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The Impact of Trade Liberalisation on Wages in the South African Manufacturing Sector between 2000 and 2007.

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Declaration

I declare that the content of this dissertation is my own work, except where acknowledged in the text, and that it has not been submitted towards a qualification at any other university.

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Abstract

This study investigates the impact of trade liberalization on wages in the manufacturing sector in South Africa between 2000 and 2007. The Stolper – Samuelson theorem predicts that trade liberalisation decreases the relative return of workers employed most intensively in the liberalising industries. We estimate the relationship between trade liberalisation and wages using expanded Mincerian wage regressions that contain measures of protection. In addition, we go beyond the Heckscher – Ohlin – Samuelson framework and investigate whether or not the impact of union bargaining power on wages in a given industry is conditional upon the level of protection. The analysis is conducted using LFS household survey data in combination with average industry tariffs and effective rates of protection. Our findings suggest that trade liberalisation has resulted in a decrease in wages. In addition, we find that the impact of trade liberalisation on wages is dependent on the level of education of a worker. Our findings suggest that relatively un-skilled individuals have suffered more from trade liberalisation than those who are relatively skilled. Finally, we find that the impact of union bargaining power on wages in a given industry is dependent upon the level of protection.

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1. Introduction

South Africa has since 1994 rapidly liberalised trade with the hope of achieving a general increase in welfare and a reduction in inequality. There have however been a number of findings during this period which suggest that employment has suffered as a result of trade liberalisation. Other findings have suggested the contrary; that trade liberalisation has had a positive impact on employment and factor returns. There is no consensus yet in the literature on the impact trade liberalisation has had on employment and wages in South Africa since 1994.

In October 1999, the Trade Development and Cooperation (TDAC) agreement was signed between South Africa and its largest trading partner, the European Union (EU). The agreement stipulates a program of liberalisation for the majority of imports from the EU. The agreement is significant in terms of econometric estimation, as it defines the changes in EU tariffs occurring from 2000 onwards as exogenously determined.

This paper takes advantage of the exogenous nature of EU tariff changes since 2000, and investigates the relationships between trade liberalisation and wages in the South African manufacturing sector between 2000 and 2007. In our investigation we make use of a multiple period cross-sectional household survey dataset together with 2 digit South African International Standardised Industry Classification industry level EU tariff data and effective measures of protection.

We use expanded Mincerian wage regressions to estimate the relationship between trade liberalisation and wages. Three variants of this relationship are estimated. In the first set of estimations, we follow Fiandeiro and Rankin (2008) and directly estimate a relationship between trade liberalisation and wages. In doing so, we add to previous studies by including industry fixed effects to control for industry specific characteristics affecting wages. In the second set of estimations, we address a void in the literature by estimating the relationship between trade liberalisation and relative wages predicted by the Stolper – Samuelson Theorem. In estimating this relationship, we include into our model an interaction between an education and tariff variable in order to determine the relative impact trade liberalisation has had on the wages of the relatively un-skilled versus the wages of the relatively skilled.

A key objective of this paper is to extend beyond the standard general equilibrium framework of the Heckscher-Ohlin-Samuelson framework and consider the impact of trade liberalisation on wages via the impact on labour demand elasticities. As will be explained in the Theoretical Background Chapter, we selected the bargaining between trade unions and firms as a channel through which to estimate the impact of trade liberalisation on wages in a partial equilibrium setting. In the final set of estimations, we make use of the information contained in the household data of the union membership status of each individual worker, and include an interaction between an industry union bargaining power variable and an industry tariff variable in the estimation of the relationship between trade liberalisation and wages. This is done to determine if the impact of union bargaining power on wages in a given industry is conditional upon the level of protection.

Our findings suggest that trade liberalisation has resulted in a decrease in wages. These findings were obtained after controlling for industry specific characteristics and a series of individual characteristics. We also find that the impact of trade liberalisation on wages is dependent on the level of education of a given worker. In addition, our findings suggest that relatively un-skilled individuals have suffered more from trade liberalisation than those who are relatively skilled. Finally, we find that the impact of union bargaining power on wages in a given industry is dependent upon the level of protection.

This paper is divided into seven chapters. In the remainder of this chapter we provide a brief overview of the relevant literature. In the next chapter, we provide a background of South Africa's trade liberalisation process since 2000 and investigate developments in the structure and level of employment and wages over the same period. In Chapter 3 we provide a detailed discussion of the theoretical models relevant to this study. In Chapter 4 we outline the methodology employed in constructing the average tariff data and the multiple period household dataset. We also provide a brief analysis of the average industry tariff data and effective rates of protection. In Chapter 5 we introduce the model specifications that contain the testable relationships established in the theory chapter. This leads to Chapter 6, where we present and discuss the results of the estimation of the models presented in Chapter 5. Finally, we provide concluding remarks in Chapter 7.

1.1 Overview of the Literature

Much of the research that assesses the impact of trade liberalisation on workers in South Africa has focused on the direct impact of trade liberalisation on employment.

A number of studies in this area have found that trade liberalisation has acted to decrease employment levels. Notable amongst these is Birdi *et al.* (2002), who estimate a dynamic panel labour demand equation using aggregate industry level data between 1972 and 1997. They find that trade liberalisation has had a negative impact on employment since 1993.

In contrast, Edwards (2001) and Fedderke *et al.* (2003) argue that much of the employment losses experienced post 1995 have been as a result of skill-biased technological change and not as a direct result of trade liberalisation. Fedderke *et al.* (2003) employ a heterogeneous panel estimation of a standard Stolper – Samuelson mandated wage regression using aggregate industry level data between 1970 and 1997. They find a positive impact on labour usage relative to capital usage, and un-skilled labour usage relative to skilled labour usage arising from increased globalisation (Fedderke *et al.* 2003). Edwards (2001), using an output decomposition approach, finds a structural shift in production towards capital intensive sectors between 1984 and 1997. He identifies problematic elements within the labour intensive sectors as the reason behind this shift and not trade liberalisation.

Bhorat (2000) finds evidence to both support and refute the claim that trade liberalisation has resulted in employment losses. He estimates the impact of trade flows on labour demand using both

cross-sectional survey data and time series data. Using the micro-level survey data, he finds a positive relationship between increased export and import volumes and labour demand between 1970 and 1995. Using the time series data however, he finds substantial decreases in employment of unskilled workers as a result of international trade between 1993 and 1997.

When considering the body of research conducted on the impact of trade liberalisation on employment in South Africa, there is no clear consensus. Furthermore, as Edwards (2004) points out, this research is a departure from the theoretical foundations of the HOS model, which through the Stolper – Samuelson theorem, predicts the impact of changes in product prices on real factor returns and not on employment. Many of the studies undertaken in the South African context have therefore not been entirely consistent with the theory.

In recent years there have been some attempts at estimating a relationship between trade liberalisation and factor returns. Fedderke *et al* (2003), in the same study referred to earlier, measure the relative impact of globalisation on returns to factors of production. They find a positive trade mandated effect on the return to labour, and a negative effect on the return to capital. More recently, Fiandeiro and Rankin (2008) estimate a relationship between trade liberalisation and wages using micro-level survey data and average industry tariffs. They find that workers who are employed in industries with low levels of protection earn more than workers who are employed in highly protected industries. They also find that wages are higher in industries that have undergone greater liberalisation (Fiandeiro and Rankin, 2008). They do not however consider the impact of trade liberalisation on relative wages, which as mentioned earlier, is the relationship established by the Stolper – Samuelson Theorem.

An area which has received little attention in empirical studies until recently is the impact of trade liberalisation on the elasticity of labour demand, and the implication of changes in labour demand elasticity on the return to labour. This neglected aspect of the impact of trade liberalisation on wages was brought to the fore by Rodrik (1997). In drawing attention to the potential impact of trade liberalisation on labour demand elasticities, Rodrik (1997) is moving the framework of analysis outside the sector level general equilibrium framework of the HOS model and into a firm level partial equilibrium setting.

Shendy (2007) is the only South African study we found that moves beyond the HOS framework and conducts estimates based on theory developed in a firm level or partial equilibrium setting. She uses an expanded Mincerian wage regression to determine if the impact of tariffs on wages is dependent upon the level of industry union bargaining power. In her estimations, she uses micro level survey data and average industry tariffs for the 1995 to 2004 period. She finds that the impact of trade liberalisation on wages is dependent on the level of union bargaining power in a given industry. Using the results of an instrumental variable regression, she finds that trade liberalisation has a negative impact on wages and that this negative impact is greater the higher the level of unionisation in a given industry.

2. Trade and Labour Developments in South Africa Post 2000

As outlined in the introductory chapter, we are interested in estimating the relationship between trade liberalisation and wages, and the relationship between trade liberalisation and the impact of trade union bargaining power on wages. The period of interest is from 2000 to 2007 and the sector of interest is the manufacturing sector. We present in Section 2.1 a brief overview of the trade liberalisation that has taken place in South Africa since 2000. We analyse changes in sector level average tariffs and investigate developments in import flows. In Section 2.2 we investigate developments in the South African labour market since 2000 to determine if this period of renewed trade liberalisation has been accompanied by changes in the composition of imports and the structure of the labour market.

2.1 Trade Policy and Import Flows

Since 2000, the focus of trade policy in South Africa has been on preferential trade agreements (Edwards *et al.* 2008). The most notable amongst these have been the free trade agreements entered into with the European Union (EU) through the signing of the Trade Development and Co-operation agreement (TDCA), and the Southern African Development Community (SADC) through the signing of the SADC Free Trade Agreement (SADC FTA). The majority of the trade liberalisation that has occurred since 2000 has been directed by these two agreements. In the following two sections, we outline some key directives of each agreement and outline the changes in average sector tariffs that have resulted. Thereafter we analyse the impact these changes have had on the relevant import flows.

2.1.1 The TDCA and Imports from the EU

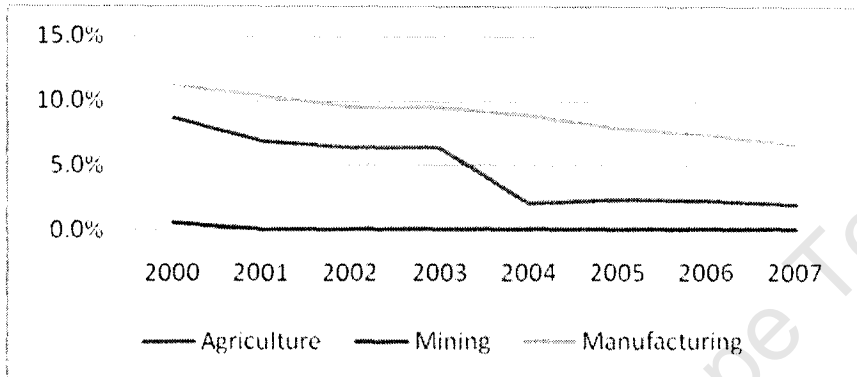
South Africa and the EU agreed in 1999 to a program of trade liberalisation between the two regions with the objective of establishing a free trade area by 2012. The TDCA, which outlined the procedure of this trade liberalisation process, was signed on the 11th of October 1999, with the articles contained in the agreement implemented from January 2000 (European Commission, 2008). Through the TDCA, the EU committed to liberalise trade on 95 % of its imports from South Africa over a 3 year period. South Africa committed to liberalise trade on 86% of its imports from the EU over a 12 year period. The two parties agreed that South Africa would indefinitely maintain relatively high average tariffs on clothing, vehicles, footwear and processed food products (Edwards *et al.*, 2008).

Figure 2.1 illustrates the changes in average sector level tariffs applied to EU imports. From Figure 2.1 we see that the average tariff rates have fallen in each of the three sectors presented. In

the manufacturing sector, the average tariff followed a steady downward path over the period presented, dropping from approximately 11.5% in 2000 to approximately 6% in 2007. This gradual liberalisation can be seen to reflect South Africa's commitment to liberalise trade with the EU under the TDCA

Figure 2.1

Sector Level Average Tariffs on EU imports. 2000 – 2007



Source: *own calculations using TIPS, TRAINS, IDC & Gov. Gazette (2000 – 07)*

The European Union represents South Africa's largest trading partner, with a share of total trade of 33.7% in 2007 (own calculations using Quantec, 2008). This is significantly higher than any other of South Africa's major trading partners (EU DG Trade Stats, 2007). From Table 2.1 we see that South Africa's imports from the EU are almost entirely made up of manufactured goods, which represent over 98% of total EU imports in each period presented.

Following the implementation of the TDCA in 2000, South Africa has continued to import very small quantities of agricultural and mining sector products from the EU as can be seen in Table 2.1. Imports of basic metals and machinery have maintained a relatively constant share of total EU imports between 2000 and 2007 while imports into the chemical and communication industries experienced a decline in share of total EU imports during the same period.

Imports of transport equipment, primarily including motor vehicles, increased dramatically in nominal terms from R13523 million in 2000 to R47084 million in 2006. The industry's share of total EU imports increased from 18.86% in 2000 to 29.37% in 2006. This increase is at least partly attributable to the Motor Industry Development Program (MIDP). Under the MIDP, foreign motor vehicle manufacturers are provided with import duty credits in return for their production of vehicles or vehicle components in South Africa. They are able to use the duty credits to export large numbers of vehicles to South Africa duty free.

Overall, imports from the EU have grown in nominal terms across all sectors in the period following the implementation of the TDCA, with the vast majority of imports being manufactured goods. Despite this, the share of EU imports in the total imports into South Africa has declined from 40.2% in 2000 to 33.7% in 2007 (own calculations using Quantec, 2008).

Table 2.1

South Africa's Imports from EU. Selected years (millions of Rand)						
ISIC SA rev 2	2000	% of Total EU imports	2003	% of Total EU imports	2006	% of Total EU imports
Agriculture	374	0.52	800	0.75	902	0.56
Mining	237	0.33	359	0.34	409	0.25
Manufacturing	70812	98.77	105009	98.74	157512	98.25
of which						
Food & Beverages	2204	3.07	2349	2.21	4206	2.62
Textiles & Clothing	1483	2.07	1621	1.52	2134	1.33
Wood & Products	2885	4.02	3599	3.38	6401	3.99
Chemicals & Plastics	14346	20.01	18579	17.47	27585	17.21
Other Non-Metallic products	1509	2.11	1650	1.55	2582	1.61
Basic Metals & Machinery	18216	25.41	25577	24.05	41659	25.99
Electrical Machinery	2711	3.78	3574	3.36	5782	3.61
Comm. Equip. & Instruments	10655	14.86	11006	10.35	17475	10.90
Transport Equipment	13523	18.86	32381	30.45	47084	29.37
Furniture & NEC	3279	4.57	4674	4.40	2603	1.62

Source: own calculations using Quantec (2008)

2.1.2 The SADC FTA and Imports from SADC

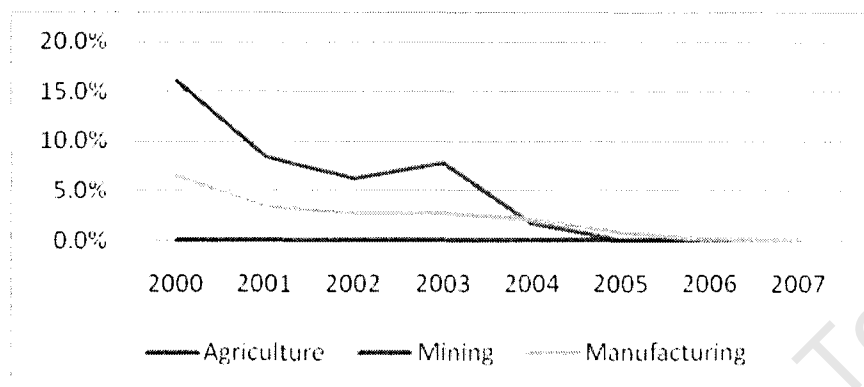
South Africa, together with the other SADC member states, signed the SADC Protocol on Trade in 2000. Under the Protocol, the SADC countries committed themselves to the creation of a free trade area within the SADC region by 2012. Following the signing of the Protocol, the most developed of the SADC countries, which includes South Africa, removed the majority of tariff and non-tariff barriers on SADC imports immediately. The remaining tariffs were all but completely removed by 2004, some non-tariff barriers remained in the form of rules of origin requirements. (Edwards *et al*, 2008). The deadline for South Africa to have completely liberalised trade with the SADC region was the end of 2008.

Figure 2.2 illustrates the changes in average sector level tariffs applied to SADC imports. We see from Figure 2.2 that the SADC sector average tariff rates fell sharply between 2000 and 2005,

with tariff barriers on SADC imports being completely removed by 2006. South Africa has thus, as of 2006, fulfilled its obligations under the SADC FTA to liberalise trade (with respect to tariff barriers).

Figure 2.2

Sector Level Average Tariffs on SADC imports. 2000 – 2007



Source: own calculations using TIPS, TRAINS, IDC & Gov. Gazette (2000 – 07)

Unlike in the case of the EU, South Africa imports relatively little from the SADC region with only 5.3% of total imports originating from the region in 2007 (own calculations using Quantec, 2008). From Table 2.2 we see that imports from SADC consisted primarily of manufactured goods in 2000. Manufactured goods made up 79.8% of total SADC imports, considerably higher than that of agricultural products at 15.94% and mining goods at 2.8%. Following liberalisation, the share of mining goods in total SADC imports jumped to 20.2% in 2003 and 26.7% in 2006. The nominal value of imports of manufactured goods also rose sharply from R3245.8 million in 2003 to R10265 million in 2006. This despite a decrease in its share of total SADC imports over the same period.

Whilst the value of imports from the SADC region has been relatively low, the share of total South African imports originating from the SADC region has increased strongly from 1.4% in 2000 to 5.35% in 2007 (own calculations using Quantec, 2008).

Table 2.2

South Africa's Imports from SADC. Selected years (millions of Rand)						
ISIC SA rev 2	2000	% of Total SADC imports	2003	% of Total SADC imports	2006	% of Total SADC imports
Agriculture	668	15.94	1109	19.98	977	6.22
Mining	117	2.78	1119	20.15	4197	26.74
Manufacturing	3343	79.78	3246	58.47	10266	65.40
of which						
Food & Beverages	178	4.24	252	4.53	213	1.36
Textiles & Clothing	374	8.92	498	8.96	625	3.98
Wood & Products	179	4.27	274	4.94	307	1.96
Chemicals & Plastics	202	4.81	278	5.01	237	1.51
Other Non-Metallic products	35	0.84	55	0.99	78	0.49
Basic Metals & Machinery	1974	47.11	1117	20.12	3916	24.95
Electrical Machinery	70	1.67	89	1.61	221	1.41
Comm. Equip. & Instruments	106	2.52	182	3.27	141	0.90
Transport Equipment	204	4.88	324	5.83	390	2.48
Furniture & NEC	22	0.53	178	3.20	4137	26.35

Source: own calculations using Quantec (2008)

Due to the dominance of imports from the EU relative to imports from SADC between 2000 and 2007, the impact on South African industries arising from trade liberalisation with the EU is expected to be far greater than that of trade liberalisation with SADC.

2.2 Labour Market Developments

2.2.1 The Structure of Employment and Wages

The trends of jobless economic growth and increasing unemployment that characterised the post 1994 South African economy have continued into the 2000's. The official level of unemployment increased from 25.8% in 2000 to 26.7% in 2005 (Stats SA, 2008). Using a broader definition of unemployment (which accounts for those wishing to work but not actively job seeking) unemployment increased from 35.9% in 2000 to 38.8% in 2005 (Pillay, 2008). These trends reversed somewhat in 2006 and 2007, with unemployment officially measured at 23% in 2007 (Stats SA, 2008).

Banerjee *et al.* (2006) find substantial changes in the structure of employment since 1975, with these changes continuing into the 2000's. Between 2000 and 2005, the share of the agriculture sector in total employment fell dramatically from 17% of total employment to 11% (Banerjee *et al.* 2006). The mining sector also experienced a slight decrease in its share of total employment over the same period. All other sectors experienced an increase in their share of total employment between 2000 and 2005, with the exception of the transport, utilities, and manufacturing sector, which maintained a constant share of total employment throughout the period (Banerjee *et al.* 2006). In addition to there

being an economy wide restructuring in employment, there has also been a significant restructuring of employment within the manufacturing sector between 2000 and 2007.

Table 2.3

Shares of Total Employment in the Manufacturing Sector. 2000 - 2007 (percentages)								
ISIC SA rev 2	2000	2001	2002	2003	2004	2005	2006	2007
Food & Beverages	20.05	17.95	17.67	18.35	18.10	20.13	17.68	17.30
Textiles & Clothing	23.08	25.18	21.89	22.25	20.41	19.11	19.24	18.00
Wood & Products	10.23	10.38	9.55	9.89	10.43	10.85	11.53	10.38
Chemicals & Plastics	9.82	9.01	11.01	11.23	10.39	10.30	9.42	9.05
Other Non-Metallic products	4.75	5.89	6.98	6.41	6.79	6.82	6.99	8.70
Basic Metals & Machinery	19.56	18.41	18.70	18.22	18.52	18.95	21.08	21.70
Electrical Machinery	1.72	2.11	2.08	1.62	1.86	1.74	1.39	1.23
Comm. Equip. & Instruments	0.49	1.10	1.08	0.76	0.66	0.72	1.17	1.20
Transport Equipment	5.56	5.32	6.49	6.04	6.73	5.61	5.76	7.47
Furniture & NEC	4.75	4.66	4.55	5.22	6.10	5.77	5.73	4.97

Source: own calculations using LFS (2000 - 07)

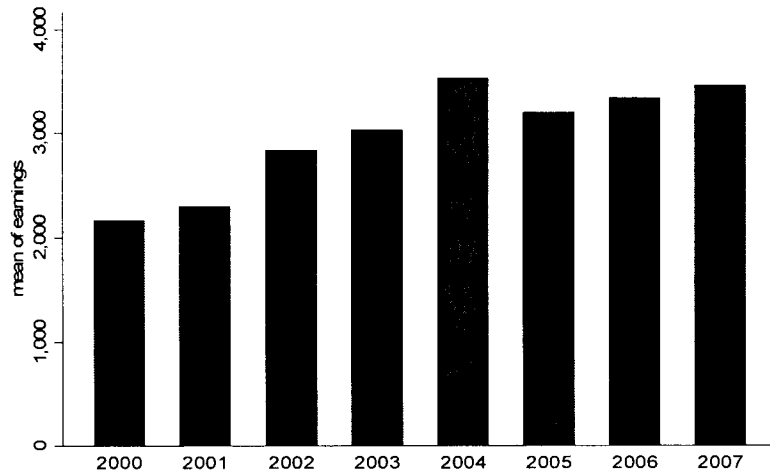
From Table 2.3 we find that that the contribution from the textiles industry to total employment in the manufacturing sector fell sharply from 23.08% in 2000 to 18% in 2007. The food and beverage, chemicals, and electric machinery industries also experienced declines in their shares of total manufacturing sector employment between 2000 and 2007. All the remaining industries, including the transport equipment industry, which maintained relatively high levels of protection under the TDCA, experienced increases in their respective shares of employment.

Banerjee *et al.* (2006) find that real wages in most segments of the South African economy declined since 1995 and continued to do so into the 2000's. During the same period, they find an increase in the number of high income workers in the economy. They also find that the returns to education for workers with a matric certificate or less declined between 2000 and 2005, whilst the returns to education for those with a post-matric qualification or a degree increased over the same period.

Referring to Figure 2.3, the mean nominal wage in the manufacturing sector increased from approximately R2100 per month in 2000 to approximately R3500 in 2007. The manufacturing sector median wage initially rose steeply in 2000, but levelled off in 2003. Referring to Figure 2.4, the median monthly wage rose from R1400 in 2000 to approximately R2000 in 2007.

Figure 2.3

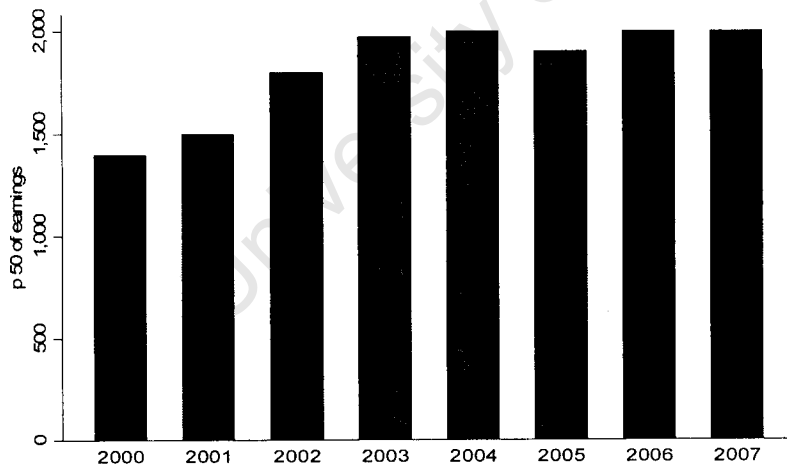
Mean Nominal Monthly Wages in the Manufacturing Sector. 2000 – 2007 (Rands)



Source: *own calculations using LFS (2000 – 07)*

Figure 2.4

Median Nominal Monthly Wages in the Manufacturing Sector. 2000 – 2007 (Rands)



Source: *own calculations using LFS (2000 – 07)*

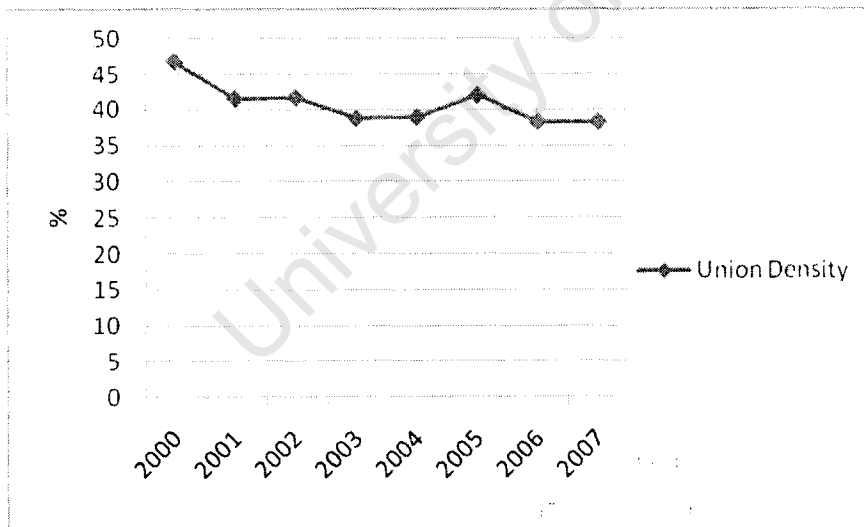
We thus find that there have been changes in both the structure and the level of employment and wages between 2000 and 2007.

2.2.2 The Role and Influence of Trade Unions

The largest trade union in South Africa is the Congress of South African Trade Unions (COSATU) (Pillay, 2008). The union accounted for two thirds of all unionised workers as of 2005. Its membership extends across a variety of sectors and industries including the manufacturing, mining and public sectors. The union has been active in wage and employment negotiations and has been intimately involved in policy determination through its alliance parties, the ANC and SACP. As of 2005, COSATU received a fair level support amongst the working class in the formal sector, with a union density (number of union members over total number of workers) of 22% (1.75 million members) (Pillay, 2008). The remaining third of unionised workers belong to several smaller unions including the Federation of Unions of South Africa (Fedusa), The National Council of Trade Unions (Nactu), Confederation of South African Workers' Unions (COSAWU), and Solidarity.

Despite the strong presence of trade unions in South Africa, the total proportion of workers who are members of trade unions (or the total union density across the entire workforce) declined from 33.2% in 1996 to 29.6% in 2006 (Pillay, 2008). As can be seen from Figure 2.5, union density in the manufacturing sector declined from 47% in 2000 to 38% in 2007.

Figure 2.5
Union Density in the Manufacturing Sector. 2000 – 2007



Source: own calculations using LFS (2000 – 07)

A major reason cited for the reduction in the organised workforce in South Africa has been the increase in the 'un-organisable' component of the formal work force. In recent years, there has been a considerable casualisation of the workforce in the metal, mining and clothing and textile industries (Pillay, 2008). These industries now employ large numbers of contract workers, and the trade unions, specifically COSATU, have as yet been unable to meet the challenge of organising these workers (Pillay, 2008).

Whilst they undoubtedly remain a powerful force in the South African body politic, there does appear to have been a reduction in the power of trade unions since 2000, especially in the manufacturing sector.

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3. Theoretical Background

In order to estimate the relationship between trade liberalisation and wages, it is necessary to first establish a theoretical relationship between trade flows and relative factor payments. The derivation of this relationship occurs within the Heckscher – Ohlin – Samuelson (HOS) framework and is outlined in the beginning of this chapter.

As mentioned in Chapter 1, part of the objective of this paper is to go beyond the standard Heckscher - Ohlin universe and to estimate the impact of trade liberalisation on workers arising from changes in the demand elasticity for labour. Following the outline of the HOS model in Section 3.1, a framework allowing for changing labour demand elasticities will be outlined in Section 3.2. Using this framework, we will develop a trade union bargaining model which will provide a channel through which the changes in labour demand elasticities are translated into changes in wages (and employment).

3.1 Trade liberalisation and relative wages within the Heckscher - Ohlin

Framework.

The Stolper - Samuelson theorem (1941) predicts that an increase in the relative price of a good will result in an increase in the relative return earned by the factor used most intensively in the production of that good (Feenstra, 2004). This foundational trade theory provides the basic relationship between trade and factor payments in the Heckscher – Ohlin 2 good, 2 factor universe.

Let us consider a two good, two factor economy operating under conditions of perfect competition (in both the goods market and the factor market). The two goods, good 1 and good 2, are produced using the following constant returns to scale production function:

$$y_i = f_i(L_i, K_i), i = 1, 2. \quad (1)$$

Let us assume that factors of production are perfectly mobile across the two industries, but are immobile across countries. Let us further assume that preferences are identical and homothetic. The two industries face the following capital and labour constraints:

$$K_1 + K_2 = K \quad (2)$$

$$L_1 + L_2 = L \quad (3)$$

where K and L are the total quantities of capital and labour available in the economy.

Each firm operating in the two industries attempts to maximise profits. Since cost minimisation is a necessary requirement for profit maximisation (Mas-Colell et al, 1995), we can represent the firms profit maximising decision in the following cost minimisation problem:

$$\min[wL_i + rK_i] \text{ s.t. } f_i(L_i, K_i) \geq 1 \text{ for } L_i, K_i \geq 0 \quad (4)$$

where w is the return to labour and r is the return to capital.

The solution to the above cost minimisation problem, referred to as the (unit) cost function, represents the minimum cost to producing one unit of good i . The function is non-decreasing in output and concave in w and r (Mas-Colell et al, 1995). The unit cost function can be presented as follows:

$$C_i(w, r) = w.a_{iL}(w, r) + r.a_{iK}(w, r) \quad (5)$$

where a_{iL} and a_{iK} are the optimal labour and capital input choices for the production of a single unit of good i . Note that these choices are a function of w and r .

To satisfy full employment and zero-profit conditions the following two sets of equilibrium conditions need to be satisfied:

$$P_1 = c_1(w, r) \quad (6a)$$

$$P_2 = c_2(w, r) \quad (6b)$$

$$a_{1L}y_1 + a_{2L}y_2 = L \quad (7a)$$

$$a_{1K}y_1 + a_{2K}y_2 = K \quad (7b)$$

where y_1 and y_2 are the total quantities produced of good 1 and good 2 respectively (Feenstra, 2004).

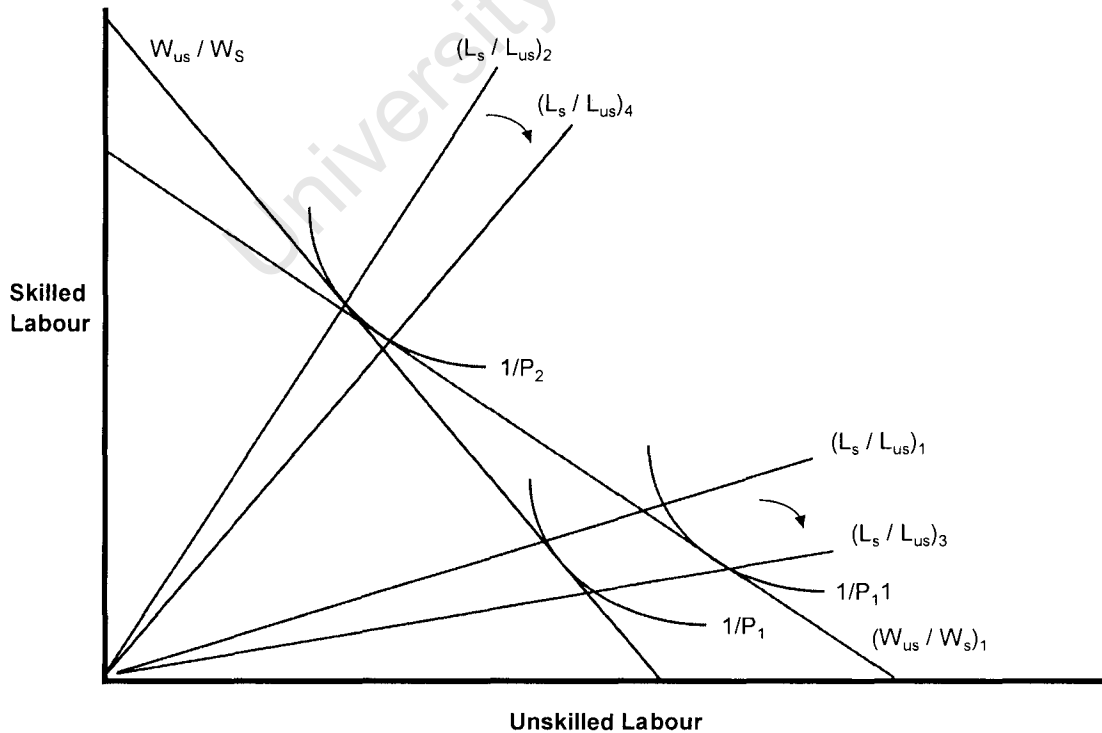
The above equilibrium system is depicted in Lerner diagram representation in Figure 3.1. Let us at this stage make the further assumption that factor intensity reversals do not occur and that the economy described above is a small economy. Furthermore, instead of considering capital and labour, let us consider as the two factors in the economy skilled and unskilled labour.

Figure 3.1 depicts the initial unit isoquant curves for good 1 ($x_1 = 1/p_1$) and good 2 ($x_2 = 1/p_2$). The unit isoquant curve for good i represents all the optimal combinations of skilled and unskilled labour that can be used to produce 1 Rand worth of good i . As can be seen from the positioning of the isoquant curves, we have assumed that the production of good 1 is relatively unskilled labour intensive whilst the production of good 2 is relatively skilled labour intensive. Also depicted in the

figure is the initial unit isocost line $w_S L_S + w_{US} L_{US} = 1$ with slope $-w_{US}/w_S$. Equilibrium in the system is achieved when zero profits are earned in both markets. This occurs when the unit isocost line lies tangential to both the isoquant curves. At these points of tangency, the skilled labour to unskilled labour ratios of production for good 1 and good 2 are $(L_S/L_{US})_1$ and $(L_S/L_{US})_2$ respectively.

Let us consider the impact of a product price change on the equilibrium system outlined above. Let us assume that as a result of the removal of tariffs on good 1, the domestic price¹ of good 1 decreases to p_1^1 whilst the price of good 2 remains unchanged. This results in there being more production required to produce 1 Rand of good 1, and is depicted in Figure 3.1 by an outward shift in the good 1 unit isoquant from $x_1 = 1/p_1$ to $x_1 = 1/p_1^1$. At the prevailing relative wage of w_{US}/w_S , the firms producing good 1 realise negative profits. This is seen graphically by the position of the $1/p_1^1$ isoquant above the $-w_{US}/w_S$ isocost. Subsequently, resources shift out of the loss making industry into the production of good 2. This raises the demand for skilled labour relative to unskilled labour resulting in the skilled labour wage relative to the unskilled labour wage rising i.e. inequality has increased. Following this, production becomes more unskilled labour intensive in both industries as firms take advantage of the relatively cheap unskilled labour. The relative unskilled wage declines till the zero profit condition is satisfied in both good markets.

Figure 3.1
Lerner Diagram



¹ The domestic price is equal to the world price multiplied by $(1 + t)$ where t is the ad valorem tariff rate applied on good i .

In Figure 3.1, the decline in the relative unskilled wage is depicted by the shifting of the isocost line w_{US}/w_S to the line $(w_{US}/w_S)_1$. At the relative unskilled wage of $(w_{US}/w_S)_1$, equilibrium is re-established. This is represented by the tangency between the $(w_{US}/w_S)_1$ line and both the $1/p_1^1$ and $1/p_2$ isoquant curves. At the new equilibrium, the skilled labour to unskilled labour ratios of production for good 1 and good 2 both decrease to $(L_S/L_{US})_3$ and $(L_S/L_{US})_4$ respectively.

The standard HOS model through the Stolper – Samuelson theorem therefore predicts that the removal of tariff barriers will, via the subsequent reduction in domestic prices, result in a relative decrease in the wages of the workers most intensively employed in the liberalising sectors.

The standard trade theoretical framework outlined above, whilst informative, has some important limitations in application.

One such limitation is highlighted by Edwards (2004), who highlights the fact that the standard approach does not sufficiently account for the impact of trade liberalisation on middle income countries. Middle income countries such as South Africa compete with both developed and developing countries. Hence whilst liberalising trade with a skill abundant developed economy may result in a decrease in inequality in the middle income country, the opposite may be true when liberalising trade with a developing nation that is relatively more unskilled labour abundant.

In the section that follows, a second limitation of the HOS model will be outlined and an additional framework of analysis to address this limitation will be established.

3.2 Trade Liberalisation and Labour Demand Elasticities

The standard HOS model does not account for changes in the domestic labour demand elasticity at the firm level that may arise as a result of trade liberalisation. The model is a general equilibrium model which considers national labour demand. An increase in the quantity of labour therefore does not change relative factor prices, but instead alters the output mix of a country via the Rybczynski Theorem (Slaughter, 1997). Thus when moving along such a national labour demand schedule, the schedule is perfectly horizontal (elastic). The impact on labour in the HOS model is thus restricted to changes in relative wages as a result of relative price changes (Rodrik, 1997).

At the firm level however, profit maximising firms demand a factor input mix that will maximise their profits. Hence, the demand for labour is a "*derived demand that varies in proportion with the demand elasticity of the goods it is used to produce*". (Rodrik, 1997: 16). It is important emphasis here that the elasticity of demand for labour nationally and that at the level of the firm are two different concepts. According to Slaughter (1997), "*there is no necessary link between labour – demand elasticities of firms and of countries.*" (Slaughter, 1997: 8).

Once we allow for finite labour demand elasticities, there are a number of ways in which trade liberalisation can impact on these elasticities.

Following the removal of tariffs on a given good, many trade models predict that domestic producers of the good will face competition from foreign producers who produce the same good or close substitutes (Slaughter, 1997). Since demand for labour is a derived demand (Rodrik, 1997), the elasticity of demand for labour increases (Rodrik, 1997 and Slaughter 1997).

Following trade liberalisation, firms are able to substitute domestic labour for foreign factors of production. This can be done directly through the off-shoring of production processes, or indirectly through the use of imported goods as inputs. The availability of foreign production factors in addition to the domestic factors of production can result in an increase in the elasticity of substitution of labour at a given output (Slaughter, 1997 and Rodrik, 1997).

Like the above examples, there are many others which serve to establish a relationship between trade liberalisation and labour demand elasticities (Slaughter, 1997 and Rodrik 1997). What remains to be established is how these changes in elasticities can be translated into either changes in employment or wages.

Rodrik (1997) identifies a channel through which this can occur. In industries where rents are available for extraction, and where wages are in part determined by bargaining between workers and firms, a rise in the elasticity of demand for labourers results in a lower share of firm rents being distributed to workers (Rodrik, 1997).

We have selected this channel; of trade unions bargaining on behalf of their members, to estimate empirically the impact of trade liberalisation on wages in context of finite labour demand elasticities.

3.2.1 A Bargaining Model between Trade Unions and Firms in Context of International Trade

We were unable to find a bargaining model between unions and firms that accounted explicitly for changes in labour demand elasticities. Each of the models we examined did however operate under assumptions outside the of HOS model. They each assumed a bargaining process between a single firm and trade union, and in doing so, implicitly assume the possibility of finitely elastic labour demands.

Following our failure to find a model that was ideally suited, we decided to select a bargaining model applied in the context of international trade. A notable model applied in this context is of the interaction between firms operating under conditions of imperfect competition and trade unions proposed by Gaston and Trefler (1993). The model assumes, through the assumption of monopolistically competitive markets, that firms earn economic rents which are divided up between firms and trade unions through the bargaining process. The assumptions of imperfect competition reflect the reality in the South African manufacturing sector for which there is evidence of price over marginal cost mark-ups (Fedderke *et al*, 2007). A brief outline of the model by Gaston and Trefler (1993) follows.

Gaston and Trefler (1993) begin by assuming that firms trade internationally on the basis of comparative advantage and import competition and export promotion are used as exogenous indicators of domestic competitiveness. Firms are assumed to exhibit no strategic rivalry. Finally, it is assumed that the market structure generates economic rents (Gaston and Trefler, 1993).

A given firm's total revenue function is given by $R(n, \rho)$, where n is employment and ρ is a measure of the firm's competitiveness. In context of international trade, various measures can be used to represent ρ , including imports, exports and tariffs (Gaston and Trefler, 1993). Importantly, this model assumes ρ to be exogenous and not determined by wages. The empirical methodology employed in this paper utilises tariffs as a measure of ρ . It is thus necessary that the tariff data used in the empirical estimation is likewise exogenous. It is further assumed that R_ρ and $R_n > 0$ and $R_{nn} < 0$.

Unions are assumed to negotiate wage-employment contracts based on the McDonald and Solow (1981) specification of union preferences. We normalise n such that n represents the probability of employment through a trade union. Union members receive a wage of w whilst non-union members receive a wage of ω with probability of $(1 - n)$ (Gaston and Trefler, 1993). Union preferences are given by:

$$n.U(w) + (1 - n).U(\omega) \quad (8)$$

Bargaining between firms and unions takes place over wage contracts which are a function of both w and n . This bargaining is assumed to be efficient and is assumed to occur simultaneously for employment and wages. The wage contract that is the outcome of the bargaining is assumed to maximise the following generalised Nash product $G(w, n)$:

$$G(w, n) = (R(n, p) - wn - \Pi)^{1-\alpha} (n.U(w) + (1 - n).U(W) - U(W))^\alpha \quad (9)$$

where Π represents the firm's rent opportunities, W is the alternate wage earned by a union member who fails to gain employment through the trade union (with probability $1 - n$), and $0 < \alpha < 1$ is an index of collective bargaining strength (Gaston and Trefler, 1993).

Gaston and Trefler (1993) assume that G is strictly concave to ensure that the solution is unique and first differences can be taken. They take the first difference of (9) with respect to w and n as follows:

$$\frac{\partial \ln(G)}{\partial w} = \frac{(1 - \alpha)n}{R(n, p) - wn - \Pi} - \frac{\alpha U_w(w)}{U(w) - U(\omega)} = 0 \quad (10a)$$

$$\frac{\partial \ln(G)}{\partial n} = \frac{(1-\alpha)(R_n(n,p) - w)}{R(n,p) - wn - \Pi} - \frac{\alpha}{n} = 0 \quad (10b)$$

A central proposition of the model provided by Gaston and Trefler (1993) is as follows:

$w = w(\alpha, \pi, \omega, \rho)$ with $\partial w/\partial \alpha > 0$, $\partial w/\partial \pi > 0$, $\partial w/\partial \omega > 0$ and $\partial w/\partial \rho$ is indeterminate (Gaston and Trefler, 1993:5).

The proposition states that the wage contracted by the union is higher the greater the union's bargaining strength is, is lower the poorer the firm's rent opportunities are, and is higher the better the wage earned by non-union members is. Importantly, the proposition states that a decrease in the competitive position of the firm (as a result of trade liberalisation) has an indeterminate effect on w . This is because it is possible in the model for unions to agree to wage cuts in return for implicit or explicit employment guarantees, resulting in $\partial w/\partial \rho < 0$ (Gaston and Trefler, 1993). An attempt therefore to model the impact of trade liberalisation on trade union power, using only wage premiums as an indicator of union bargaining power is limited. This will need to be considered when interpreting empirical estimations based on the wage regressions that follow in Chapter 6.

As mentioned in Section 2.2.2, COSATU enjoys a dominant position in South Africa. Considering the dominance of COSATU in wage employment contract negotiations, there exists a possibility that COSATU possesses some level of monopoly power. In cases where unions possess monopoly power, the union selects w , with the firm responding with its choice of n in accordance with its demand for labour. In this case, the optimal wage is a function of only ω and ρ , with $\partial w/\partial \omega > 0$ and $\partial w/\partial \rho$ having an indeterminate sign. Hence, with respect to ω and ρ , their relationship to w remains unchanged by the imposition of the monopoly union assumption (Gaston and Trefler, 1993).

4. Data

We begin this chapter by outlining in Section 4.1 the methodology employed in constructing the average industry tariff rates and effective rate of protection that will be used in the estimation of the models to be presented in Chapter 5. We also build on the description of the average tariff data provided in Chapter 2 by providing an analysis of industry level average tariffs and effective rates of protection in the manufacturing sector. In Section 4.2, we outline briefly the procedure used in constructing the household level dataset that will also be used in the estimation of the models presented in Chapter 5.

4.1 Tariff Data

4.1.1 Construction of Tariff Dataset

For use in this study, we required a set of industry level nominal tariff rates and effective rates of protection consistent with the industry categories contained within the Stats SA Labour Force Survey for the period 2000 to 2007. Since such a dataset was not readily available, it was constructed employing a methodology consistent with Edwards (2005), with some departures where necessary.

The construction of the nominal tariff dataset consisted of a number of stages. The first stage was the acquisition of the tariff data. We required both European Union (EU) tariff data and aggregate tariff data. The latter required us to acquire most favoured nation (MFN) and Southern African Development Community (SADC) tariff data, which together with the EU tariff data covered all trade between South Africa and the world. The data was obtained at the Harmonised System (HS) 8 digit level from the Trade and Industrial Policy Strategies (TIPS), the Trade Analysis and Information System Database (TRAINS) and the Industrial Development Corporation (IDC). Where necessary, the data was updated using the South African government Gazettes (Edwards, 2005).

The majority of tariffs in use between 2000 and 2007 were ad valorem tariffs. The remaining tariffs could be categorised as being either mixed, specific, specific maximum, compound, or formula tariffs².

² **Specific tariffs** specify a monetary value that must be paid per unit of a good e.g. 193.6c/kg. **Compound tariffs** are the sum of a specific tariff component and an ad valorem component e.g. 25c plus 1.04c/litre. **Mixed tariffs** offer a choice between a specific or ad valorem component, with the maximum of the two applied e.g. 40% or 240c/kg. **Formula tariffs** are used to ensure the free on board price of a given import is maintained at a level specified in the formula. If the price falls beneath the specified level, the formula provides for additional tariffs to be levied e.g. 10% or 55c/kg less 90% (Edwards, 2005). Finally, **specific maximum tariffs** require the specific component of the tariff to be applied until a specified maximum ad valorem equivalent is reached, at which stage the specified ad valorem rate is applied e.g. 450c/kg with a maximum of 96%.

For our purposes, we required a standardised measure of protection, free from differences in units of measurement. We thus followed the convention and converted all non ad valorem tariffs into their ad valorem equivalents. This process constituted the second stage of the construction of the industry level dataset.

Formula tariffs have since the late 1990's been gradually removed from tariff schedules (Edwards, 2005) and thus rarely featured in the 2000 – 2007 tariff data. When encountered, the ad valorem components of the tariffs were used. In dealing with the remainder of the tariff types, it was necessary in each case to convert the specific components of the tariff into an ad valorem equivalent. The methodology employed by Edwards (2005) to achieve this was to use collection rates in place of specific and mixed tariffs. The use of collection rates, however, can act to underestimate protection on products with high tariff rates (Edwards, 2005). Such products, if imported, are imported in small quantities, resulting in low collection rates. Thus a product under a high level of protection is measured as having relatively little protection.

Due to the problems of underestimation, we departed from the methodology used by Edwards (2005) and opted instead to use price data to directly convert the specific components of the tariffs into ad valorem rates³. Cost insurance freight (c.i.f.) price data of imports from the EU, SADC, and the rest of the world were obtained at the HS 8 digit level from Quantec. A problem encountered with the c.i.f. prices was that they exhibited a greater than expected variability across time. This variability served to generate a degree of inconsistency in the measures of protection across the different periods. We were able to offset the effects of the variability to some extent through the use of 3 year average prices for each region as opposed to single year prices.

Since the tariff data was to be linked with the Labour Force Survey (LFS) data, the HS 8 digit level tariff data needed to be mapped to the industry level coding utilised in the LFS. The LFS utilises an industry classification standard that follows closely, but that is not identical to, the 3 digit level International Standard Industrial Classification (ISIC) (revision two). Furthermore, whilst the LFS does contain industry data at the three digit level, upon closer examination of the survey data it was clear that the more aggregated two digit level coding would have to be used (the reason for this will be explained in Section 4.2).

We were unable to find a direct concordance between the HS level data and the 'South African' version of the ISIC coding employed in the LFS (we will refer to this coding as the ISIC SA). We thus had to construct a concordance. We did this by first mapping the HS 6 digit coding to the standard 4 digit ISIC coding using a set of concordances sourced from Quantec. Thereafter, we manually created a concordance from the 4 digit ISIC coding to the 2 digit ISIC SA coding using the industry coding file supplied by Statistics South Africa as supporting documentation to the LFS data files.

³ We did this by dividing the values specified by the specific tariff components with the price of the goods on which the tariffs were applied e.g. a specific tariff of 193.6c/kg on a product of price R5.10 yields an ad valorem rate of $193/510 = 38\%$

The final stage in the creation of the industry level dataset was the aggregation of the ISIC 4 digit tariff data to the LFS SA 2 digit level data using the created concordance as a mapping. In aggregating up the tariff data, an average tariff for each level of aggregation is calculated. There are numerous methods that can be used to calculate average tariffs. Lawrence (2005) makes use of simple averaging⁴. A simple averaging of tariffs provides equal weighting to all tariffs within a given level. This leads to an upward bias in the average tariff if the majority of imports into the country are made up of a few goods with very low or zero tariffs applied to them, and there exist a number of goods with high tariffs but that are not significant in terms of volume. We thus decided to depart from Edwards (2005) and to follow the an alternate methodology of calculating weighted average tariffs

Using the data available to us, we were able to calculate import weighted average tariffs. This entailed weighting the tariff on each line item by the associated Rand value of imports for the relevant region. Whilst this methodology overcame the bias associated with weighting each line item equally (as is done when taking simple averages), it created a new type of bias. Since the objective of applying a tariff is in most cases to limit imports, by using import values to weight tariffs, the average tariff is inevitably biased downwards as higher tariffs are always given less weight. In addition to this, there existed a high level of variability in the value of imports in each region over time. This variability in import values was transmitted in the weighting process to the average tariff rates, which depicted a significantly greater level of variability than was present in the un-aggregated tariff data. To remove the effects of the excessive variability in the import values, we took the average of the import values for each region across the full 2000 to 2007 period.

In using a fixed weighting however, some of the 2007 average tariff values were biased upwards as a result of a reduction in line items that occurred in the updating of the HS schedule in 2007.⁵ In addition the overall reduction in line items in the 2007 schedule, a few new line items were introduced into the schedule that year. These items were underweighted relative to items that had been traded over the entire period resulting in a downward bias in those average tariff values. The 2000 – 2006 average tariffs were however a considerable improvement on those yielded by the single year import value weighting. We thus decided to use the fixed weighting.

Nominal tariff rates provide an indication of the level of protection on completed goods or output. They do not however account for protection on inputs into the production process. Using nominal tariff rates as a measure of protection therefore provides an incomplete indication of the level and impact of protection in the economy. Many researchers therefore opt to use effective rates of protection as a measure of protection. This measure of protection calculates the level of protection on value added and thus captures the impact of protection on each stage of production as well as on output. For this reason, we included effective rates of protection in addition to the nominal tariff rates in our analysis.

⁴ Where the tariffs applied to each line item within a given level/industry are added together and the sum is divided by the number of line items in that level.

⁵ This resulted in some line items that previously appeared independently in the schedules being aggregated together.

The effective rates of protection were calculated as per Edwards (2005) using supply use tables for the year 2000. For use in the calculation, we required a set of total average tariffs which we obtained through combining the EU, MFN and SADC average tariff rates we had calculated previously.

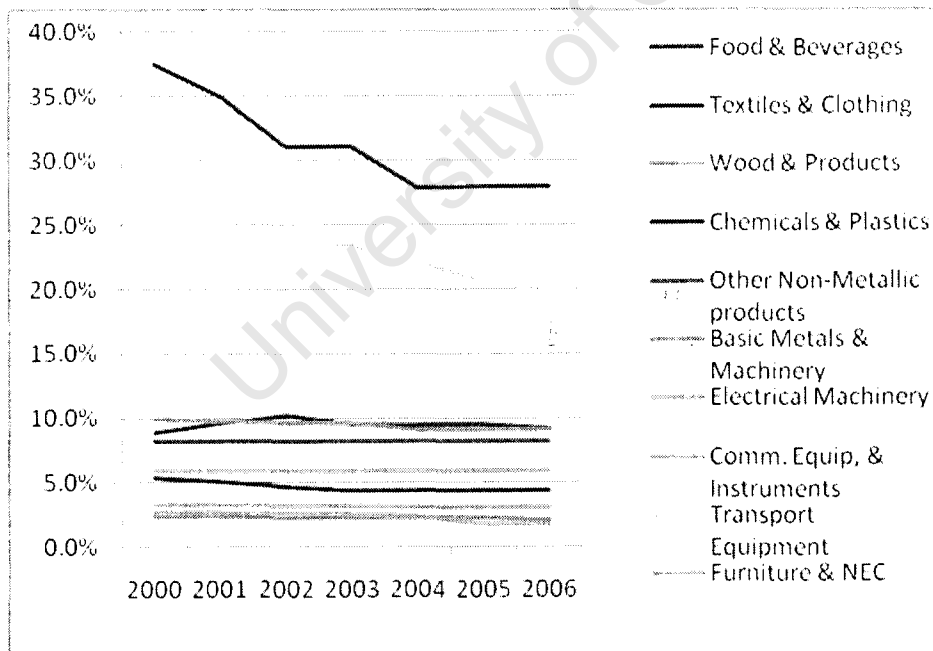
4.1.2 Analysis of Average Nominal Tariffs and Effective Rates of Protection

We will be using only manufacturing sector tariff data in the empirical estimation to follow. As outlined in 4.1.1, this tariff data will enter the empirical estimation at the two digit ISIC SA industry level. The industry level tariff rates applied to MFN, EU and total manufactured imports for the period 2000 – 2006 are depicted by figures 4.1, 4.2 and 4.3 respectively⁶. The 2007 industry tariffs have been excluded from the figures due to their bias discussed in Section 4.1.1.

From Figure 4.1, we see that average tariffs on MFN imports fell sharply in the textiles and clothing and the transport equipment industries. Tariffs on the remaining industries remained constant across the 2000 to 2006 period.

Figure 4.1

Industry Level Average Tariffs on MFN imports. 2000 – 2007



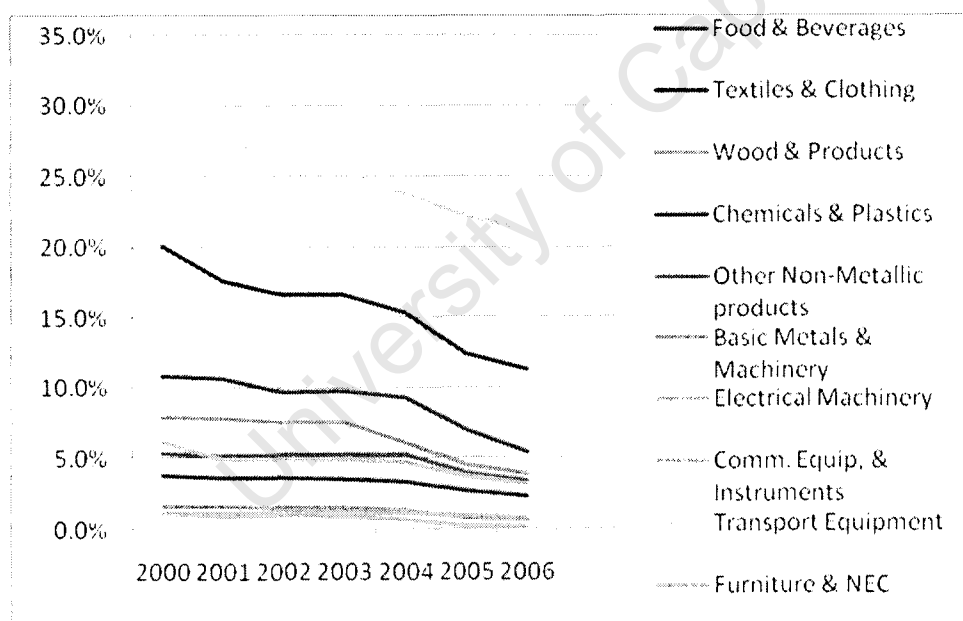
Source: own calculations using TIPS, TRAINS, IDC & Gov. Gazette (2000 – 07)

⁶ SADC industry tariffs are not examined here due to their low share in total South African imports in the period between 2000 and 2007. Imports from SADC during this period represented only 2.2% of total imports (own calculations using Quantec, 2008).

Examining Figure 4.2, we find that tariffs on EU imports also fell sharply in the textiles and the transport equipment industries over the same period, but remained relatively high as of 2006. In addition, the average tariff level in the food and beverage and the wood and products industries fell significantly. The remaining industries each experienced a decline in their average tariffs with the exception of the furniture industry, where the average tariff remained constant. From Figure 4.3, we find that total average tariffs in the textiles and the transport equipment industries follow a downward trend that coincides closely with the EU and the MFN average tariffs for the same industries. The average tariffs on the remaining industries declined slightly between 2000 and 2006. The MFN average tariffs in these industries remained constant during this period, and any variations in SADC average tariffs over the period would have little or no impact on the total average tariff due to its low share in total imports. The slight decrease in the total average tariffs is thus a result of liberalisation in trade with the EU in these industries.

Figure 4.2

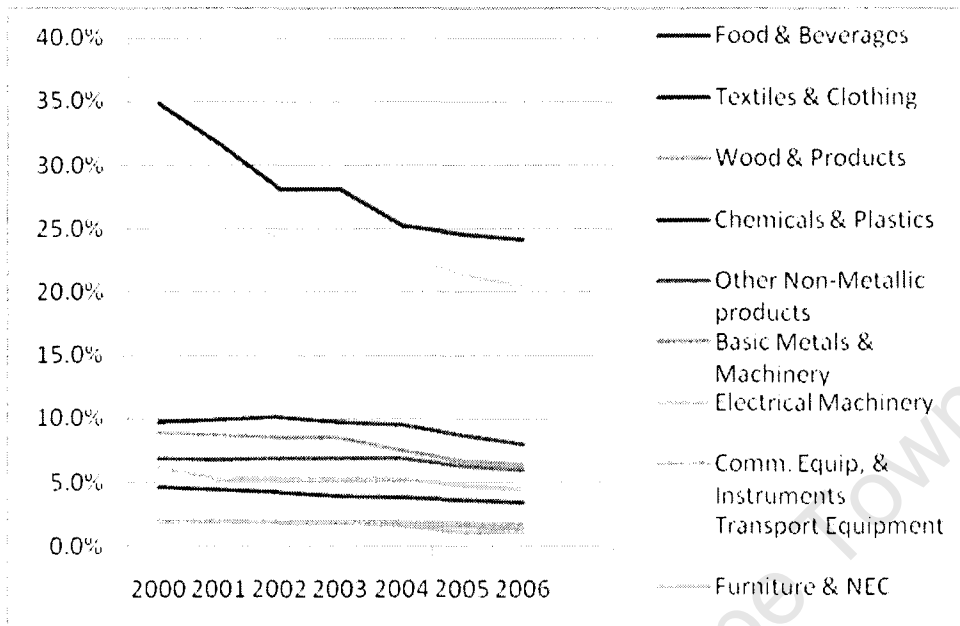
Industry Level Average Tariffs on EU imports. 2000 – 2007



Source: own calculations using TIPS, TRAINS, IDC & Gov. Gazette (2000 – 07)

Figure 4.3

Total Industry Level Average Tariffs. 2000 – 2007



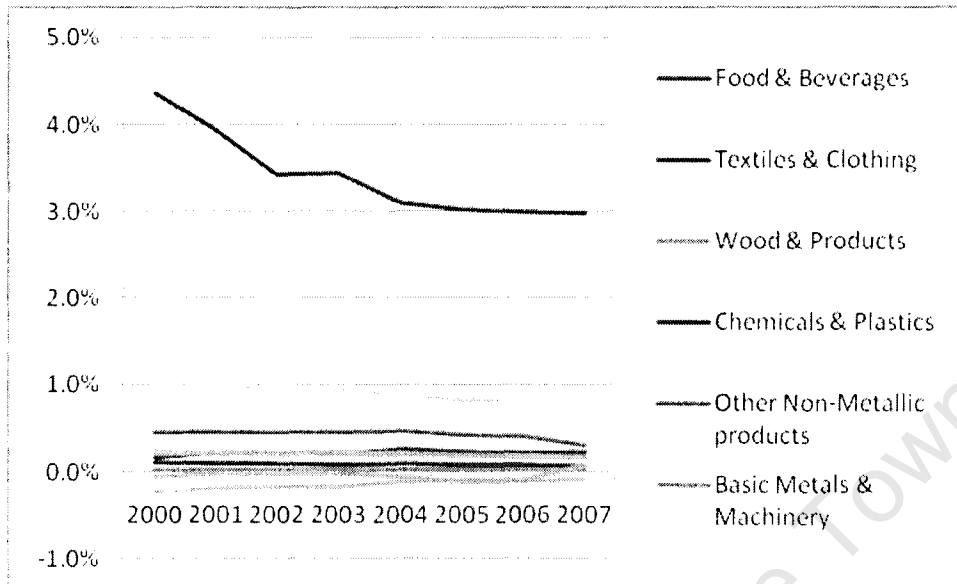
Source: own calculations using TIPS, TRAINS, IDC & Gov. Gazette (2000 – 07)

Examining changes in the effective rates of protection, we find from Figure 4.4 that there has again been liberalisation in the textiles and the transport equipment industries. In the remainder of the industries, there has been even less of a decrease in protection than when using total tariffs as a measure. In some industries the level of protection has remained virtually unchanged across the period.

When using both average tariffs and average effective rates of protection, we find that there has been strong liberalisation in the textiles and transport equipment industries between 2000 and 2007. In addition, there has been some degree of liberalisation in the remaining industries over the same period.

Figure 4.4

Total Industry Level Effective Rates of Protection. 2000 – 2007



Source: own calculations using *TIPS*, *TRAINS*, *IDC* & *Gov. Gazette* (2000 – 07)

4.2 Household Data

For use in this study, we constructed a household level dataset using Statistics South Africa's 2000 – 2007 Labour Force Survey data. The data and supporting documentation were obtained from the University of Cape Town's DataFirst Resource Centre. Since our focus in this study is on the impact of trade liberalisation on the wages of the employed, we only made use of the *STATS SA worker data* files in constructing the data set.⁷ The biannual LFS is conducted each March and September. In order to exploit a greater number of observations, and to allow for the use of industry fixed effects, we constructed a multiple period dataset that combined observations from each of the March LFS's carried out between 2000 and 2007. The March surveys were selected as they provided the closest time match to the tariff data, which was updated on February of each year.

In constructing the dataset, we first created a common set of standardised individual characteristic variables in each single period data set. We then merged the individual datasets into one multiple period dataset. In merging the datasets, only observations belonging to workers in the manufacturing sector were kept.

As referred to in Section 4.1.1, the average tariff data was to be merged by industry into the household data set. This therefore necessitated the creation of an industry categorical variable using the LFS data. As mentioned previously, the default industry coding used in the LFS is the three digit ISIC SA coding. The three digit coding consists of ninety-five unique industry categories. This coding

⁷ Following each LFS, *STATS SA* release a separate data file called *worker data* which contains observations for employed individuals only.

can be aggregated up to a 2 digit level coding consisting of ten unique industry categories. In creating the categorical industry variable therefore, we needed to decide between using the ninety-five disaggregated categories or the ten aggregated categories.

From the discussion in Section 4.1.1 it is clear that much information is lost in the aggregation of tariff data and hence less aggregation is preferred when using tariff data. When using the disaggregated industry categories however, an immediate problem arose in that there were either very few or no observations in a large number of the categories. As an example, in the 2001 survey data, 33 of the 95 disaggregated industry categories contained zero observations.

A key variable that will be used in Chapter 6 to determine if the impact of industry bargaining power on wages is dependent on the level of protection will be an industry union density variable. This variable will contain for each year, observations of the total number of unionised workers in each industry over the total number of individuals employed in each industry. The observations in the union density variable will thus range from a minimum of zero (no union presence in a given industry) to a maximum of one (complete unionisation of the workforce in a given industry). In industries with zero observations, were the number of observations to increase by one worker in the following year, and were the worker to be a trade union member, this would result in the union density increasing from zero to one between the two years. This would greatly exaggerate the true variation in union densities.

Due to this problem, which we believed to be more severe than those associated with the aggregating of the tariff data, we decided to use the 2 digit ISIC SA industry categories in creating the industry categorical variable.

5. Model Specification

In this chapter we outline the empirical methodology employed in this paper. We outline three models for estimation. The first two models outlined in Section 5.1 are used to determine if a significant relationship between trade liberalisation and wages exists, and if so, what the direction of the relationship is. The third model, outlined in Section 5.2, is used to determine if the impact of liberalisation on wages is dependent on the level of industry union bargaining power. Finally, in Section 5.3 we draw attention to a form of bias that the estimates of the models outlined in this chapter are at risk of exhibiting. The results of the estimates on the three models will be presented in Chapter 6.

5.1 Trade Liberalisation and Wages

In order to test the relationship between relative wages and trade liberalisation established by the Stolper Samuelson theorem, we use an expanded Mincerian wage regression that incorporates directly average EU industry tariffs and effective rates of protection as a proxies for trade liberalisation.

We will estimate two variants of the expanded Mincerian wage regression to test the above relationship. The first regression model presented estimates directly the impact of trade liberalisation on wages while the second model presented estimates the impact of trade liberalisation on relative wages.

5.1.1 Trade Liberalisation and Wages

In the first of these variants we follow Fiandero and Rankin (2008) and estimate the following model.

$$\ln w_{ijt} = \beta_1 C_{ijt} + \beta_2 \tau_{jt} + \mu_j + \alpha_t + \varepsilon_{ijt} \quad (11)$$

An explanation of each of the variables included in the regression model above follows:

$\ln w_{ijt}$ is the log of monthly wages of individual i belonging to industry j at time t . A log-linear relationship between wages and the explanatory variables is assumed in conformity with the standard Mincerian wage regression specification.

C_{ijt} is a vector of some of the standard individual characteristics introduced into Mincerian wage regressions. These include years of schooling, gender, trade union membership status, provincial location, population group, and occupation.

τ_{jt} contains the average EU industry tariff rates or average industry effective rates of protection (depending on which one is used) for industry j at time t .

μ_j & α_t are industry and year fixed effects respectively.

The inclusion of the year and industry fixed effects in each of the models estimated in this paper is an important differentiating feature between this study and some other South African studies, including that by Fiandeiro and Rankin (2008), which fail to include these fixed effects. By failing to include industry fixed effects in a regression such as the one presented in equation (11), there is likely to be some level of omitted variable bias in the tariff variable estimate. Without the inclusion of industry fixed effects, the estimate on the tariff variable not only reflects the impact of trade liberalisation on wages, but also the impact of industry specific characteristics on wages. We thus include the industry fixed effects to control for time invariant characteristics unique to each industry. This is of course only possible when using a multiple period dataset like the one used in this study⁸. When using a multiple period dataset, it is necessary to control for time specific economic shocks that affect all observations. This is the reason for including the year fixed effects.

It is important to note at this stage that nominal wages and tariffs are used in the regressions that feature in this paper. The inclusion of the year dummy is therefore in part an attempt to account for inflation across sectors.

Since we are estimating relationships using a multiple period dataset it is possible to think of each regression equation outlined in this chapter as a 'stack' of equations; one for each of the years represented in the dataset. In estimating the 'stacked' equation, it is plausible to assume that the variability of the error term across observations in each of the individual component equations differs across the different component equations. This as each component equation contains data from a different labour force survey conducted at a different time and using a different mix of households. We therefore expect heteroscedasticity between the error terms of the different component equations. To account for this, all estimates are conducted using robust standard errors.

Following the estimation of the model presented in equation (11), a significant estimate of β_2 would suggest that there is a statistically significant relationship between wages and tariff rates and/or effective rates of protection. The sign on the estimate, if significant, will suggest the direction of the relationship between the two variables.

5.1.2 Trade Liberalisation and Relative Wages

The relationship estimated by Fiandeiro and Rankin (2008), whilst of interest, is inconsistent with the trade theory in that it attempts to estimate a relationship between trade liberalisation and wages instead of relative wages. The model we propose, which represents the second variant of the expanded Mincerian wage regression referred to earlier, is as follows:

⁸ When using single year data, there is perfect co-linearity between the tariff variable and the industry fixed effects.

$$\ln w_{ijt} = \beta_1 C_{ijt} + \beta_2 \tau_{jt} + \beta_3 hieduc_{ijt} * \tau_{jt} + \mu_j + \alpha_t + \epsilon_{ijt} \quad (12)$$

with $hieduc_{ijt} * \tau_{jt}$ being the interaction between years of education (*hieduc*) and tariff rates/effective rates of protection.

The interaction term is included in order to capture any non-linearity in the model with respect to the impact of tariffs and education on wages. If the estimate of β_3 is found to be significantly different from zero, this would suggest that the impact of changes in average tariffs on wages is dependent on the level of education of the individual. Thereafter, the sign on this estimate will allow us to determine what the relative impact of trade liberalisation has been on the wages of relatively skilled workers versus that of relatively unskilled workers.

5.2 Trade Liberalisation and Union Power

In Chapter 3, we selected the bargaining of trade unions on behalf of their members as a channel through which changes in labour demand elasticities following trade liberalisation can be translated into movements in wages.

As mentioned in Section 3.2, in considering the impact of trade liberalisation on the elasticity of demand for labour, we are moving away from the assumptions of the Heckscher – Ohlin universe. In so doing, we are moving out of the general equilibrium model of the Heckscher Ohlin universe and into a firm level partial equilibrium model. A fundamental problem with this is that we do not have a complete set of firm level data which we can use to test relationships that assume a finitely elastic demand for labour. Slaughter (1997), in attempting to estimate a relationship between labour demand elasticities and a vector of trade variables, faced the same data availability problem. He opted instead to use industry level data, claiming that it is possible for labour demand elasticities to be finite at the industry level (Slaughter, 1997). In following Slaughter (1997), we still face an additional problem in that we are using national household survey data that invariably contains variation best explained in a general equilibrium setting. However, in this regard we follow Shendy (2007) who uses industry level tariff data and household data in a similar study.

We follow Shendy (2008) and estimate the following model:

$$\ln w_{ijt} = \beta_1 C_{ijt} + \beta_2 \tau_{jt} + \beta_3 UD_{jt} + \mu_j + \beta_4 \tau_{jt} * UD_{jt} + \alpha_t + \epsilon_{ijt} \quad (13)$$

where UD_{jt} is the union density ratio for industry *j* at time *t*, and $\tau_{jt} * UD_{jt}$ is an interaction term between the average industry tariff (or effective rate of protection) and the industry union density ratio.

The industry union density ratio is the ratio of union members in a given industry to total workers, both union and non-union members, in the industry. This variable is used as a proxy for

union bargaining power (Shendy, 2008). The interaction term is included to capture non-linearity in the model with respect to the impact of tariffs and union density on wages. In estimating β_4 , we are examining if the impact of union bargaining power on wages in a given industry is conditional upon the level of protection as alluded to by Rodrik (1997) and predicted by Gaston and Trefler (1993).

5.3 The Problem of Simultaneity Bias and Testing for Endogeneity

Much of the difficulty encountered in estimating the impact of changes in tariffs (as a proxy for trade liberalisation) on wages, is in overcoming the problem of the endogenous nature of tariffs in such estimations. There is evidence to suggest that circumstances in the South African labour market inform policy decisions made regarding protection (Casale and Holden, 2002). Casale and Holden (2002) find that industries in South Africa with relatively low levels of employment are more likely to attract high trade barriers than other industries. This reasoning can plausibly be extended to wages. Hence measures of protection are possibly endogenous in models where wages are the dependent variable.

As mentioned in Chapter 4, much of the variation in tariffs applied to goods in the manufacturing sector since 2000 has been on goods traded with the EU. Considering that the variation in these tariffs is as a result of arrangements between South Africa and the EU agreed upon before 2000, the inclusion of EU average industry tariffs in the wage regression as a proxy for trade liberalisation is both valid and should not cause a problem of simultaneity bias. However, we have no guarantee that the inclusion of the effective rates of protection into the regressions will not cause simultaneity bias. This is because the effective rates of protection are calculated using total average tariff rates which include MFN and SADC tariff rates in addition to EU tariff rates. We will therefore conduct a Hausman Specification Test for endogeneity on the π_{it} variable using effective rates of protection. The results of this test will be provided in Chapter 6.

6. Estimation Results

In this chapter we present the results of the simultaneity bias test and the empirical models outlined in Chapter 5. We begin by presenting and interpreting the results of the Hausman Specification test referred to in Chapter 5. Thereafter, in Section 6.2 we provide and interpret the results of some preliminary regressions conducted using only the household level data and not including any measures of protection. These regressions provide some insights into the relationships between various individual characteristics and wages. Finally, in Section 6.3 we present the results of the estimations on the models presented in equations 11, 12 and 13.

(Please refer to the Table Appendix at the end of this paper to find the tables and an explanation of the variables referred to in this chapter).

6.1 Hausman Specification Test for Endogeneity

In this section we test to see whether or not the *ERP* variable is exogenous in the following system (equation (11) is reproduced here):

$$\ln w_{ijt} = \beta_1 C_{ijt} + \beta_2 \tau_{jt} + \omega_i + \alpha_t + \epsilon_{ijt} \quad (11)$$

Recall that τ_{jt} , when containing EU average tariff observations, is exogenous to the model presented above. However, we are not certain that the effective rates of protection, which are derived from EU as well as MFN and SADC average tariffs, are exogenous to the model. We run a Hausman Auxiliary Regression Specification Test to determine whether or not *ERP* suffers from simultaneity bias (is endogenous).

The test involves regressing the *ERP* variable on a matrix of the remaining explanatory variables and an instrument. The residuals of this regression are then included on the left hand side of the regression presented in equation (11).

The null and alternate hypotheses of the test are as follows:

H_0 : The estimate of β_{ERP} using OLS is consistent and efficient. The estimate of β_{ERP} using the instrumental variable technique is consistent but inefficient (i.e. no simultaneity bias).

H_1 : The estimate of β_{ERP} using OLS is inconsistent. The estimate of β_{ERP} using the instrumental

variable technique is consistent (i.e. simultaneity bias).

If the estimated coefficient on the residuals is significantly different to zero, we reject the null hypothesis in favour of the alternate.

For use in the test, we need an instrument for the *ERP* variable. A valid instrument, z , must be correlated with the *ERP* variable i.e. $E(z'ERP) \neq 0$. Furthermore, z must be uncorrelated with the error term i.e. $E(z'\varepsilon_{ijt}) = 0$. The correlation coefficient between *ERP* and *tariff* is 0.62, and the *tariff* variable, as stated previously, is uncorrelated with ε_{ijt} . The *tariff* variable is therefore a valid instrument for *ERP*.

The results of the final stage regression are presented in column 5 of Table 5.2. Using the standard error of the estimate on the *residual* variable, a p – value of 0.879 is calculated for a test with the null hypothesis of $\hat{\delta}_{residual} = 0$. From the p – value we conclude that the estimate on the residual variable is not statistically different to zero and are thus unable to reject the null hypothesis of no simultaneity bias at all conventional levels of significance. The *ERP* variable is thus exogenous in the model presented in equation (11).

6.2 Preliminary Regressions

Table 5.1 presents the results of a set of wage regressions of the log of wages on a vector of individual characteristics and fixed effects. Column 1 presents the results of a basic regression of wages on individual characteristics, excluding any fixed effects. In each set of results presented, the estimates on the vector of individual characteristics are significant at conventional levels of significance. In each case, the estimated coefficients on the age, education, gender, union, coloured, Indian and white variables are all positive, with the coefficient on the age2 variable being negative. The signs on these estimates all conform to standard Mincerian wage expectations. From the estimated coefficients we deduce that, holding all else constant, a person earns a greater wage the older he/she is (this occurs at a diminishing rate) and the greater the number of years of education he/she has received. Furthermore, a coloured, Indian or white person earns a higher wage than a black person. Finally, a person who is male earns more than a person who is female and a trade union member earns a higher wage than a person who is not a member of a trade union.

In Column 2 we present the results of the regression including year fixed effects (α_t in equation (11)). Following the inclusion of the fixed effects, the adjusted R – squared figure increases to 52.32% from 50.49% in the previous regression presented in Column 1, indicating an increase in the explanatory power of the model. The estimates on each of the fixed effects are significant at all conventional levels of significance, while the sign and significance of the estimates on the remaining variables remain unchanged from the previous regression. Due to the statistical significance of the year fixed effects, we conclude that the expectation outlined in Chapter 5 regarding the presence of period specific economic shocks in the data is valid.

In Column 3 we present the results of the regression including both time fixed effects and industry fixed effects (represented by μ_j in equation (11)). Following the inclusion of the industry fixed effects, the adjusted R – squared figure increases from 52.32% to 54.36%, indicating a further increase in explanatory power. The estimates on each of the industry fixed effects are significant at all levels of significance, while the sign and significance of the estimates on the remaining variables remain unchanged. Due to the statistical significance of the industry fixed effects, we conclude that their inclusion in our model is valid.

Finally, due to the threat of heteroscedasticity outlined in Chapter 5, the full fixed effects regression was run again using robust errors. The results of the regression are presented in Column 4. Examining the results we find that the standard errors are marginally different to those presented in Column 3 and the statistical significance of each variable remains unchanged. Despite the slight difference made, using robust standard errors in stacked regressions of this nature is prudent and will be used henceforth.

6.2 Wage Regressions including Measures of Protection

As outlined in section 4.1, the problems encountered when weighting the tariff data resulted in an upward bias of some levels of the 2007 tariff data. Because of this, henceforth each regression is estimated twice; once including and once excluding 2007 data.

6.2.1 Trade Liberalisation and Wages

Table 5.2 presents the results of wage regressions based on equation (11). In Column 1 (which includes 2007 data) the estimate on the *tariff* variable is significant at the 10% level. From the estimated coefficient on the *tariff* variable we deduce that a 100 basis point decrease in tariff rates results in a 0.75% decrease in the wage of an individual worker, holding all else constant. The estimated coefficient on the tariff variable is no longer significant at any conventional levels when considering only 2000 – 2006 data⁹. In Column 3 we consider the impact on wages of changes in the effective rate of protection instead of tariff rates. The estimate on *ERP* is significant at all conventional levels. From the estimates on *ERP* we deduce that a 100 basis point decrease in the effective rate of protection results in a 9.3% decrease in an individual worker's wage, holding all else constant. This result varies only marginally when 2007 data is excluded.

While we would expect the estimate on the *ERP* variable to be higher than that of the tariff variable, since effective rates of protection account for protection on both inputs and outputs, the estimate on the ERP variable appears to overestimate the impact of changes in effective protection on wages. Even the estimate on the *tariff* variable is greater in magnitude than obtained in a similar

⁹ Note that the high values of the estimates on the tariff variable as they appear in the Tables are as a result of the tariff rates entering the estimation as ratios. Hence the estimates measure the percentage increase in wages arising from a 10000 basis point increase in tariff rates).

study by Fiandeiro and Rankin (2008). Possible explanations for this overestimation will be provided at the end of the chapter.

As mentioned in Chapter 5, Fiandeiro and Rankin (2008) run similar regressions in their study, but with a few key differences. They make use of single year regressions instead of multiple year data and estimate regressions on the log of hourly wages instead of the log of monthly wages. Furthermore, they make use of 3 digit SA ISIC level aggregated tariff data instead of the 2 digit SA ISIC level data used in this study. Despite these differences, the results obtained in their study nevertheless provide a useful check for the results obtained in this paper. Fiandeiro and Rankin (2008) find a negative and significant estimate of the coefficient on the tariff variable. This contradicts our finding of positive estimated coefficients. A likely explanation for this is that Fiandeiro and Rankin (2008) fail to control for differences in industry characteristics when estimating the coefficient on the tariff variable. Their result therefore not only reflects the relationship between trade liberalisation and wages, but also the influence of unobserved industry specific characteristics on wages.

There has since 2000 been at least some level of liberalisation in each of the manufacturing sector industries (see Figure 4.5 and Figure 4.6). Some of these industries predominantly employ relatively skilled workers whilst others employ relatively unskilled workers (LFS 2000 – 2007, own calculations). Ignoring relative effects, there is some theoretical support for the expectation of average wages declining overall. The results we obtain therefore conform to our broad expectations

However, as mentioned in Section 5.2, the relationship that Fiandeiro and Rankin (2008) estimate is inconsistent with the trade theory in that it focuses directly on wages as opposed to relative wages. In the following section, we consider the results of estimations which are closer to the underlying theory.

6.2.2 Trade Liberalisation and Relative Wages

The results of a set of regressions based on equation (12) are presented in Table 5.3. In the results presented in Columns 1 (including 2007 data) and 2 (excluding 2007 data), all individual characteristic and fixed effects estimates are significant at conventional levels. In both sets of results, the estimates on the tariff variable is positive, with the estimates on the interaction *tariff*hieduc* variable being negative. The estimates on these variables are significant at the 1% level in both sets of results. We thus conclude that a decrease in tariff rates results in an decrease in wages, with this decrease occurring at a diminishing rate as the level of education attained by an individual worker increases (holding all else constant).

Differentiating equation (12) (using the estimated coefficients in place of the β 's) with respect to tariff (τ) and setting the result equal to zero, we are able to calculate the turning point level of education, after which the impact of a decrease in tariff rates results in an increase in wages. This is calculated as follows:

2000 – 2007 Data

$$1.414474 - 0.078514 \cdot \text{education} = 0$$

$$\text{education} = \frac{1.414474}{0.078514}$$

$$\text{education} = 18.02 \text{ years}$$

2000 – 2006 Data

$$1.55099 - 0.0841495 \cdot \text{education} = 0$$

$$\text{education} = \frac{1.55099}{0.0841495}$$

$$\text{education} = 18.43 \text{ years}$$

Therefore, a decrease in the tariff rates will result in an increase in the wage of an individual with greater than 18.02 years of education (18.43 years if only 2000 – 2006 data is used).

Columns 3 and 4 present the results of the estimations using effective rates of protection instead of tariff rates. Again, all estimates are significant at conventional levels of significance. Calculating the years of education turning point as done above, we find turning points of 19.96 and 21.55 years respectively for the variables in columns 3 and 4.

In the context of relative wages, the results presented in Columns 1 to 4 indicate that relatively un-skilled individuals have suffered more from trade liberalisation than those who are relatively more skilled. Furthermore, since the turning point obtained in each case is greater than the maximum value of the *hieduc* variable, it is clear that no worker in the sample experiences an increase in wages following a decrease in tariffs.

In section 4.1 we saw that the textiles and clothing industry experienced a greater degree of liberalisation than the other industries, with the exception of the transport equipment industry. Of the total household sample spanning the years 2000 to 2007, 22% of workers were employed in the textiles industry. Of these workers, 73.63% had less than grade 12 education (LFS 2000 – 2007, own calculations). According to the Stolper – Samuelson theorem, following the relatively greater degree of trade liberalisation in the textiles industry, workers in the textiles industry would suffer a decline in wages relative to the other industries. Since the majority of the workers in the textiles industry are relatively unskilled, this would contribute to a decline in the unskilled wage relative to the skilled wage. The results presented in columns 1 to 4 thus conform to the expectations of the Stolper Samuelson Theorem in context of the South African manufacturing sector between 2000 and 2007.

6.3 Wage Regressions Including Measures of Protection and Union Density

Table 5.4 presents the results of wage regressions based on equation (13). All individual characteristic and year and industry fixed effects estimates that appear in the Table are significant at conventional levels. In column 1 (which includes 2007 data) the estimates on the *tariff* variable, the *UD* variable, and the interaction *UD*tariff* variable are not statistically significant. In column 2, where the 2007 tariff data is excluded, the *tariff* variable and the *UD* variable remain statistically insignificant. The estimate on the *UD*tariff* variable is however positive and significant at the 5% level of

significance. This suggests that the impact of industry union bargaining power on wages is dependent upon average tariff rates.

Columns 4 and 5 present the results of the regressions using effective rates of protection instead of tariff rates. In both sets of results, the estimates on the *ERP* variable and the *UD*ERP* interaction variable are not significant.

The substantial difference between the estimates on the *UD*, *tariff*, and *UD*tariff* variables presented in Columns 1 and 2 of Table 5.4 was unexpected and of concern. A possible explanation for the large difference in results could be the bias associated with the 2007 tariff data discussed earlier. However, the estimates of the same regression excluding both 2006 and 2007 data (presented in column 3) are in general considerably different to the estimates presented in Columns 1 and 2. An exception is the estimate of the coefficient on the interaction variable which is significant and positive. Overall however, it appears that the estimates on these variables are generally highly sensitive.

There is at least one explanation for the sensitivity observed in the results. The standard deviation of the full 2000 – 2007 set of average industry tariff rates used in the regressions is 0.068. Similarly, the standard deviation on the effective rates of protection is 0.013. There is thus little variation in the average tariff rates and the effective rates of protection.

In addition to there being little variation in the tariff and effective rates of protection data, these variables are highly correlated with the industry and time fixed effects. A regression of the *tariff* variable on these fixed effects yielded an R – squared value of 97.3%. The same regression, using the *ERP* variable instead of the *tariff* variable, yielded an R – squared value of 98.29%. Thus, once we account for differences across industries and period specific effects, we find that there is very little variation left over in the *tariff* and *ERP* data.

Despite the lack of variation in the *tariff* and *ERP* data, the results presented in column 2 follow very closely those obtained by Shendy (2008) when using average tariff rates as a measure of protection. She obtains estimates on the tariff and union density variables that are insignificant and her estimate on the interaction variable is positive and significant at the 5% level of significance. The lack of variation in the *tariff* and *ERP* data is partly due to the high level of aggregation employed in this study. Since Shendy (2008) made use of the same level of aggregation, and due to the close similarity between her results and ours, we suspect that her estimates are similarly overestimated and volatile.

Due to the estimates on the *tariff* and *UD* variables being insignificant in Columns 2 and 3 of Table 5.4, we are unable to infer anything on the nature of the relationship between trade liberalisation and union bargaining power except to say that the impact of industry union bargaining power on wages is dependent upon average tariff rates.

If we were to assume however, based on previous results, that there exists a significant and positive relationship between the level of protection and wages, the estimate on the *UD*tariff* would

suggest that the negative impact of trade liberalisation on wages is greater the higher the union density. This would suggest that trade liberalisation results in a convergence between union negotiated wages and wages determined in industries with a low union presence. This would be indicative of a decrease in the ability of unions to negotiate wages on behalf of their members following trade liberalisation.

As a final note on the results obtained in this chapter, recall from Section 3.2.1 that the trade union in the bargaining model presented was assumed to negotiate wage and employment contracts. Importantly, in our estimations of the model presented in equation (13) we do not control for changes in the level of composition of employment in each industry. To control for movements of individuals in and out of the labour market, we require a reliable household panel dataset which is currently unavailable. Our inability to control for changes in employment has invariably introduced some degree of bias not only into the estimate on the $UD*Tariff$, but on each of the estimates of the $tariff$ and ERP variables.

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7. Conclusion

In this study we have estimated the relationship between trade liberalisation and wages using three models. In the first set of estimations, we used a Mincerian wage regression to estimate the relationship between wages and trade liberalisation directly and found a positive and significant relationship. In the second set of estimations, we moved closer to the underlying HOS theory discussed in Chapter 3 by including an interaction of the education and tariff variables into the model. This was done to estimate the impact of trade liberalisation on relative wages. We found significant and negative estimates on the coefficient of the interaction variable. This suggests that the impact of trade liberalisation on wages is dependent on the level of education of a worker. Moreover, the sign of the estimate suggests that relatively un-skilled individuals have suffered more from trade liberalisation than those who are relatively skilled.

In estimating a relationship between wages and trade liberalisation as we have done in the two sets of estimations outlined above, we have contributed to the broader literature in this area in three ways. Firstly, we have addressed the shortage in the literature of studies that estimate relationships between trade liberalisation and wages. We have also addressed an area in the literature that has been highly neglected in estimating the impact of trade liberalisation on relative wages. Secondly, we have exploited variations in average tariffs and effective rates of protection which are exogenous to the models estimated, and in doing so, we have overcome the problems associated with endogeneity affecting a number of similar studies. Finally, we have accounted for time invariant industry specific characteristics in each of the estimations. In addition, we have, through the use of a combined average tariff and household dataset, controlled for a number of individual characteristics in our estimations. Most of the studies conducted in this field fail to control for these effects and characteristics.

The results obtained, when considered in context of the developments in South Africa between 2000 and 2007, conform to theoretical expectations. The relatively high level of liberalisation accompanied by the substantial casualisation of workers in the textiles industry between 2000 and 2007 is reflected in our finding of widening inequality between the relatively un-skilled and the relatively skilled as a result of trade liberalisation.

In the final set of estimations, we included an interaction of the union bargaining power and tariff variables into the standard estimation of the relationship between trade liberalisation and wages. We obtained a significant and positive estimate of the coefficient on the interaction variable. This suggests that the impact of union bargaining power on wages is dependent upon tariff rates. Due to a lack of additional information, we were unable to infer anything further on the nature of the relationship between trade liberalisation and union bargaining power.

In estimating the relationship between trade liberalisation and wages as was done in the final set of estimations, we have attempted to move beyond the confines of the HOS model and consider the impact of liberalisation in a partial equilibrium setting. This is something which has only recently been attempted in the South African context, and is an area for which there is much room for greater exploration. Having achieved this in this study, we have made an important contribution to a developing body of work.

Overall, the findings of this study suggest that government should consider the negative impact in terms of wages of trade liberalisation on workers in the manufacturing sector when formulating policy. Key considerations that should be borne in mind by government when formulating trade policy at the industry level are the relative skill set of the majority of the workforce in the industry and the historical level of union power in the industry.

A shortcoming of this study and of the current literature on the relationship between trade liberalisation and wages, is the failure to control for changes in employment and the movement of workers between industries. Further study is therefore required using panel survey data instead of single period or multiple period cross sectional data. A reliable national panel survey dataset is however not currently available.

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Table Appendix

Table A1**Description of Variables**

Variables	Description
gender	Gender with female as the base category
age	The age of an individual
age2	The square of the age
hieduc	Years of education
union	Union membership status with non-union member as the base category
pop2	Coloured (with black as the base category)
pop3	Indian (with black as the base category)
pop4	White (with black as the base category)
tariff	Average industry nominal tariffs
ERP	Average industry effective rates of protection
ind1 - ind10	Industry fixed effects
yr2000 - yr2007	Year fixed effects

Table 5.1**Preliminary Regression Results**

Dependent Variable: Log of Monthly Wages

	(1)	(2)	(3)	(4)
<i>Worker Characteristics:</i>				
gender	0.420 (0.010)**	0.415 (0.010)**	0.316 (0.011)**	0.316 (0.011)**
Age	0.063 (0.003)**	0.065 (0.003)**	0.064 (0.003)**	0.064 (0.003)**
age2	-0.001 (0.000)**	-0.001 (0.000)**	-0.001 (0.000)**	-0.001 (0.000)**
Hieduc	0.072 (0.002)**	0.067 (0.002)**	0.063 (0.002)**	0.063 (0.002)**
Union	0.272 (0.010)**	0.281 (0.010)**	0.272 (0.010)**	0.272 (0.010)**
pop2	0.297 (0.017)**	0.299 (0.017)**	-0.289 (0.017)**	0.289 (0.017)**
pop3	0.385 (0.022)**	0.406 (0.022)**	0.427 (0.021)**	0.427 (0.022)**
pop4	0.844 (0.018)**	0.859 (0.017)**	0.810 (0.017)**	0.810 (0.018)**
<i>Year Fixed Effects:</i>				
yr2001		0.090 (0.027)**	0.085 (0.027)**	0.085 (0.027)**

yr2002		0.175	0.168	0.168
		(0.027)**	(0.026)**	(0.027)**
yr2003		0.198	0.195	0.195
		(0.027)**	(0.027)**	(0.027)**
yr2004		0.312	0.305	0.305
		(0.027)**	(0.027)**	(0.027)**
yr2005		0.298	0.283	0.283
		(0.028)**	(0.027)**	(0.028)**
yr2006		0.377	0.359	0.359
		(0.027)**	(0.027)**	(0.028)**
yr2007		0.462	0.440	0.440
		(0.027)**	(0.027)**	(0.028)**
<i>Industry Fixed Effects</i>				
ind1			0.218	0.218
			(0.017)**	(0.017)**
ind3			0.190	0.190
			(0.019)**	(0.019)**
ind4			0.404	0.404
			(0.019)**	(0.019)**
ind5			0.085	0.085
			(0.022)**	(0.023)**
ind6			0.361	0.361
			(0.017)**	(0.017)**
ind7			0.349	0.349
			(0.036)**	(0.034)**
ind8			0.353	0.353
			(0.047)**	(0.052)**
ind9			0.457	0.457
			(0.023)**	(0.022)**
ind10			0.150	0.150
			(0.025)**	(0.026)**
Observations	18561	18561	18561	18561
R - squared	0.51	0.52	0.54	0.54

Standard errors in parentheses; ~ significant at the 10%, * significant at 5%. ** significant at 1%.

Other controls included: 8 provincial dummies and 8 occupational dummies.

Table 5.2

Results of Wage Regressions on equation (11)

Dependent Variable: Log of Monthly Wages

	Tariff Rates		Effective Rates of Protection		Hausman Test
	Incl. 2007	Excl. 2007	Incl. 2007	Excl. 2007	
	(1)	(2)	(3)	(4)	
<i>Worker Characteristics:</i>					
Gender	0.315 (0.011)**	0.311 (0.012)**	0.315 (0.011)**	0.311 (0.012)**	0.315 (0.011)**
Age	0.064 (0.003)**	0.067 (0.003)**	0.064 (0.003)**	0.067 (0.003)**	0.064 (0.003)**
age2	-0.001 (0.000)**	-0.001 (0.000)**	-0.001 (0.000)**	-0.001 (0.000)**	-0.001 (0.000)**
Hieduc	0.063 (0.002)**	0.062 (0.002)**	0.063 (0.002)**	0.062 (0.002)**	0.063 (0.002)**
Union	0.272 (0.010)**	0.268 (0.011)**	0.272 (0.010)**	0.268 (0.011)**	0.272 (0.010)**
pop2	0.289 (0.017)**	0.293 (0.018)**	0.288 (0.017)**	0.292 (0.018)**	0.288 (0.017)**
pop3	0.426 (0.022)**	0.418 (0.023)**	0.425 (0.022)**	0.417 (0.023)**	0.425 (0.021)**
pop4	0.810 (0.018)**	0.823 (0.020)**	0.810 (0.018)**	0.823 (0.020)**	0.810 (0.017)**
<i>Measures of Protection:</i>					
Tariff	0.752 (0.429)~	0.881 (0.585)			
ERP			9.432 (3.047)**	9.433 (3.305)**	8.823 (5.004)~
<i>Hausman Test residual:</i>					
Residual					0.946 (0.15)
Observations	18561	16032	18561	16032	
R – squared	0.54	0.55	0.54	0.55	

Robust standard errors in parentheses; ~ significant at the 10%, * significant at 5%. ** significant at 1%.

Controls included: 8 provincial dummies, 8 occupational dummies, 9 industry fixed effects, and 7 year fixed effects.

Table 5.3

Results of Wage Regressions on equation (12)

Dependent Variable: Log of Monthly Wages

	Tariff Rates		Effective Rates of Protection	
	Incl. 2007	Excl. 2007	Incl. 2007	Excl. 2007
	(1)	(2)	(3)	(4)
<i>Worker Characteristics:</i>				
gender	0.316 (0.011)**	0.313 (0.012)**	0.318 (0.011)**	0.314 (0.012)**
Age	0.064 (0.003)**	0.067 (0.003)**	0.064 (0.003)**	0.067 (0.003)**
age2	-0.001 (0.000)**	-0.001 (0.000)**	-0.001 (0.000)**	-0.001 (0.000)**
Hieduc	0.068 (0.003)**	0.068 (0.003)**	0.068 (0.002)**	0.066 (0.002)**
Union	0.272 (0.010)**	0.268 (0.011)**	0.272 (0.010)**	0.268 (0.011)**
pop2	0.287 (0.017)**	0.291 (0.018)**	0.285 (0.017)**	0.289 (0.018)**
pop3	0.426 (0.022)**	0.418 (0.023)**	0.425 (0.022)**	0.417 (0.023)**
pop4	0.807 (0.018)**	0.819 (0.020)**	0.803 (0.018)**	0.817 (0.020)**
<i>Measures of Protection:</i>				
Tariff	1.414 (0.468)**	1.551 (0.611)*		
ERP			15.248 (3.176)**	14.491 (3.420)**
<i>Interaction Variables:</i>				
tarrif*hieduc	-0.079 (0.024)**	-0.084 (0.025)**		
ERP*hieduc			-0.764 (0.138)**	-0.673 (0.148)**
Observations	18561	16032	18561	16032
R - squared	0.54	0.55	0.55	0.55

Robust standard errors in parentheses; ~ significant at the 10%, * significant at 5%. ** significant at 1%.

Controls included: 8 provincial dummies, 8 occupational dummies, 9 industry fixed effects, and 7 year fixed effects.

Table 5.4
Results of Wage Regressions on equation (13)

Dependent Variable: Log of Monthly Wages

	Tariff Rates			Effective Rates of Protection	
	Incl. 2007	Excl. 2007	Excl. 2007 & 2006	Incl. 2007	Excl. 2007
	(1)	(2)	(3)	(4)	(5)
UD	0.291 (0.168)~	0.212 (0.182)	0.260 (0.220)	0.406 (0.145)**	0.418 (0.153)**
tariff	-0.001 (0.828)	-0.410 (0.938)	0.077 (1.111)		
UD*tariff	1.890 (1.373)	3.540 (1.663)*	3.238 (1.920)~		
ERP				-1.700 (9.366)	-0.932 (9.636)
UD*ERP				13.069 (13.649)	12.364 (14.050)
Observations	22016	19031	16128	22016	19031
R - squared	0.54	0.54	0.54	0.54	0.54

Robust standard errors in parentheses; ~ significant at the 10%, * significant at 5%. ** significant at 1%.

Controls included: 8 provincial dummies, 8 occupational dummies, 9 industry fixed effects, and 7 year fixed effects, age, age2, gender, hieduc, union, and race dummies.