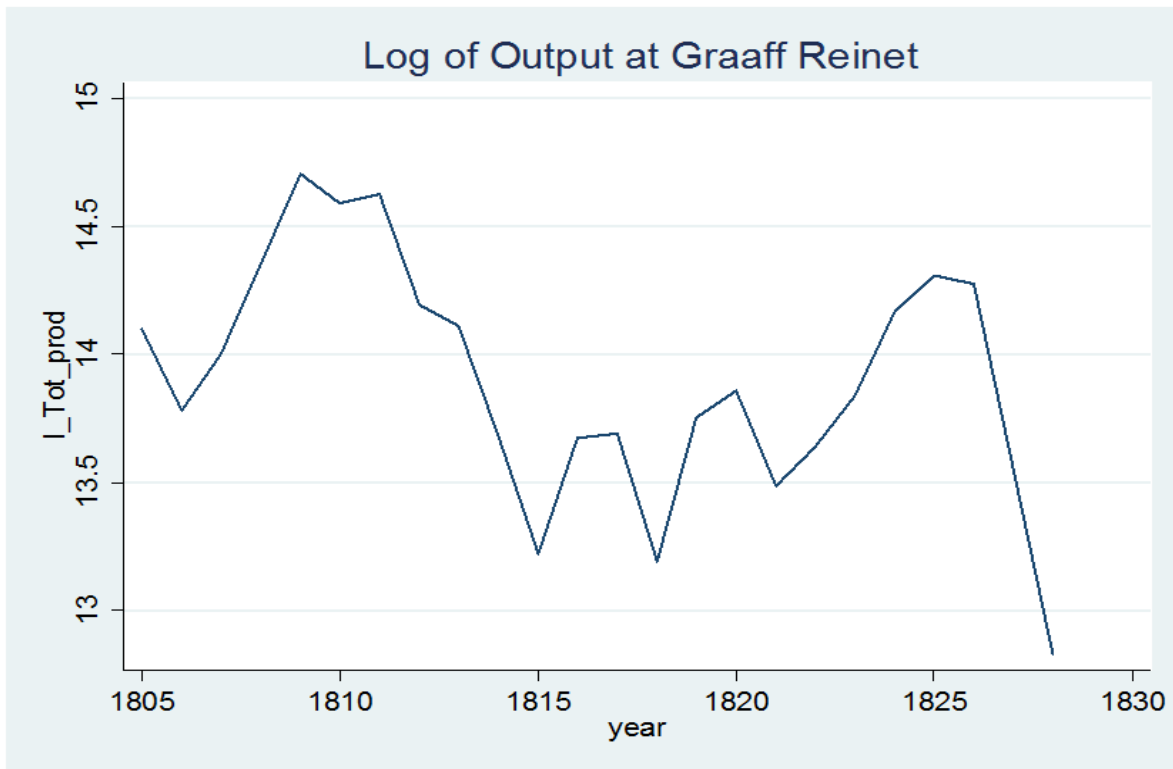
censuses. This information is particularly important, especially since excluding the Khoe from studies of the economy of the early Cape colony would yield an inaccurate overall picture of the colonial agricultural production process (Fourie & Green 2015).

Since sheep and cattle rearing formed the backbone of Graaff Reinet agriculture it would be normal to expect that the size of sheep and cattle holdings to vary with the frontier migration patterns since sheep and cattle move with their owners. Figure 3: plots the log value<sup>3</sup> of combined sheep and cattle numbers spanning the period 1805 to 1828. This plot clearly shows the extreme volatility present in frontier livestock holdings over the period of study. What is also clear is the apparent devastating effect that frontier conflicts such as both the Fourth (1811 to 1813) and Fifth Frontier Wars (1818 to 1819) had on livestock holdings. It also appears as if the livestock holdings of frontier settlers at Graaff Reinet does not recover completely after the Fourth Frontier War in part due to migration of Graaff Reinet and Uitenhage settlers further into the Zuurveld. The severe dip in livestock holdings in 1828 and missing 1827 values is as a result of poor record-keeping to the end of the utilisation of the *Opgaafrollen* by the British colonial authorities. Since the British colonial government was relying less on older VOC administrative processes, which depended on the old loan-farm system for collecting taxes, the incentive to maintain accurate *Opgaafrollen* data declined sharply.

**Figure 5: Value of Total cattle and sheep production and settler numbers 1802 to 1823**

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<sup>3</sup> The price data obtained to calculate the values for cattle and sheep originates from the MOOC8-series Probate Inventories as indicated later on in the paper.



#### b. Method

The ultimate aim of this paper is to determine whether or not slaves at Graaff Reinet was a flexible source of labour. Since Graaff Reinet at the time of this study was a typical frontier society it would be natural to expect that slave labour would at the very least be substitutable with Khoe labour, especially during times of Khoe desertions. What makes this study particularly unique is the fact that the indigenous Khoe labour can also be incorporated into this analysis. In order to observe whether this substitutable labour relationship was present in this open frontier society this study makes use of Transcendental Logarithmic (Translog) production functions to calculate elasticity coefficients for each year of the *Opgaaffrollen* considered (Field 1988; Behar 2010). We will essentially be estimating the price elasticity of complementarity between the three types of labour (slave labour, Khoe labour and settler labour) on the eastern frontier for each year from 1802 to 1828. The elasticities derived for each year (and production factor) of the study will effectively show whether these types of labour during the period of study remain substitutes or not. Graaff Reinet frontier household units will be treated similarly to firm units analysed by Behar (2010).

Methodologically, utilising a Translog production function relaxes the assumption of strong separability between the production inputs assumed by other functional forms such as Constant Elasticity of Substitution (CES) and Cobb-Douglas production functions (Berndt & Christensen 1973). This a priori assumption may lead to incorrect inferences if the degree of elasticity between the factor inputs is different for different settler households (Berndt & Christensen 1973:82). This problem is largely solved by utilising more flexible functional forms such as the Generalised Leontief production Functions or Translog Production functions.

Ultimately the following Translog production function is specified:

$$\ln Q_{it} = a_0 + a_{St} \ln S + a_{Kt} \ln K + a_{Ft} \ln F + \frac{1}{2} b_{SSt} (\ln S)^2 + \frac{1}{2} b_{KKt} (\ln K)^2 + \frac{1}{2} b_{FFt} (\ln F)^2 + b_{SKt} \ln K \ln S + b_{SFt} \ln S \ln F + b_{FKt} \ln F \ln K \quad (1)$$

In equation (1)  $\ln Q_{it}$  represents the log of output for each settler household at time  $t$ ,  $S_t$ ,  $K_t$  and  $F_t$  are the utilisation of slave, Khoer and settler labour in the Graaff Reinet agricultural production process at time  $t$ . Furthermore, we assume that the major industry for the Graaff Reinet district was livestock rearing, a fact confirmed by Penn (2005). More specifically, the output variable in the production function  $Q_{it}$  is assumed to be a combined sheep and cattle indicator. In making this assumption the fact that other non-agricultural or even crop based agricultural outputs are not considered may also have a distorting effect on the elasticity of substitution coefficients calculated. This is especially true when considering the fact that the *Opgaafrollen* entirely neglects to incorporate data on manufactured goods such as soap, which appears to have generated large profits for frontier households (Mason 1994:95).

The final output variable was obtained through multiplying settler household cattle and sheep holdings per year by price data obtained from the eastern Cape colonial probate inventories recorded in the MOOC8-series<sup>4</sup>. The entire probate inventories information transcribed, span 162 years and record the value of assets accumulated in an individual's estate at death. We only utilised prices which appeared in the records during the 20-year period of the study. Ultimately, the value of total cattle production and sheep production were then added together to form a global output variable for Graaff Reinet. Since the output variable in the Translog production function has to be transformed from a stock concept to a flow, each year's stock output was multiplied by a rate of return on capital of 6% (Worden 1985).

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<sup>4</sup> MOOC is an abbreviation for The Master of the Orphan Chamber.

The rate of return of 6% selected stems from the fact that the general average rate of return on assets or loans for the Cape colony at the time was approximately at this level. This decision was also taken since merely calculating the change in cattle and sheep holdings from year to year and multiplying that figure by price would not yield any meaningful results. Particularly due to the fact that if stocks of cattle decline from one year to the next, it might be either due to a farmer's sale of the livestock or due to losses as a result of disease. The ambiguity this scenario creates has prompted the methodology applied to calculating the output variable.

This physical production process will be estimated by means of Ordinary Least Squares (OLS). It is assumed that all inputs are exogenous, factor prices are endogenous and that input and output value selection does not occur simultaneously. The estimated parameters will then be utilised to calculate the cross-price Hicksian Elasticity of Complementarity (HEC) for the different labour inputs. The HEC coefficient for each year will be estimated by the following equation:

$$HEC_{ijt} = (b_{ijt} + M_{it}M_{jt})/M_{it} M_{jt} \quad (2)$$

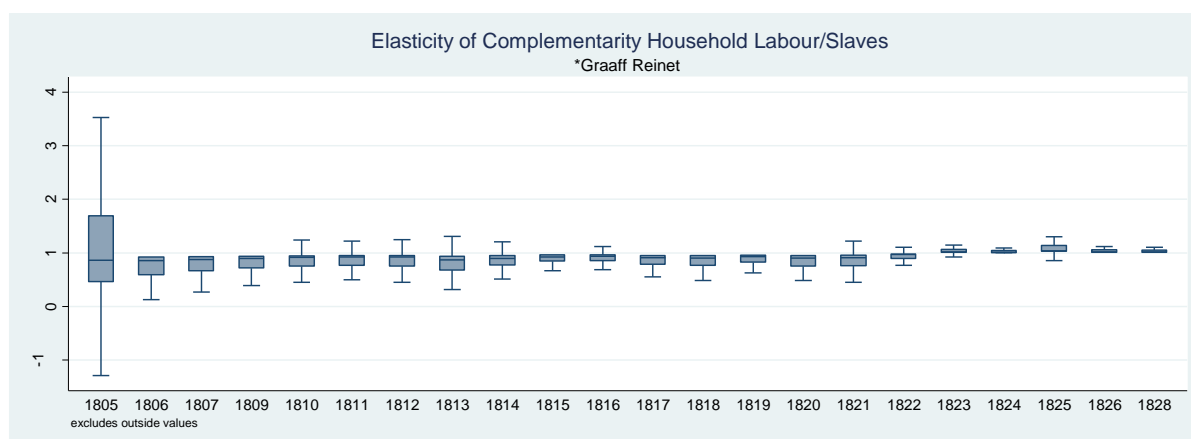
In equation (2)  $HEC_{ijt}$  is the calculated elasticity of complementarity between factor  $i$  and factor  $j$  at time  $t$ ;  $b_{ijt}$  represents the estimated parameter for the interaction term between  $\ln i$  and  $\ln j$  at time  $t$  and  $M_i$  is the logarithmic marginal product  $\partial \ln Q_t / \partial \ln X_{it}$  at time  $t$ .  $M_{it}$  and  $HEC_{ijt}$  are functions of the inputs K, S, and F. This analysis will derive Elasticity of Substitution values for each settler household during each year of the study.

In estimating the Translog production function for each year of the *Opgaafrollen* a five year moving average for each year is calculated. This smoothing approach increases the observations utilised in each regression adding to the robustness of the eventual results. If the elasticity of Complementarity coefficient is calculated to be strongly positive ( $AES_{ij} > 0$ ) the inputs in the production process are complements (different inputs all together), however; if the elasticity of substitution coefficient is calculated to be negative ( $AES_{ij} < 0$ ) the inputs considered are substitutes.

## 6. Results

Let us begin by calculating the elasticities between settler family labour and khoe labour. In Figure 6A the calculated elasticities of complementarity coefficients from 1805 to 1828 clearly show that slave and settler family labour are compliments throughout the period of analysis, since the Hicksian mean elasticities of complementarity are all positive over the entire period of study. Complementarity implies that the two labour inputs are distinctly different. This result is to be expected since the master-servant relationship already existed between slave and settler household labour at the Cape colony (Field 1988). It is clear that slave and settler family labour remain distinctly different types of labour throughout the period. Eastern frontier settlers remain the supervisory masters and slaves perform the domestic labour around the farm homestead (Lovejoy & Ross 1985). This complementarity appears to be reasonably strong for most settler households at Graaff Reinet over the entire period of study, which primarily dispels the notion of a fluid relationship between slave and settler household labour.

*Figure 6A:*

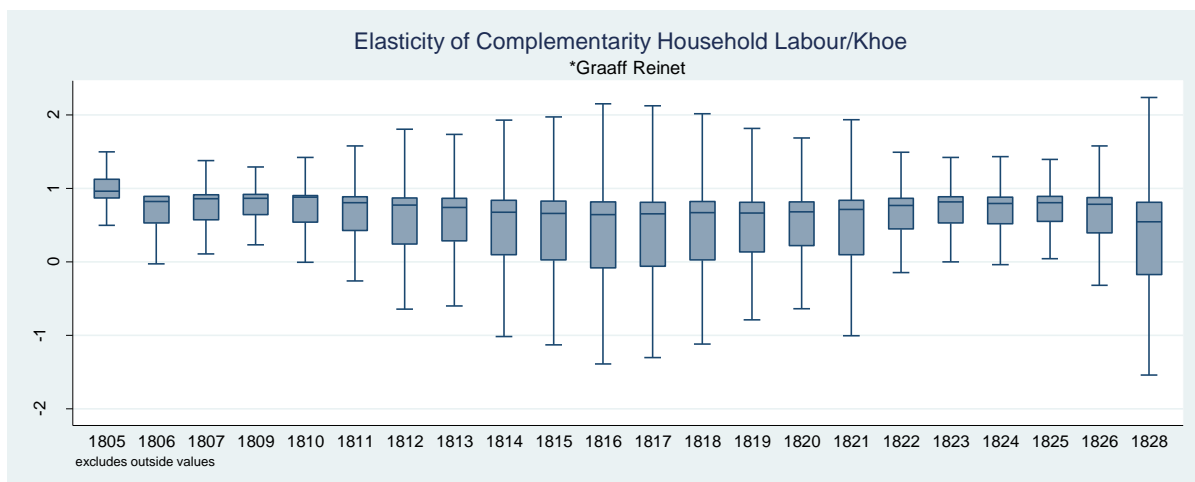


Moving on to the mean elasticity of complementarity estimates for household and Khoe labour for the period in question shown in Figure 6B also remains positive throughout. Khoe and family labour are also distinctly different labour inputs into the livestock rearing production process at Graaff Reinet. In addition, the elasticity estimates from 1814 to around 1818 show a widening trend in its spread across frontier farms with a number of farms reporting negative elasticities of complementarity (substitutes). This phenomenon can largely be explained by the recovering population numbers after the Fourth Frontier War. As a coping mechanism to labour losses after the Frontier War some farms (very few) had to substitute family labour with Khoe

labour. This may suggest household and Khoe labour were somewhat fluid and to some degree could be substituted.

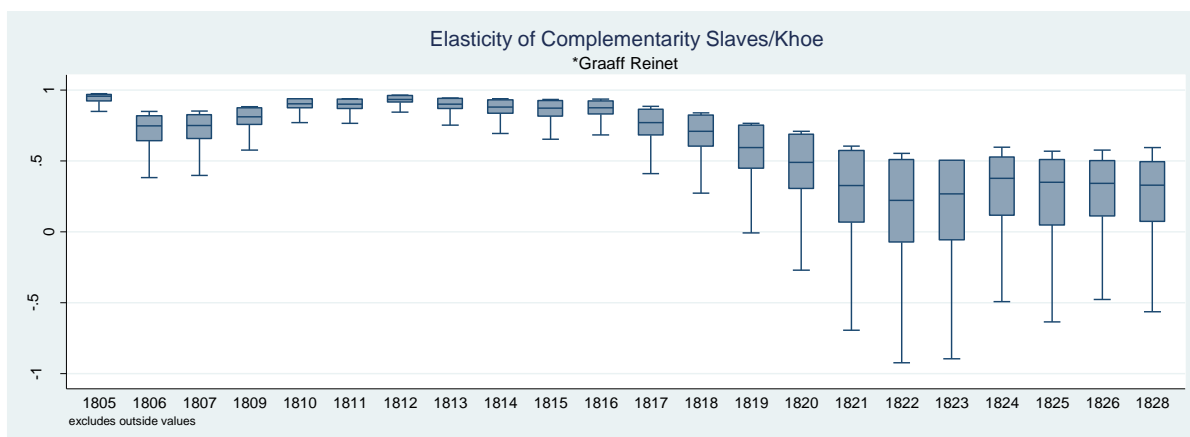
However, on the larger farms each labour input (slave, settler and Khoe) had already been performing distinctly different tasks altogether. The lack of a substitution effect between Khoe and family labour is not surprising. It suggests that there was already an established hierarchical order between white settlers and the indigenous populations. Meanwhile, the recurrent frontier wars show that the Khoe still had the power to resist this hierarchical order. The question is to what extent the settlers substituted indigenous Khoe labour for slaves as a coping mechanism during periods of Khoe resistance?

Figure 6B:



In times of scarce Khoe labour the most logical response would be to replace them with slave labour as a coping mechanism, if the option was available. Yet when viewing Figure 6C the mean elasticity of complementarity figures calculated for slaves and Khoe over the 1805 to 1828 period remains complements throughout. This result indicates that slaves and Khoe at the Graaff Reinet frontier were performing very different tasks in the farming production process. This is an especially important conclusion since it refutes the idea that slave labour is relatively flexible and with some degree of investment in retraining can be repurposed to do almost anything.

Figure 6C:



Restriction to individuals present in 1815 and who have been in the panel for longer than two years.

So far our estimates have not taking into consideration that the period was marked by major changes in the composition of the frontier labour force caused by conflict and wars. The periods during and directly after the Fourth Frontier War shows a marked decline in the population numbers of all the different labour groups to varying degrees. The largest simultaneous decline in the Graaff Reinet settler, slave and Khoe numbers over the period of this study occurs in 1814 after the Fourth Frontier War. The total population of settlers, Khoe and slaves recorded in the *Opgaafrollen* declines by 33.5%, 37.7% and 31.1% respectively. This structural break in the data may bias the results obtained in favour of this complementary labour relationship in the aforementioned analysis so we restrict the sample utilised in the calculation of elasticities of complementarity to settler households that were present before and after the population shock in 1814. If this restriction is applied the total observations across all the years falls substantially to around 8000 from roughly 42 180.

Figure 7A:

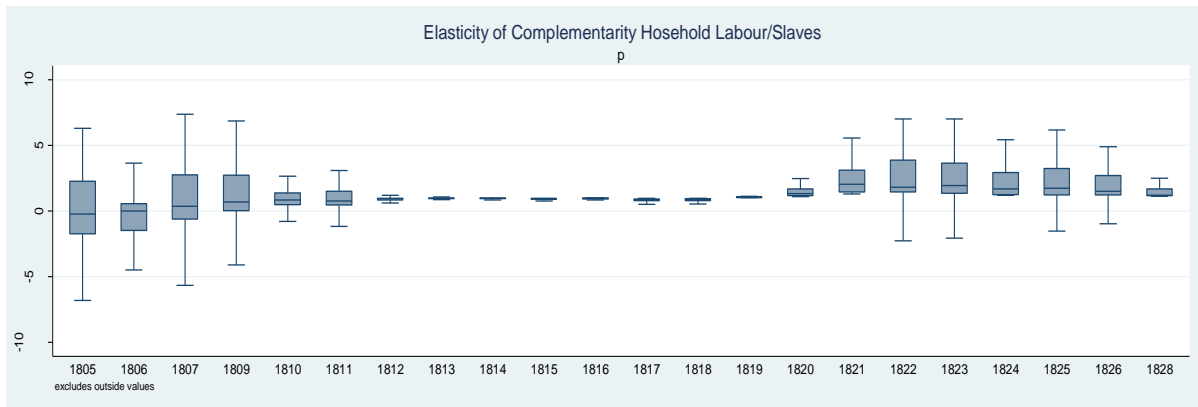


Figure 7A shows the recalculated elasticity of complementarity estimates for settler household labour and slaves after the aforementioned restriction is imposed. In the case of household labour and slaves the complementary relationship continues to persist. Save for 1805 and 1806 (where substitutability is present) all the years show reasonably strong complementarity (positive mean elasticities of complementarity). When viewing Khoer and slaves, it is also clear that these two types of labour inputs remain complements throughout the period of analysis even after the restriction is imposed as shown in Figure 7B. What does appear to happen from 1822 onwards is that Khoer and slave labour become substitutes on a small number of farms (possibly wealthier farms). This phenomenon can be explained by the fact that Khoer numbers started declining rapidly in the later years of the *Opgaaffrollen*, effectively forcing more settler farming endeavours, who could afford to acquire slaves, to substitute away from Khoer labour. However; since this was not possible for all farms Khoer and slave labour remained complements on most farms.

Figure 7B:

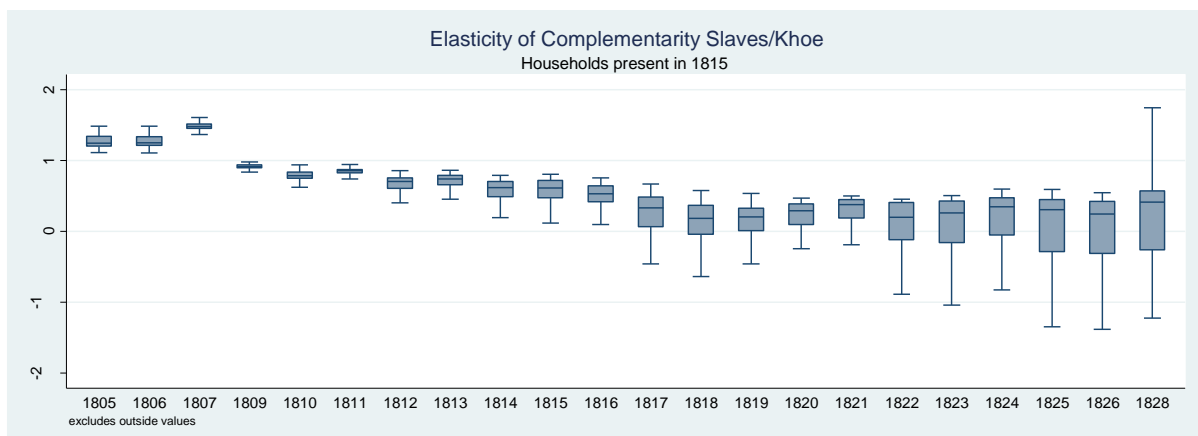
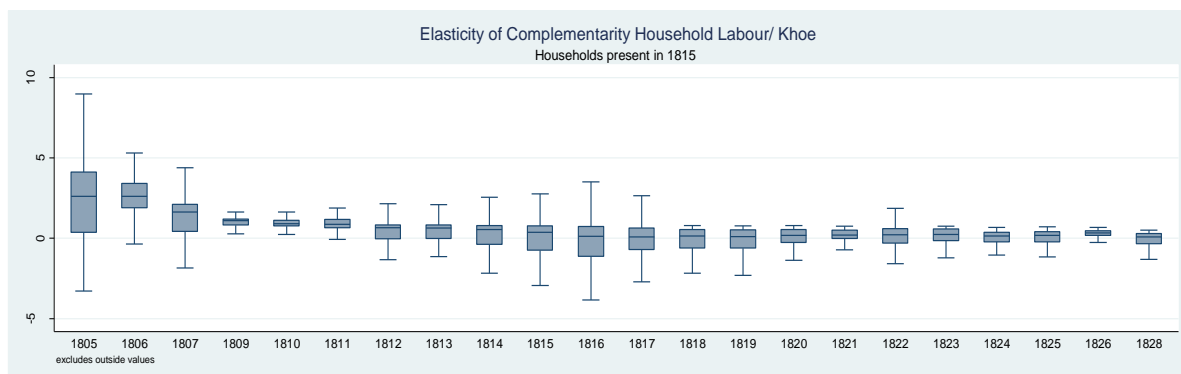




Figure 7C confirms that even when only individuals that were present in the *Opgaafrollen* prior to the 1814 structural break are followed it is clear to see that the mean elasticity of complementarity estimates between Khoe and family labour remains positive over the period of this study. However, from 1816 to 1828 it appears as if the complementary relationship between household and Khoe labour becomes significantly weaker. This conclusion seems to support the notion that as Khoe labour supplies were declining over time and the frontier settlers had to rely less on Khoe labour for rearing their cattle and sheep. In the years after 1816 it appears as if Khoe and household labour on some farms becomes substitutes, strengthening the notion then over the course of the 19<sup>th</sup> century Khoe labour became a less reliable source of labour. Overall, since it is impossible to increase settler household sizes over short time horizons the strong reliance on Khoe labour did persist to some extent.

Figure 7C:



Restricting analysis to slave-owners only from 1805 to 1828

As shown in the descriptive statistics slave ownership was primarily concentrated to a smaller group of wealthier households. That we find no substitution effect may simply be because for the vast majority using slaves as a coping strategy was not an option. Let us therefore focus solely on the minority group of slaveholders to analyse to what extent they used slaves to substitute for Khoe labour. This restriction will also test the robustness of the complementarity result for slave, Khoe and settler family labour over the period of this study. Unfortunately, after instituting this restriction (keeping only households with one or more slaves in the sample) the number observations in the dataset is reduced from 42 180 to 11 456. This also clearly illustrates that slave ownership was not widespread as 73% of the observations are dropped from the sample if settler households in possession of one or more slaves are viewed.

Figure 8A

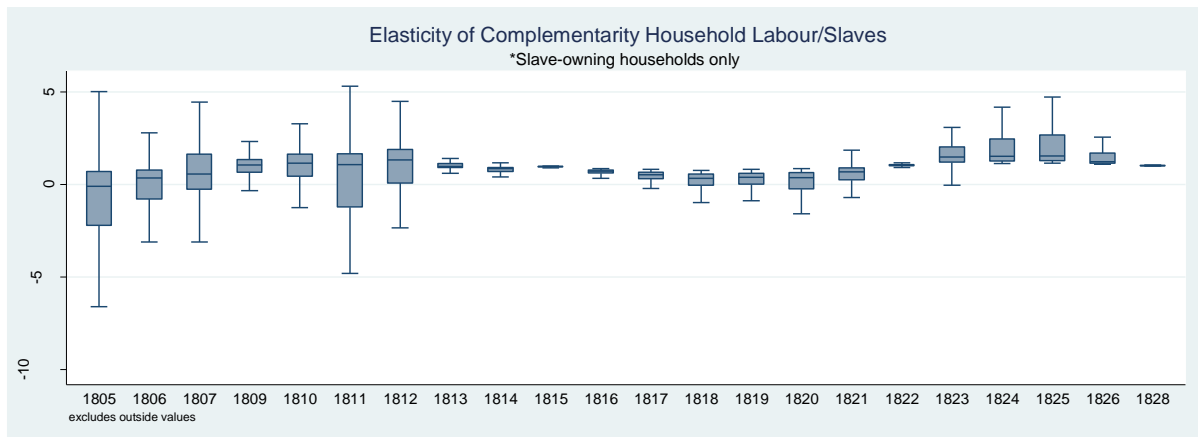
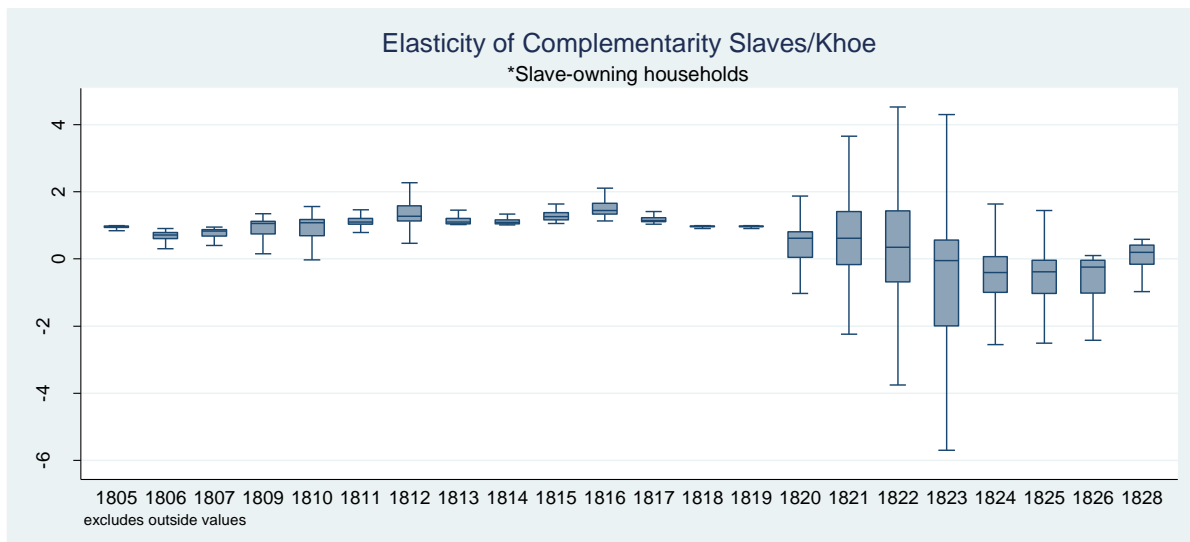


Figure 8A: shows that the mean elasticity of complementarity estimates for slaves and settlers when imposing the aforementioned restriction from 1805 to 1828 remains positive (Save for 1805). This finding broadly supports the conclusion that settler (family labour) and slave labour was complementary as was found with the entire sample. However; the degree of complementarity when restricting the sample to slave owners at Graaff Reinet is much weaker. Slave labour therefore is not easily substitutable with family labour and seriously brings into question whether slave labour itself can be considered flexible.

When considering the complementarity estimates between slaves and Khoe for the period 1805 to 1822 in Figure 8B for slave owning households the result shows a strong complementary outcome (1828 also shows a complementary outcome). However; after 1822 when Khoe numbers fall drastically Khoe and slave labour become substitutes. It therefore appears as if slave and Khoe labour perform distinctly different labour roles in the livestock rearing production process from 1805 to 1822; yet as Khoe numbers decline the wealthier slave-owning frontiersmen are able to substitute away from Khoe labour and procure slaves as a coping mechanism. This result indicates that many slaves may have acquired the location specific skills which made Khoe labour desirable over time. It may thus have been easier for frontier farmers to replace lost Khoe labour with slaves as time passed. Indeed, it is clear that if slaves were available to employ in the Graaff Reinet pastoral production process that settler farmers would opt to use them. However; this only occurred when Khoe labour was relatively scarce.

Figure 8B:



## 7. Division of labour and location specific skills

In Graaff Reinet at least, the results of the aforementioned analysis show that family and some Khoe labour were available to poorer frontier pastoral households (slave labour was also available to a much lesser degree). This study finds that Khoe and household labour are complements primarily as the master-servant dynamic between the Khoe and the settler masters had already set in. The Khoe in service to settler households would generally tend to the flocks of sheep and heads of cattle since they were already nomadic pastoralists for millennia, their in-depth knowledge of the landscape and invaluable knowledge of sheep and cattle rearing made their labour valuable in the pastoral production process. The settlers would serve as the supervisors to the Khoe labour, performing an oversight role in the pastoral process. However; Khoe labourers were also rebellious and were often far from a reliable source of labour. This has been made evident from the continuous conflicts in the eastern frontier zone over the period of the study.

As a natural response to the unstable Khoe labour supply, it would be convenient to expect that if households at the frontier had the means they would rely on slave labour to a greater degree. Yet the results from the analysis shows that Khoe and slave labour also remained complements throughout the period, even in wealthier slave owing households (for the majority of the period). Context specific factors therefore play a significant role in determining the degree of flexibility of slave labour. In this study we theorise that this inflexibility of slave labour with respect to Khoe labour stems from the fact that the capital investment necessary to purchase,

transport and train a slave for pastoral farming practices was far too high for the primarily poor frontiersmen. It was much easier to partake in Khoe raids or obtain indigenous wage labour who had been practising pastoral agriculture in the region for millennia. In turn slaves were mostly kept either as domestic labour around the home, as a status symbol for more affluent settler families, or tended to the small number of wine, wheat, barley and rye endeavours that were present at Graaff Reinet (Worden 1985). The presence of wheat reaped, vines, barley reaped, rye reaped for a rather small number of eastern frontier farmers confirms that at least a small amount of crop cultivation took place. Since many slaves that were purchased by the wealthier interior farmers at Graaff Reinet acquired slaves from the wine and wheat producing Cape centre, slave labour in general was more suitably trained for crop cultivation. The location specific context therefore made slave labour relatively inflexible with respect to Khoe labour

It does appear that when the entire sample is restricted to slave owning households that over time slave labour does become substitutable with Khoe labour. This may be due to the fact that sufficient time had passed for slaves to acquire the knowledge and skill for pastoral farming, previously explaining the preference for Khoe labour. Since the wealthier frontier families had access to slaves initially they were able to invest time and resources in retraining their slaves to cope with declines in Khoe labour. Nevertheless, this back-up measure was only available to the rich and the poor effectively had no means to substitute away from Khoe labour, especially since the period it took for slaves and Khoe to eventually become substitutable took 18 years. This time investment was vast since it would span a significant portion of the useful life of a slave. This was simply not a viable option for households who were just making end meet.

## 8. Concluding Remarks

In general slaves are considered to be the most flexible type of labour when compared to free and indentured labour. In fact, a significant amount of economic theories on the origins of slavery, such as the Nieboer-Domar hypothesis relies heavily on the assumption that slave labour in an open frontier setting, with some retraining, could effectively be substituted with any form of labour. This conclusion has not gone uncontended as many cross-sectional studies have shown that at least slave and free labour could be considered to be completely different inputs in the agricultural production process. However; these static cross-sectional studies apart

from focusing almost completely of slavery in the Americas, do not account for the fact that labour characteristics may evolve over time.

The eastern frontier district of the Cape colony at Graaff Reinet over the 1805 to 1828 period presents a fertile testing ground for the degree of flexibility of slave labour in an open frontier setting. Despite the fact that economic theory on the origins of slavery posit that unfree labour arrangements would not arise in labour saving pastoral societies, slave and indentured indigenous labour was present in the primarily sheep and cattle rearing Graaff Reinet district. Settler households in this open frontier district made extensive use of family, (free and indentured) Khoe and slave labour in the livestock production process. However; the fluidity of this frontier society meant that the Khoe were not a very reliable source of labour. Frequent revolts by the indigenous people of Graaff Reinet meant that often the Khoe would simply desert settler farming endeavours.

The results obtained from the elasticity of complementarity estimates between settler family labour and Khoe show that the master-servant relationship between these two groups had already been established by the advent of the 19<sup>th</sup> century. The Khoe were tending to the livestock, largely due to their in-depth knowledge of the environment as well as their extensive experience with pastoralism over millennia. In turn, the settler family members were performing a more supervisory role.

As a natural coping mechanism one would assume that frontier farmers would automatically rely more on slave labour especially due to the fact that slaves were a reasonably flexible source of workers. However; as the elasticity of complementarity results show context specific factors matter very much for the degree to which slaves can be substituted for other forms of labour. Slave and Khoe labour remain complements in pastoral production for almost the entirety of the study period. Slave labour was available to only a few wealthy frontiersmen and would have to be acquired at a vast capital expense. The context specific knowledge of pastoral agriculture also took a very long time to transfer to slaves. Ultimately, the cost and effort involved to make use of slaves was not available to frontier households who were barely making ends meet.

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