



Occupational Shifts and Shortages

Skills Challenges Facing the South African Economy

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ABBREVIATIONS AND ACRONYMS

GDP	Gross Domestic Product
LFS	Labour Force Survey
NABC	National Association of Bargaining Councils
NEC	not elsewhere classified
OLS	Ordinary Least Squares
QLFS	Quarterly Labour Force Survey
SASCO	South African Standard Classification of Occupations
SETA	Sector Education Training Authority
TES	temporary employment service

1 INTRODUCTION

South Africa is a middle-income developing country that has experienced profound changes in the 1990s as it moved from a system of governance characterised by racial segregation and unequal opportunities prior to 1994 to democracy in 1994. Notwithstanding the important strides made in the post-apartheid years, the South African economy has largely been unable to deal with its pressing unemployment and poverty problems. One conceptual view of what has shaped South Africa's unemployment challenge is the notion that the economy has increasingly demanded higher-skilled workers while the labour force consists of a large contingent of less educated lower-skilled workers: a classic mismatch between labour demand and labour supply. In terms of labour demand, the research has suggested that factors such as technology, the changing structure of the economy and trade flows have all engendered a skills-biased labour demand trajectory (Bhorat & Hodge 1998; Thurlow 2006; Dunne & Edwards 2006).

Between 1970 and 1995, there was a deepening of capital in the economy, accompanied by a shift away from primary sectors towards secondary and tertiary sectors. As a result, the primary sectors suffered steady employment losses, while most other sectors saw gains, with the financial and business activities sector showing the largest gains. This was accompanied by broad occupational employment shifts that were skills-biased in nature. Within sectors, this manifested in increased demand for high-skilled occupations in the primary and secondary sectors, while the demand for unskilled workers declined. This, combined with the growing importance of the tertiary sectors, which on the whole are more skill-intensive than the primary and secondary sectors, yielded a strongly skills-biased labour demand trajectory. Factors such as technological change within firms or the relatively

lower price of capital to labour have been some of the major explanations for the changing preference of firms from lower-skilled to higher-skilled workers (Bhorat & Hodge 1998).

The post-apartheid labour market has seen a continuation of growth in the tertiary sector, accompanied by an expansion in the sector's aggregate employment. In addition, while the tertiary sector has been growing and absorbing greater employment, its ratio of skilled workers relative to unskilled workers continues to increase. This marks the intensification of a skills-biased labour demand trajectory, already established in the pre-1994 period. The growing importance of the tertiary sector in the economy is likely to impact negatively upon the demand for less skilled workers. Thus, employment changes since the transition from apartheid have been a function of a variety of factors, including structural changes in the composition of output (Bhorat & Hodge 1998; Edwards 2001; Dunne & Edwards 2006). The losers have been less skilled workers, while the winners, invariably, have been better-educated skilled workers.

This report extends the analysis of labour demand trends to the 2001–2012 period. It consists of a descriptive analysis of skill-biased labour demand changes, through an examination of sectoral and occupational employment growth trends. We also consider, through the use of the Katz and Murphy (1992) decomposition technique, whether between- or within-sector forces play a greater role in the labour demand for workers in different occupations. Within-sector employment shifts are those changes in labour allocation that come from within the industry itself. Sources include technological change in a sector that may create the need for a certain skill-type over another or a change in the price of a

non-labour factor that results in an altered preference for certain labour types. Between-sector changes are relative employment shifts occurring between sectors in the economy as a result of changing shares in relative output of different sectors. As sectors typically have differing patterns of skill demands, a growing or declining share in production of a sector may alter labour demand at different skill levels. The share of domestic output due to trade flows can similarly affect labour demand between sectors.

Labour demand changes have an impact on wage levels of workers. Thus, traditionally, if an economy has become increasingly skills-intensive, one would expect to find larger wage premia for better-skilled and better-educated workers over time. More recently, the international literature on labour demand explores the idea that technological change has not just reduced wages of low-skilled workers while raising the wages of the high-skilled, but that wages have fallen particularly for workers who are involved in work where the tasks are very routine or

where the work is 'offshorable'. These workers tend to be in the middle of the distribution, thus leading to declining wage premia in the middle of the wage distribution. This view of technological change moves beyond the high/low-skilled categories and identifies the tasks related to occupations as a key channel through which wages are affected.

In line with this literature, the report analyses the changing returns to occupational tasks. Following Firpo et al. (2011) we first identify five 'task categories', which are created to explore the way that different tasks are likely to be affected by technological change and international trade or competition. Having created the task categories, we then explore, through the use of quantile regressions, how the returns to occupational tasks have changed across the wage distribution over time. We expect to see a fall in wages for jobs involving tasks that are easily routinable and hence face high risks of automation and international competition.

2 DATA

South African labour market analysis is shaped by data availability and coverage, gradual improvements in survey design and implementation, and changing definitions. The October Household Survey – conducted by Statistics South Africa and the key official household survey dataset providing labour market information between 1994 and 1999 – was replaced in 2000 by the biannual Labour Force Survey (LFS). This survey was, in turn, replaced by the Quarterly Labour Force Survey (QLFS) in 2008. Since we are interested in skills-biased employment trends in the post-2000 period, our analysis uses labour market data from the LFS and QLFS. We note that the QLFS differs quite significantly from the LFS in methodological and definitional terms. In particular, the definition of discouraged workseekers between the two surveys differs substantially, with the result that the broad labour force and broad unemployment are not comparable between the two surveys. Employment numbers between the two surveys are, however, comparable.¹

Both the LFS and QLFS surveys are rotating panel household surveys with a sample size of roughly 30 000 dwellings in each wave. In our analysis the data is pooled and treated as repeated cross sections over time, and we use the standard weights provided by Statistics South Africa. Wage data is available from the LFS for the periods 2001–2007, and from the QLFS for 2010 and 2011. The wage data provided for 2010 and 2011 is annual, and it is not possible to accurately link this wage data to the particular quarter in which it was collected. However, given that we are interested in annual data, this should not bias our estimates. As it has not yet been widely used, the 2011 wage data should be treated with some caution. We note that the earnings data in the LFS includes a combination of both point and bracket responses; we transformed all brackets into point estimates.²

3 SKILLS-BIASED LABOUR DEMAND: A DESCRIPTIVE OVERVIEW

3.1 Introduction

Economic growth in South Africa was weak during the 1980s and early 1990s when political uncertainty was rife. Since the advent of democracy in 1994 though, the South African economy began to recover with positive GDP growth rates in all years except 2009, when the global financial crisis resulted in the economy posting negative growth. Earlier studies show that the South African economy became increasingly capital-intensive prior to 1994, and that this trend was accompanied by structural changes in the economy, with the tertiary sector accounting for a growing share of GDP (DPRU, 2003). The post-apartheid economy has experienced a continuation of the movement away from primary production towards tertiary production, accompanied by a greater share of employment within the tertiary sectors relative to the primary and secondary sectors. In addition, the economy experienced a marked increase in its ratio of skilled

workers relative to unskilled workers (DPRU, 2007). These developments mark the intensification of a skills-biased labour demand trajectory, already established in the pre-1994 period.

The descriptive overview below analyses whether this skills-biased labour demand trend has continued in the post-2000 period through an in-depth analysis of employment trends. In particular, the disaggregation by sector and skills below aims to show whether the increasing dominance of the tertiary sector has prevailed and whether economic growth has continued to disproportionately benefit better-skilled workers.

3.2 GDP and employment trends

Prior to the global financial crisis of 2008/2009 (which forced South Africa, among a host of other countries, into a real economy recession) GDP growth rates in the South African economy were

Figure 1: GDP and employment growth, 2001–2011



Source: SARB & StatsSA (LFS 2001–2007 and QLFS 2008–2012), authors' calculations

positive though not impressive at 3–5.6%. The recession of 2008 generated a growth rate of 3.6% in 2008, which by 2009 had turned negative. In fact, 2009 is the only year since the advent of democracy in which the country has posted a negative annual growth rate. While growth rates returned to positive levels for the 2010–2012 period, they remain on average below their pre-crisis levels.

Employment grew more slowly than GDP during the period of relatively good GDP growth: while average GDP growth for the 2002–2007 period stood at 4.6%, average employment growth, though positive, was much lower at 2.8%. In turn, the global recession of 2008/2009 had a severe and deleterious impact on employment levels in the South African economy, with employment shrinking by almost 5% in 2009 and again by 1% in 2010. Young African workers with incomplete schooling bore the brunt of the recession (DPRU, 2010). Employment growth turned positive in 2011 and 2012, but has not breached the 3% level since the recession.

To link the impact of the decline in growth as a result of the recession to consequences for the labour market, Table 1 estimates simple output-employment elasticities for the pre- and post-crisis period. The simple elasticity of employment provides an indication of the sensitivity of GDP to employment growth, and hence serves as a proxy measure of the labour-absorptive rate of economic growth.

Table 1: Simple GDP elasticity of total employment: 2001–2012

	Average annual growth		Simple elasticity
	Employment	GDP	
Pre-crisis (2001–2007)	2.9%	4.6%	0.64
Post-crisis (2008–2012)	-0.3%	1.9%	-0.16

Source: StatsSA (LFS 2001 & 2007 and QLFS 2008 & 2012), authors' calculations

Notes:

1. The growth rates are average annual growth rates.
2. The simple elasticity is the employment growth rate divided by the GDP growth rate.
3. The September round of the LFS is used for the 2001 and 2007 data, while Q3 data from the QLFS is used for 2008 and 2012 data.

The table shows that the simple employment elasticity for the 2001–2007 period stood at 0.64,

indicating that for every 1% growth in GDP total employment increased by 0.64%. This stands in sharp contrast to the post-crisis period, where a 1% increase in growth led to a 0.16% decline in employment. Put differently, this data shows that – for the post-crisis period – while average annual GDP growth stood at 1.9%, employment in this period declined by 0.3%. While output growth recovered fairly quickly in the aftermath of the crisis, labour market demand inertia remains.

Employment growth trends in South Africa thus broadly followed GDP growth trends in the post-2000 period, though employment growth was generally lower than GDP growth. Furthermore, it appears that during harsh economic times such as the 2008/2009 recession, the negative growth response of employment is much more pronounced than the shrinkage in GDP. The results above imply both that GDP growth rates would have to accelerate to much higher levels in order to deal adequately with South Africa's poverty and unemployment problems, but also that global economic difficulties appear to have a sharp and relatively long-lasting impact on South Africa's labour market.

3.3 Aggregate and sectoral employment trends

The past 11 years have seen considerable growth in total employment, from 11.2 million in 2001 to 13.7 million in 2012. However, while the growth in employment was significant between 2001 and 2007, there was no significant growth in employment between 2008 and 2012. In particular, the period between 2001 and 2008Q4 was marked by a steady rise in employment in the South African economy from 11.2 million employed to 14.1 million employed.³ The global downturn of 2008 led South Africa into recession in late 2008 and although the impact on output was relatively mild and short-lived, the impact on the labour market has been profound: from a peak in employment of almost 14.1 million in 2008Q4, the economy lost more than 1 million jobs, and by 2010Q3 employment had plummeted to levels last seen in 2006. Thus, the global crisis of 2008/2009 resulted in the expansion of employment in the South African economy over the 2006–2008 period being completely nullified by the end of 2010.

The period between 2010Q3 and 2012Q3 saw a significant increase in the number of employed as the labour market began to recover from the crisis. Overall though, the employment level in 2012Q3 of 13.7 million still falls short of the high of 14.1 million seen prior to the recession. The aggregate gains in employment in the South African labour market since 2000 were driven by job creation in the 2001–2007 period. While GDP recovered fairly quickly in the aftermath of the recession, the impact on employment has been severe and long-lasting.

Excluding discouraged workseekers from the definition of the labour force,⁴ the labour force participation rate in the labour market in 2001 stood at around 57% in both 2001 and 2007. In turn, the data between 2008 and 2012 shows a decrease in the narrow labour force participation rate from 58 to 55%. This decline in the labour force occurred mainly during the recession as young workers delayed their entry into the labour market, suggesting that these individuals sought to upgrade their human capital endowments in the short to medium term. Older workers also declined in participation, presumably as a function of early retirement (DPRU 2010).⁵

Unemployment rates were very high in 2001, with almost 30% of narrowly defined labour market

participants and 41% of broadly defined labour market participants unable to find work. Importantly, both narrow and broad unemployment rates declined between 2001 and 2007 when the economy was growing relatively quickly. By 2007, the narrow rate of unemployment stood 6 percentage points lower at 23% while the broad rate of unemployment stood 5 percentage points lower at 36%. In turn – keeping in mind that broad unemployment rates are lower in the QLFS than in the LFS – in the period between 2008 and 2012, when the economy was severely hit by the global recession, the narrow and broad rate of unemployment rose from 23 to 25% and 27 to 33% respectively. Put differently, by 2012, a third of those who were willing and able to work but not necessarily actively searching for work, could not find jobs in the South African economy.

The structure of the economy

This section considers the structure of the economy and its impact on the trends in employment between 2001 and 2012 more closely. Figure 2 illustrates the interaction between GDP and employment growth trends by sector. We expect that sectors in which there was good output growth in the period would have been more likely to create jobs in the economy, while declining sectors would have shed jobs. Each of the bubbles in Figure 2 represents a sector of the

Table 2: The South African labour market: 2001–2012

	LFS	LFS	QLFS	QLFS	Change	
	2001 Sep	2007 Sep	2008 Q3	2012 Q3	2001 Sep–2007 Sep	2008 Sep–2012 Sep
Aggregates (thousands)						
Working age population	28 118	30 420	31 216	33 253	8.2%*	6.5%*
Employed	11 181	13 306	13 839	13 678	19.0%*	–1.2%
Official unemployment	4 655	3 905	4 157	4 668	–16.1%*	12.3%*
Official labour force	15 836	17 211	17 996	18 346	8.7%*	1.9%
Broad unemployment	7 649	7 348	5 239	6 840	–3.9%	30.6%*
Broad labour force	18 830	20 654	19 078	20 518	9.7%*	7.5%*
Official unemployment rate	29	23	23	25	–6 pp*	2 pp*
Broad unemployment rate	41	36	27	33	–5 pp*	6 pp*
Official labour force participation rate	56	57	58	55	1 pp	–2 pp*
Broad labour force participation rate	67	68	61	62	1 pp	1 pp

Source: StatsSA (LFS 2001 & 2007 and QLFS 2008 & 2012), authors' calculations

Notes:

1. The broad estimates include both seeking and discouraged workseekers as part of the labour force, while the narrow/official estimates do not regard discouraged workseekers as part of the labour force.
2. * denotes a significant change at the 5% level.
3. pp – percentage points.

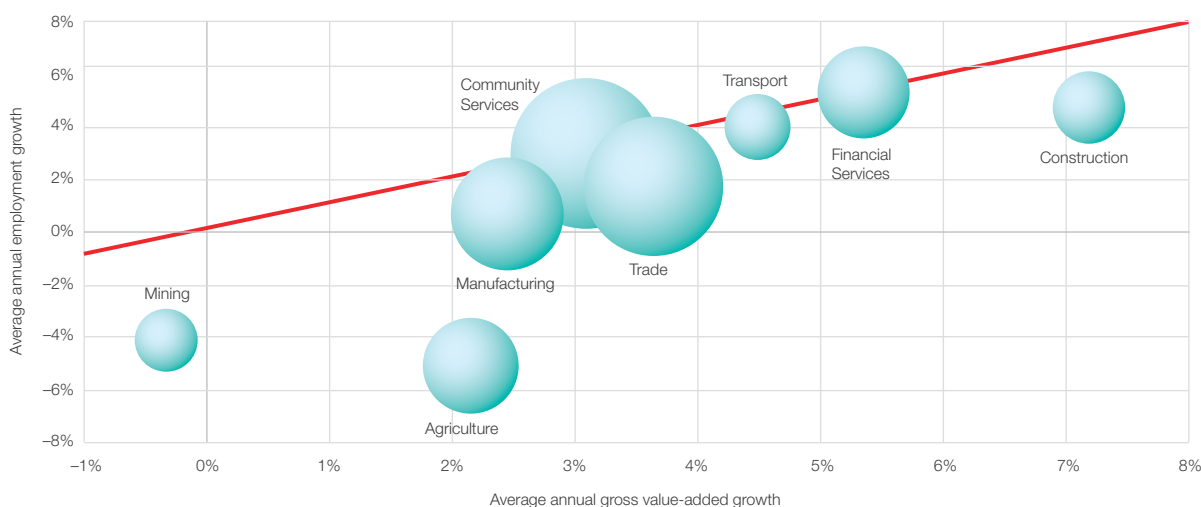
economy; the size of the bubble indicates the relative size of employment in that sector in the base year, 2001.⁶ The vertical axis shows average annual employment growth, while the horizontal axis shows the average annual growth in gross value added. Thus the coordinates for the centre of each of the bubbles are the relevant sector's employment and gross value-added growth for the period. The dotted line divides the figure into two sections: bubbles below the line show sectors in which employment growth was lower than gross value-added growth, while bubbles above the line show sectors in which employment growth exceeded output growth.

Figure 2 illustrates that the primary sectors of the economy fared particularly badly in the period between 2001 and 2012: output growth was negative for mining (-0.3%) and lowest among positive-growth sectors for agriculture (2.2%). Furthermore, these are the only two sectors that experienced a contraction in employment in the period, with employment growth in agriculture and mining contracting by 5.1% and 4.1% respectively. Thus, employment declined in the agricultural sector of the economy even though the sector experienced mild growth in gross value added. A contributing factor to the decline in employment in the agricultural sector was the minimum wage, introduced in the sector in March 2003 (Bhorat et al. 2011).

The decline in employment in the mining sector outstripped the decline in growth. The poor performance of the mining sector for the period can be attributed to a range of factors, including a strongly appreciating Rand in the mid-2000s, infrastructural constraints (particularly as far as rail transport is concerned), the energy crisis in South Africa and the application of new mining laws (OECD 2008), while damaging widespread strike action in the mining sector in 2010 and 2011 would have further exacerbated the problem.⁷

Among the sectors that experienced the best output growth in the period were construction and three tertiary sectors, namely, the financial services, transport and trade sectors. Importantly though, employment growth did not exceed output growth in any of the sectors and only the finance and community services sectors experienced employment growth that was almost as high as gross value-added growth. Specifically, while gross value-added growth for the finance and community services sectors stood at 5.4 and 3.1% for the period between 2001 and 2012, employment growth was at 5.3 and 3%, respectively. These two tertiary sectors of the economy thus experienced growth that was labour-neutral, while all other sectors of the economy experienced output growth that was faster than employment growth.

Figure 2: Gross value-added and employment growth, by sector: 2001–2012⁸



Source: SARB & StatsSA (LFS 2001 and QLFS 2012), authors' calculations

In particular, the discrepancy between output and employment growth was the highest in the two primary sectors, followed by construction. Construction was the fastest-growing sector in the period, growing at 7.2% between 2001 and 2012, but employment growth in this sector was much lower at 4.7%. The boom in the construction sector in the period can be attributed to, among other factors, infrastructure projects related to the 2010 World Cup, the construction of the Gautrain rapid-rail system and several other public and private-sector investment initiatives, including those undertaken by Eskom and Transnet (Hanival & Maia 2008).

Two of the large-employing sectors in the economy – trade and manufacturing – experienced mediocre output growth in the period of 2.4 and 3.6%, respectively, but much lower employment growth of 0.6 and 1.7%, respectively. These relatively poor employment results for trade and manufacturing can, in part, be understood in terms of the impact of the recession on the South African economy: during the recession, the manufacturing sector, together with construction, experienced the largest job losses, with semi-skilled workers, in particular, negatively affected. Furthermore, informal sector workers – mostly captured under trade – were also particularly hard hit during the recession, with these workers accounting for a disproportionate share of jobs lost (DPRU 2010).

In summary, Figure 2 shows an economy in which the primary sectors played an increasingly small role as far as economic growth is concerned, while tertiary sectors expanded. In addition, employment growth in the period was, on the whole, better in the tertiary sectors than in the secondary sectors, and negative in the primary sectors of the economy. Importantly for a country like South Africa with high unemployment, two tertiary sectors – finance and community services – are the only sectors that experienced labour-neutral growth, while gross value-added growth outstripped employment growth in the other sectors, with the primary sectors, construction and trade most severely affected. By 2012, the tertiary sectors accounted for almost three quarters (72%) of total employment, up from 63% in 2001.

At this point we note that one of the more contentious issues in the South African labour market in the post-2000 period has been the rise in labour brokering. Benjamin (2009) cites that the number of temporary employment service (TES) agencies registered with the services Sector Education Training Authority (SETA) alone rose from 1 076 in 2000 to 3 140 in 2006, while the National Association of Bargaining Councils (NABC) estimated that almost 1 million workers were employed through labour brokers in 2010 (SABPP 2012). The use of labour brokering employment is contentious as it is seen to be a mechanism through which labour laws and minimum wage laws can be avoided: according to Benjamin (2009) the number of agencies rose sharply in the 2000s, which can be seen as an indicator that labour law avoidance is a major contributing factor to the rise in labour brokering.

It is not possible to directly ascertain the number of workers employed through labour brokers in the South African economy, since the nationally representative household surveys do not probe whether workers are employed through labour brokers. Nonetheless, the business activities (not elsewhere classified [NEC])⁹ sub-sector of the financial services sector includes labour brokering activities.¹⁰ Given this, it might be that the increase in employment in the financial services sector may, in part, reflect the increase in those employed through labour brokers in the South African economy. We consider this in further detail below.

Table 3 analyses the sectoral growth trends in employment in Figure 2 more closely. The table shows absolute and relative growth numbers for each of the sectors. The absolute growth numbers show the absolute increase or decrease in employment for that sector for the period, while the relative growth figures show the growth of the sector relative to overall employment growth in the economy for the period. Relative growth is thus calculated by taking the growth rate for the sector and dividing it by the total employment growth rate for the period. If relative growth is equal to one, sector employment grew as quickly as overall employment in the period.¹¹ In turn, if the relative growth figure is greater than one, this indicates that

employment growth in that sector was higher than overall employment growth, and vice versa.

The growth data clearly shows that workers in the primary sectors were losers in this period: the agriculture and mining sectors were the only sectors that experienced declines in employment in the period, with employment declining particularly sharply in the agricultural sector of the economy. More than half a million jobs were lost in agriculture in the period between 2001 and 2012, while more than 200 000 jobs were lost in mining. Unsurprisingly then, these two sectors also showed large negative relative growth. The employment numbers in the mining sector may be underestimated though, as detailed in endnote 7.

The relative growth figure of one for the secondary sectors implies that employment in these sectors grew as fast as overall employment growth in the economy. This relative growth figure is, however, driven by the construction sector: though the construction sector employed just 5.7% of the workforce in 2001, employment growth in

construction was two and a half times larger than overall employment growth in the period. In contrast, neither the manufacturing nor utilities sectors saw a significant increase in employment in the period, implying that these two sectors performed relatively poorly. The results for the manufacturing sector, in particular, are of concern, since it was the third-largest employing sector in the economy in 2001. As a result of its poor performance, the manufacturing sector's share of employment dropped from 14.5% to 12.7% in the period.

The tertiary sectors of the economy fared the best in terms of employment growth in the period with the financial services and community services sectors creating 782 000 and 1 million jobs, respectively. The community services sector can be singled out: this sector employed almost 18% of the workforce in 2001 and its impressive relative growth performance resulted in the sector accounting for more than 40% of the increase in employment in the period. As a result, the sector's share of employment rose to between a fifth and a quarter of total employment by 2012.

Table 3: Growth in employment, by sector: 2001–2012

	Growth (2001–2012)		Employment shares		Share of change (2001–2012)
	Absolute	Relative	2001	2012	
Primary	-719 232*	-2.6	15.5%	7.4%	-28.8%
Agriculture	-514 468*	-2.7	10.5%	4.8%	-20.6%
Mining	-204 764*	-2.2	5.0%	2.6%	-8.2%
Secondary	537 376*	1.0	21.0%	21.1%	21.5%
Manufacturing	112 149	0.3	14.5%	12.7%	4.5%
Utilities	10 774	0.5	0.8%	0.8%	0.4%
Construction	414 453*	2.5	5.7%	7.7%	16.6%
Tertiary	2 720 821*	1.6	63.1%	71.5%	108.9%
Trade	513 572*	0.9	21.9%	21.7%	20.6%
Transport	288 364*	2.1	4.9%	6.1%	11.5%
Financial services	782 108*	2.8	9.3%	13.3%	31.3%
Business activities NEC	502 841	4.2	3.6%	6.6%	20.1%
Other	279 267	1.8	5.7%	6.7%	11.2%
Community services	1 041 524*	2.1	17.8%	22.2%	41.7%
Private households	95 253	0.4	9.2%	8.3%	3.8%
Total	2 497 763*	1.0	100.0%	100.0%	100.0%

Source: StatsSA (LFS 2001 and QLFS 2012), authors' calculations

Notes:

1. Relative growth is calculated by dividing the average annual growth rate for the sector by the total average annual growth rate.
2. * denotes a significant change at the 5% level; we were unable to ascertain whether the changes in employment of sub-sectors within financial services were significant.
3. The share of change is calculated by dividing change in employment in the sector by the overall change in employment.

We examine public sector employment growth in further detail in Table 4.¹² We note first (not shown here) that 85.2% of public sector workers in 2001 were found in the community services sector, and by 2012 more than 90% of all public sector workers were working within the community services sector. Thus, the community services sector serves as a proxy for public sector employment. Second, the table shows that overall growth was driven by public sector rather than private sector growth: the average annual growth rate of public sector employment in the period was 2.5%, while private sector jobs grew at an average annual growth rate of 1.7%. Employment thus grew substantially faster in the public sector compared to the private sector.

Third, more disaggregated data in the last two columns of the table shows the following: the public sector accounted for 19.7% of the change in employment in the period, while the private sector accounted for 80.3% of change in employment in the period. Thus, a fifth of employment growth in the period between 2001 and 2012 was due to public sector employment growth.

Table 3 shows that the financial services sector – though relatively small in terms of its employment share (9.3% in 2001) – performed most impressively in terms of relative growth in the period. This sector saw the fastest growth in employment in the period, with its growth rate standing at 2.8 times the overall employment growth rate. Between 2001 and 2012, the financial services sector's share of total employment rose from 9.3% to 13.3%. However, the increase in financial services employment was mainly due to an increase in employment within the business activities sector.

The performance of the trade sector is generally dependent on the overall performance of the

economy, as it represents the final demand spending by consumers. Though the trade sector employed the largest share of workers in 2001, employment in the sector grew marginally more slowly than overall employment growth, thus keeping its share in employment at 22%. Importantly then, due to phenomenal growth in employment in the community services sector, the trade sector was overtaken by the community services sector as the largest-employing sector in the South African economy in 2012.

The financial sector deserves further scrutiny given that labour brokering employment may be driving employment within this sector. Thus, the disaggregation of the financial services sector in Table 3 is an attempt to identify whether some part of the increase in employment in the financial services sector may be due to labour brokering employment. The financial services sector consists of five subsectors. They are (i) business activities NEC; (ii) monetary intermediation; (iii) insurance and pension funding (except compulsory social security); (iv) legal, accounting, bookkeeping and auditing activities; and (v) other. In Table 3 we have disaggregated financial services into business activities NEC and 'other' which incorporates the remaining four sub-sectors of financial services. Of the five sub-sectors under financial services,¹³ the business activities sub-sector accounted for the largest proportion of the employed in 2001 at 38.4%. Furthermore, the table shows that this sub-sector saw a rise of over half a million jobs in the period between 2001 and 2012 or 64% of the employment created within the financial services sector in the period. The business activities sector – within which labour brokering activities fall – has thus been the driver of employment growth within the fastest-growing sector (financial services) of the economy between 2001 and 2012.

Table 4: A closer look at public sector employment: 2001–2012

	2001–2012			2001	2012	2001–2012	
	Private	Public	Total	Share of public sector workers in community services		Share of change	
	Average annual growth					Private	Public
Employment	1.7%*	2.5%*	1.8%*	85.2%	90.7%	80.3%	19.7%

Source: StatsSA (LFS 2001 and QLFS 2012), authors' calculations

Note: * denotes a significant change at the 5% level.

Even though the data does not provide a more detailed breakdown of employment within the sub-sector, we could argue that the dominant activities are employment agency, labour brokering and security services activities. The results in Table 3 above would then suggest that growth within the financial services sector of the economy appears to have been driven by, among other activities, security service and labour brokering activities.

In order to provide a better picture of the kinds of workers employed in the business activities sub-sector, we disaggregate the sub-sector by its main occupation groups in Table 5. The disaggregation shows that in 2001 the business activities sub-sector consisted, in the main, of workers in protective services (42.6%), helpers and cleaners (14.8%) and 'other' workers (33.7%). Between 2001 and 2012, protective services workers increased by 228 000 and helpers and cleaners by 85 000. The increase in helpers and cleaners in offices, hotels and other establishments is a reflection of an increase in the use of contract cleaning staff, possibly employed through labour brokers. Furthermore, farmhands and labourers in this sub-sector increased from 0 to 50 000 in the period between 2001 and 2012, and this too may be evidence of an increase in the use of workers employed through labour brokers.

In summary, it is difficult to estimate the number of workers employed through labour brokers and temporary employment services in the South African economy. Using official labour force survey data, it can be assumed that those who report being employed by labour brokers would be captured

under the business activities sub-sector of financial services. This sub-sector was the main driver of growth within the financial services sector between 2001 and 2012, with protective services workers NEC, helpers and cleaners and farmhands and labourers accounting for the majority of the growth in the sector. There is thus tentative evidence in the labour force surveys of an increase in those employed through labour brokers.

We note two issues though: first, many of those employed by labour brokers may not be aware of the fact that they are employed by labour brokers and may thus wrongly classify themselves under other sectors of the economy. Labour brokering employment is found in many sectors of the economy including agriculture, construction, manufacturing, financial services, community services, wholesale and retail trade, mining, transport and communication (CAPES 2010). Thus, these numbers probably largely under-estimate the incidence of labour broker employment in South Africa since respondents self-report on the sector of work and may thus wrongly classify themselves under other sectors in the absence of direct questions on whether workers are employed through labour brokers.¹⁵

Second, it cannot be said with certainty that those counted under the business activities sub-sector of financial services are employed through labour brokers. What is clear though is that the employment change within the business activities sub-sector of financial services – as shown in Appendix 3 – was dominated by services and sales workers (46%) and elementary workers (37%), while managers (30.1%)

Table 5: Occupations within the business activities NEC sub-sector of financial services: 2001–2012

	2001	2012	2001	2012	Growth (2001–2012)	
	number		share		number	%
Occupations within business activities NEC						
General managers of business services	35 602	13 276	8.9%	1.5%	-22 326	-62.7%
Protective service workers NEC	169 360	397 250	42.6%	44.1%	227 890	134.6%
Helpers and cleaners ¹⁴	58 774	144 233	14.8%	16.0%	85 459	145.4%
Farmhands and labourers	0	47 632	0.0%	5.3%	47 632	100.0%
Other	134 287	298 479	33.7%	33.1%	164 192	122.3%
Total business activities NEC	398 022	900 863	100%	100%	502 841	126.3%

Source: StatsSA (LFS 2001 and QLFS 2012), authors' calculations

Note: We were unable to ascertain whether the changes in employment of the occupation groups within the business activities NEC sub-sector of financial services were significant.

and professionals (50.4%) accounted for the majority of the change in employment in the other sub-sectors of financial services. This evidence then points to the fact that employment growth in the period within financial services was driven by the business activities sub-sector, and that the increase in employment in the business activities sub-sector, in turn, was dominated by medium-skilled service and sales workers and unskilled elementary workers.

Overall, our sectoral analysis indicates that in the period between 2001 and 2012, relative growth in employment was fastest in two tertiary sectors – financial services (2.8) and community services (2.1) – together with a single secondary sector – construction (2.5), though the increase in employment in the financial services may partly be reflecting an increase in those employed through labour brokers. Three tertiary sectors, namely community services, financial services and trade, together accounted for 93.6% of the change in employment for the period, while the construction sector accounted for a further 16.6% of the increase. Both of the primary sectors provided a severe drag on employment levels, accounting for a negative share of 28.8% in the change in employment in the period. Finally, the manufacturing sector showed a lacklustre performance, with no significant increase in employment in the period.

3.4 Occupational employment trends

Table 6 shows that economic growth favoured high-skilled occupations followed by unskilled and then medium-skilled occupations. The employment growth rate for high-skilled occupations was double the overall employment growth rate, while the growth rates for medium and unskilled jobs were at 0.6 and 0.8 of the overall growth rate respectively.

The absolute numbers show that 1.1 million high-skilled jobs were created in the economy between 2001 and 2012, while the number of medium and unskilled jobs grew by 768 000 and 613 000, respectively. Thus, although workers across the skills spectrum shared in employment growth in the period, skilled workers in particular benefitted most, in both absolute and relative terms. In turn, medium-skilled workers were the relative losers in the period.

Employment growth of managers and professionals was close to triple and double overall employment growth respectively. Professionals (26.7%) and managers (19%), together with medium-skilled service and sales workers (25.1%) and unskilled elementary workers (20.7%) accounted for the largest shares of the increase in employment. Striking from these results is the contributions of managers and professionals to the change in employment relative to their shares in the workforce in 2001. Specifically, while managers and professionals accounted for 5.9% and 14.9% of employment in 2001, they contributed 19% and 26.7% to the change in employment in the period, thus increasing their share of the workforce to 8.3% and 17%, respectively by 2012.

It is worth noting though, as shown in Appendix 4, that a quarter of the increase in managers and more than 40% of the increase in professionals in the period emanated from the community services sector. Put differently, a large proportion of the growth in high-skilled occupations was due to increased community service employment in the period. The trade sector (27%), financial services sector (19%) and construction sector (12%) also accounted for reasonably large increases in managerial employment. In turn, aside from community services, the financial services (29%) sector also accounted for a large proportion of the increase in professional employment in the period.

Service and sales workers were second only to managers in terms of relative growth, with the employment growth rate for this occupation standing at 1.8 times the overall employment growth rate. They also accounted for a quarter of the change in employment in the period. As a result, from accounting for 12.7% of the workforce in 2001, service and sales workers accounted for 15% of the workforce in 2012. The increase in service and sales workers can mainly be attributed to higher demand from community services (52%) and financial services (40%) (see Appendix 4).

Two medium-skilled occupations, namely craft and trade workers and operators and assemblers, experienced the smallest relative gains in the period. Neither of these two occupations experienced

Table 6: Growth in employment, by occupation: 2001–2012

	Growth (2001–2012)		Employment shares		Share of change
	Absolute	Relative	2001	2012	(2001–2012)
High-Skilled	1 141 326*	2.0	20.8%	25.3%	45.7%
Managers	475 491*	2.7	5.9%	8.3%	19.0%
Professionals	665 835*	1.7	14.9%	17.0%	26.7%
Medium-Skilled	767 555*	0.6	49.6%	46.1%	30.7%
Clerks	300 982*	1.2	9.8%	10.2%	12.1%
Service & sales workers	627 027*	1.8	12.7%	15.0%	25.1%
Skilled agricultural & fishery workers	-311 122*	-8.0	3.4%	0.5%	-12.5%
Craft & trade workers	124 687	0.4	13.7%	12.1%	5.0%
Operators & assemblers	25 981	0.1	10.1%	8.4%	1.0%
Unskilled	612 716*	0.8	29.4%	28.5%	24.5%
Elementary occupations	517 463*	1.0	20.1%	20.3%	20.7%
Domestic workers	95 253	0.4	9.2%	8.3%	3.8%
Total	2 497 763*	1.0	100.0%	100.0%	100.0%

Source: StatsSA (LFS 2001 and QLFS 2012), authors' calculations

Notes:

1. Relative growth is calculated by dividing the average annual growth rate for the occupation by the total average annual growth rate.

2. * denotes a significant change at the 5% level.

significant employment growth economy-wide in the period between 2001 and 2012. Consequently, their shares in total employment dropped from 13.7%–12.1% and 10.1%–8.4%, respectively. The data in Appendix 4 however shows significant inter-sectoral churning for these medium-skilled workers in the period.

The data for unskilled workers shows that growth in employment of elementary workers matched overall growth in the economy, while the growth in domestic workers was not significant. As a result the proportion of elementary workers remained at around 20%, while the proportion of domestic workers declined from 9.2% to 8.3%. The results for domestic workers are probably due to the introduction of a minimum wage for domestic workers in 2002.

These results provide descriptive evidence of the impact of the growth trajectory of the economy on workers of different skills. In particular, they show that managers, professionals, and service and sales workers were in high demand over the 2001–2012 period, while, in relative terms, the demand for craft and trade workers, and operators and assemblers fell. Finally, clerks and elementary workers maintained their status in the labour

market, with the growth in employment for these two occupations matching overall employment growth.

Table 7 sheds more light on the changes in skills shares in the primary, secondary and tertiary sectors of the South African economy in the period between 2001 and 2012. The primary sector lost 719 000 jobs in the period, with a loss of more than half a million medium-skilled jobs and around 175 000 unskilled jobs, together with no significant increase in high-skilled employment. The large and dramatic decrease in medium-skilled jobs in the primary sector resulted in the proportion of medium-skilled workers declining significantly by 17.7 percentage points from 54.5% to 36.8%. Given positive GDP growth in agriculture and some parts of mining, this effectively means an increase in the capital intensity of production.

In the secondary sector, both high-skilled and unskilled employment rose significantly by around 200 000 jobs each, resulting in the proportion of high-skilled and unskilled employment in the sector rising by around four percentage points each. In turn, the secondary sector experienced no significant rise in medium-skilled employment in the period. The proportion of medium-skilled workers in

Table 7: Changes in skills shares, by sector: 2001–2012

		Proportions					Change in proportion	Change in number
		2001	2004	2007	2010	2012	2001–2012	
Primary	High-skilled	2.9%	5.4%	4.8%	7.2%	7.6%	4.8 pp	27 602
	Medium-skilled	54.5%	52.5%	53.1%	35.2%	36.8%	-17.7 pp	-571 229*
	Unskilled	42.6%	42.1%	42.1%	57.6%	55.5%	12.9 pp	-175 392*
	Total	100%	100%	100%	100%	100%		-719 232*
Secondary	High-skilled	14.2%	15.3%	16.6%	19.0%	18.1%	3.9 pp	188 518*
	Medium-skilled	69.8%	64.7%	63.6%	64.2%	61.5%	-8.3 pp	136 140
	Unskilled	16.0%	19.9%	19.8%	16.8%	20.4%	4.4 pp	214 002*
	Total	100%	100%	100%	100%	100%		537 376*
Tertiary	High-skilled	27.4%	27.1%	31.8%	28.3%	29.3%	1.9 pp	931 498*
	Medium-skilled	41.8%	41.5%	39.8%	42.6%	42.6%	0.8 pp	1 214 349*
	Unskilled	30.8%	31.4%	28.4%	29.1%	28.1%	-2.7 pp	576 288*
	Total	100%	100%	100%	100%	100%		2 720 821*

Source: StatsSA (LFS 2001 and QLFS 2012), authors' calculations

Notes:

1. The primary sectors include agriculture and mining; the secondary sectors include manufacturing, utilities and construction; and the tertiary sector includes trade, transport, financial services, community services and private households.
2. High-skilled workers include managers and professionals; medium-skilled workers include clerks, service and sales workers, skilled agricultural and fishery workers, craft and trade workers and operators and assemblers; and unskilled workers include elementary workers and domestic workers.
3. * denotes a significant change at the 5% level.
4. pp = percentage points

this sector thus dropped from around 69.8% to around 61.5%.

Between 2001 and 2012, employment grew by 2.7 million workers in the tertiary sector of the economy. High-skilled and medium-skilled workers accounted for 2.1 million or more than 70% of the increase in employment, with unskilled employment accounting for the rest of the increase. As a result, both the proportions of high-skilled and medium-skilled in the sector rose, while the proportion of unskilled declined by 2.7 percentage points. By 2012, high-skilled workers accounted for just under 30% of tertiary sector workers, while medium-skilled and unskilled workers accounted for 42.6% and 28.1% of the tertiary sector, respectively.

In summary, both the primary and secondary sectors of the economy witnessed dramatically declining proportions of medium-skilled workers, for differing reasons: in the primary sector of the economy, the declining share of medium-skilled workers was due to a significant decline of more than half a million medium-skilled jobs, while, the lack of growth in medium-skilled jobs accounts for the declining share of medium-skilled workers in the secondary sector

of the economy. Both the secondary and tertiary sectors experienced a rise in the proportions of high-skilled workers in the period, due to significant and relatively high increases in high-skilled workers in these sectors. In contrast, while unskilled employment also rose in both secondary and tertiary sectors, the proportion of unskilled workers only rose in the secondary sector; the decline in the proportion of unskilled workers in the tertiary sector of the economy was due to the much smaller increase in unskilled workers in the tertiary sector (576 000) compared to the increases in high (931 000) and medium-skilled employment (1.2 million) in this sector.

Overall, skills-demand in the South African economy is related to a number of factors. First, the relative shrinkage of the primary sectors and manufacturing imply significant declines in the relative demand for less-skilled workers since the shrinking sectors constitute the least skills-intensive sectors of the South African economy (Rodrik 2006). Second, skills-upgrading throughout the economy has resulted in a decline in the demand for less-skilled workers. Put differently, there has been substitution away from less-skilled towards more skilled labour.

Third, there has been a significant capital-deepening of the economy in the tradable sectors of the economy, that is, production techniques adopted within the tradable sectors of the economy have become increasingly capital-intensive (Rodrik 2006).

The reasons for the movement of the economy away from agriculture, mining and manufacturing towards tertiary production are complex. In looking at the decline in manufacturing particularly, Rodrik (2006) considers whether manufacturing became less profitable in the 1990s and onwards compared to before. He finds that the relative price of manufacturing goods decreased, but also that significant trade liberalisation in the 1990s would inevitably have led to competitive pressures in the manufacturing sector. Thus, with substantial trade liberalisation in the 1990s in South Africa, the manufacturing sector has found its dominant position in the local market under threat as years of inward industrialisation left it uncompetitive internationally (Bhorat et al. 1998). As a result, manufacturing production declined steeply. Furthermore, tariffs fell relatively sharply in labour-intensive sectors. Consequently, the commodity structure of trade has shifted against sectors that are labour-intensive, thus reducing the demand for labour, and particularly less-skilled labour, relative to capital (Thurlow 2006, in Edwards & Stern 2006).

Within manufacturing, Dunne and Edwards (2006) find substantial variation in the impact of trade on employment across manufacturing sub-sectors. Overall trade (exports plus imports) raised employment in resource-based industries (iron and steel, food and beverages, etc.) and chemical industries (basic chemicals, plastics and rubber, etc.), while trade reduced employment in more labour-intensive sectors such as clothing, textiles and footwear, as well as in sectors producing metal products. These changes have led to significant churning within the workforce, but demand for labour has fallen fastest among less-skilled workers (Dunne & Edwards 2006).¹⁶

The movement towards more skilled workers as well as the increasingly capital-intensive methods of production are both related to technological change. As far as technological change is concerned, Dunne

and Edwards (2006) show that the majority of employment losses between 1994 and 2003 were likely due to skills-biased technological changes while trade liberalisation also accounts for some of the proportion change. More specifically, it appears that firms have found ways to cut costs and raise production by investing in capital and skills and shedding unnecessary jobs. Thurlow (2006) asserts that trade reforms have also contributed to the rising capital and skill-intensity of production.

3.5 Conclusion

The descriptive analysis provided above shows some interesting results. First, employment growth trends in the South African economy follow GDP growth trends, though employment growth tends to be slower than GDP growth. The South African labour market appears very vulnerable to economic slumps: the labour market impacts of the recent recession provide evidence that difficult economic times have a quick, severe and long-lasting impact on the South African labour market. Though the economy is recovering well from the recession, neither GDP growth rates nor employment levels have returned to pre-crisis levels.

Second, the period between 2001 and 2012 saw a continuation of the movement of the economy away from primary sector production towards tertiary production: the two primary sectors experienced the slowest GDP growth rates, with mining output declining, and employment in both agriculture and mining contracting severely in the period. The primary sectors of the economy have thus experienced a severe slump in the period. In turn, manufacturing employment was stagnant in the period. The East Asian growth experience has shown that light manufacturing¹⁷ is critical for a dynamic and sustainable growth path. Hence, we have not achieved an optimal growth strategy, given our relatively capital-intensive manufacturing, with no globally competitive light manufacturing base to speak of (see, for instance, the discussion in Hausmann and Klinger (2006) on South African exports).

Third, the tertiary sectors such as community services, financial services and trade accounted for

the largest increases in employment in the period. Importantly, growth in the community services and financial services sectors was labour-neutral, while output growth outstripped employment growth in the other sectors, particularly in the primary sectors and construction. Employment growth within the financial services sector – one of the fastest-growing sectors – has been driven by growth within the business activities NEC sub-sector which, in turn, may be pointing to increasing labour broker employment. The increase in community service employment points to a large expansion in public sector employment in the period, with the public sector accounting for a fifth of the change in total employment in the South African economy between 2001 and 2012. South Africa's share of public sector employment is high and is therefore cause for concern. For example, the IMF argues that the recent increase in public sector employment is not the best way to increase employment in South Africa, because it may crowd out critical health and education spending as well as put upward pressure on wages in the economy (IMF 2012).

Fourth, managers, professionals, and service and sales workers appear to have been in relatively high demand in the period between 2001 and 2012, due mostly to increases in employment in the community services sector and financial services sector. Craft and trade workers and operators assemblers were the relative losers: employment levels of craft and

trade workers and operators and assemblers did not increase significantly in the period, while almost all other occupations, except domestic workers and skilled agriculture and fishery workers, experienced significant increases in employment. As a result the share of these two medium-skilled occupations (craft and trade workers and operators and assemblers) in total employment declined from 23.8% to 20.5% between 2001 and 2012. Medium-skilled clerks and unskilled elementary workers maintained their status in the labour market, with relative growth figures for these two occupations closely matching overall employment growth.

Fifth, the proportions of medium-skilled workers declined dramatically in both the primary and secondary sectors of the economy. In contrast, large and significant increases in high-skilled employment in the secondary and tertiary sectors resulted in the proportion of high-skilled employment in these sectors rising.

Thus, growth in employment has been driven by the public sector, financial services, labour brokers in semi- and unskilled occupations and trade. Hence, the real growth engine missing is light manufacturing; furthermore, there is a missing skills base to grow this sector. The economy, through the SETAs, needs to rapidly increase the supply of the skills that will be closely tied to a globally competitive light manufacturing sector.

4 DECOMPOSING LABOUR DEMAND

4.1 Introduction

The data presented so far suggests that labour demand needs have become increasingly biased towards individuals with greater skill levels. More specifically, South Africa's labour market, in the period between 2001 and 2012, saw a high demand for managers, professionals, service and sales workers while craft and trade workers and operators and assemblers were the relative losers. Overriding these shifts, has been the dominance of tertiary sectors, including the community services, financial services and trade sectors in explaining the aggregate shifts, though the increase in financial services employment should be treated with some caution. The fact that we can observe the labour demand outcome, however, is only half the puzzle solved. The other, perhaps more important, half of the puzzle is to determine the relative importance of the factors that shaped this labour demand trajectory. It is useful to think of labour demand patterns as being driven at the sectoral level by two forces – *within-sector shifts* and *between-sector shifts*. The issue is to estimate the relative strengths of these two forces in explaining the employment trends observed in the descriptive overview above. In order to achieve this, we utilise a basic decomposition technique drawn from Katz and Murphy (1992).

Within-sector employment shifts are those changes in labour allocation that come from within the industry itself. Sources of within-sector shifts include technological change in a sector that may create the need for a certain skill-type over another or a change in the price of a non-labour factor, such as capital equipment or computers, that results in altered preference for certain labour types. Outsourcing of non-core functions, although hard to measure, is another form of within-sector shifts that may result in

changing labour preferences. Between-sector changes are relative employment shifts occurring between sectors in the economy as a result of changing shares in the relative output of different sectors. As sectors typically have differing patterns of skill demands, a growing or declining share in production of a sector may alter labour demand at different skill levels. The share of domestic output that changes due to trade flows can similarly affect shifting labour demands between sectors. Finally, the shifts in product demand across industries may also play a role in explaining between-sector labour allocations. Hence a growing share of the product market by a specified sector may result in altered preferences for certain skills.

4.2 Methodology

The Katz and Murphy (1992) decomposition technique has its theoretical foundation in a set of labour demand equations, where labour is hired subject to a cost constraint, assuming constant returns to scale in the production function. The derivation allows the authors to arrive at a representation of labour demand where the total relative labour demand shift is represented according to a given group (occupation, for example), which is then readily decomposable into a between-sector and within-sector component. It should be remembered that both these shifts are to be understood under a regime of fixed relative wages.

The total shift as well as the between-sector shift, according to occupation or socio-economic groups, are directly observable. Utilising this theoretical approach, one can then arrive at an empirically estimatable equation, to determine the size of these three segments of relative labour demand by any given cohort. The index of relative labour demand shifts is constructed as follows:

$$x_k^d = \frac{D_k}{E_k} \frac{E_{jk}}{E_j} \frac{E_j}{E_k} \frac{E_{jk}}{E_k} \quad (1)$$

The subscript k refers to occupation (or other groups) and j refers to sectors.

The total relative demand shift for group k in the period under consideration is measured by x_k^d or

$$\frac{E_{jk}}{E_k}, \text{ where } \frac{E_{jk}}{E_k} \text{ is group } k\text{'s share of total}$$

employment in that sector in the base year. E_j is the change in total labour input in sector j between the two years. This measure then expresses the percentage change in demand for each group as a weighted average of the percentage change in sectoral employments in which the weights are group-specific employment distributions (Katz & Murphy 1992). Note that the between-sector component explaining part of the shift in relative demand for group k is given by D_k , while the within-sector shift is simply the difference between the total- and between-sector shifts. As with the Katz and Murphy (1992) approach, we normalise total employment in each year to sum to one, and so obtain a measure of relative demand shifts. In addition, the values for E_{jk} and E_k are represented in base year, which in this case is 2001.

It should be noted that there are a number of drawbacks with the decomposition approach. First, it assumes that wages are constant in all employment shifts recorded. Hence we record quantity shifts only, without recourse to the possible impact of wage changes on labour demand. Secondly, the technique and, indeed, all decomposition techniques, suffer from static analysis. In other words the analysis may show, for example, that technological change resulted in a decrease in employment of certain groups or occupations in the period under study. However, it does not (or cannot) take account of the indirect input-output effects of such a change. These indirect effects may in the long term, via higher national economic growth for example, cause an increase in the demand for these labour types. This is the most fatal critique of the decomposition technique, but yet one that is not easily resolved by better alternative techniques currently available.

4.3 Results

In the discussion below, we show the results of the decomposition methodology detailed above. The shifts reported are *relative* demand shifts, so trying to capture more accurately the magnitude of net sectoral employment growth, which absolute growth figures tend to mask. Importantly, Table 8 reports on the changes in demand for a particular group due to within and between-sector shifts, thus showing the proportion of the change in relative demand due to inter (between) and intra-sectoral (within) forces. In particular, we show the within-sector share represented as a share of total relative change in employment. Given the importance of community services as a proxy for public sector employment, we show the relative demand shifts with and without community services in Table 8.

Looking at the results including community services first, the table shows a relative increase in demand for all occupation groups in the period, with high and semi-skilled workers displaying the largest increases. The occupations displaying the highest total relative demand in the period were professionals, followed by clerks, managers and service and sales workers. These increases match well with the data above showing strong employment growth in sectors such as financial services, community services and trade, together with managers, professionals, service and sales workers and clerks.

The poorest performers in terms of relative demand were elementary workers, operators and assemblers and domestic workers. Thus, the period between 2001 and 2012 was marked by a high relative demand for high-skilled occupations, together with some medium-skilled workers (clerks and service and sales workers), while medium-skilled craft and trade workers and operators and assemblers and unskilled workers experienced a relatively low demand.

The results for elementary workers here may be surprising, given that there was a significant growth of 517 000 elementary workers in the period between 2001 and 2012. The data below however shows *weighted relative shares* of employment; put differently, the data shows the relative performance

of occupations given their shares in employment in 2001. The low total relative demand for elementary workers can thus be understood in the context of the fact that this occupation accounted for the largest chunk of employment in 2001 – that is, a fifth of all employment – but the growth in employment for this occupation was relatively slow, as shown in Table 6. The low relative demand for craft and trade workers, and particularly operators and assemblers is unsurprising – neither of these two occupations saw significant increases in employment in the period between 2001 and 2012, with operators and assemblers displaying particularly poor results.

Importantly, Table 8 shows that for all the occupation groups shown, the within-sector component dominates over between-sector shifts in explaining the profile of relative demand. This is true particularly of managers where 95% of the increase in relative demand in the period can be explained by intra-sectoral forces. In fact though, for all other high and medium-skilled workers the share of within-sector relative demand in explaining total relative demand is very high, ranging at 87–96%. In turn, while the within-sector component is also important for elementary workers, its dominance is less-striking, reflecting that between-sector forces played a greater role in determining relative demand for this occupation compared to other occupations. More specifically, this data probably reflects the collapse of unskilled employment in the primary sectors.

Finally, the relatively high within-sector component for domestic workers is probably a reflection of the impact of the introduction of a minimum wage for domestic workers in 2002, which has resulted in stagnating levels of employment for domestic workers in the period. Overall, the results including community services in Table 8 show that intra-sectoral force dominate in our analysis of relative demand changes for different occupations over time, while inter-sectoral forces play a larger role in the relative demand of elementary workers compared to all other occupation groups.

To isolate the impact of public sector employment from the relative demand shifts that may have been occurring elsewhere in the economy, we ran the decomposition for all the employed, excluding community services, since public sector workers are mainly found within the community service sector. These results are shown on the right-hand side of Table 8 and are an attempt to illuminate the extent to which government employment may have influenced labour demand results.

There are few interesting results from the analysis excluding community services: firstly, the overall labour demand shifts are lower for each of the occupations in Table 8 when excluding community services. This is unsurprising given that the community services sector accounted for around 40% of the increase in employment in the period

Table 8: Industry-based relative demand shift measures, by occupation: 2001–2012

	Including community services				Excluding community services			
	Between	Within	Total	Share of within in total	Between	Within	Total	Share of within in total
High-skilled								
Managers	0.92	12.63	13.32	94.9%	0.79	11.10	11.71	94.8%
Professionals	3.03	15.04	17.20	87.4%	1.13	6.09	7.07	86.1%
Medium-skilled								
Clerks	1.59	12.88	14.07	91.6%	1.08	9.13	10.01	91.2%
Service & sales workers	1.92	11.75	13.23	88.9%	1.21	7.69	8.71	88.3%
Skilled agriculture & fishery	-0.55	-19.60	-20.47	95.8%	-0.62	-22.55	-23.59	95.6%
Craft & trade workers	1.35	7.88	9.01	87.4%	1.28	7.50	8.58	87.4%
Operators & assemblers	0.19	1.63	1.81	90.1%	0.12	1.04	1.15	90.0%
Unskilled								
Elementary workers	0.28	1.10	1.37	80.1%	-0.17	-0.69	-0.86	79.7%
Domestic workers	0.37	3.49	3.83	91.1%	0.37	3.49	3.83	91.1%

Source: StatsSA (LFS 2001 and QLFS 2012), authors' calculations

between 2001 and 2012, though we note that not all of this increase can be apportioned to the public sector. Relative demand shifts are lower, in particular, for professionals, and to a lesser extent clerical and service workers. A more detailed analysis of the industry employment figures (see Appendix 4) reveal that more than 40% of the increase in professionals in the period was accounted for by the community services sector, while more than 50% each of the increase in clerks and service and sales workers was accounted for by the community service workers. In this context, the lower total relative demand figures, particularly for professionals, clerks and service and sales workers makes sense.

Secondly, Table 8 shows though that the share of within and between-sector forces explaining total relative demand shifts are very similar, regardless of whether we include or exclude community services. Professionals are the only occupation worth mentioning, though the change is marginal: the share of within-sector demand in explaining total relative demand of professionals declines from 87.4% to 86.1% when we exclude the community services sector from our analysis.

Thus, the data in Table 8 shows that for all occupations, the within-sector forces in explaining overall relative demand shifts far outweighs the between-sector forces. For all occupations barring that of elementary workers, within-sector influences constituted 86–96% of aggregate labour demand shifts. Hence, the forces of technological change, the greater preference for a specific factor mix and so on, have all catalysed firms into altering their labour demand practices in a specific manner. Put simply, forces within each sector and firm have been the primary reason for the labour demand changes that have occurred in the period between 2001 and

2012. It should be noted that the smaller within-sector share of elementary workers is picking up the high attrition of these sectors in the primary sectors of the economy which are in secular decline.

The results from the decomposition in this section match well with employment shifts found in the section above. More specifically, in the context of a growth path within which mining and agricultural employment has collapsed, together with the creation of higher skilled jobs in the tertiary sectors, it is unsurprising that the overall relative demand shifts presented in this section show strong demand for managers, professionals, service and sales workers and clerks. Furthermore, the data shows that medium-skilled craft and trade workers and operators and assemblers and unskilled workers experienced low relative demand, and these results too are unsurprising, given the relatively poor performance of manufacturing and the primary sectors.

Given the importance of the public sector for growth in high-skilled and some medium-skilled occupations, the lower total relative demand figures, particularly for professionals, clerks and service and sales workers, when excluding the community services sector in the decomposition above, makes sense. Thus, the key missing link in a low-skilled abundant country like South Africa is light manufacturing, since this would create much-needed jobs for lower skilled workers.

Finally, the importance of within-sector forces in explaining relative demand patterns for medium and unskilled workers may be a reflection of the fact that sectors such as mining, agriculture, and manufacturing have been in decline due to various internal factors including technological change.

5 OCCUPATIONS AND WAGES

In this section of the report, we extend our analysis to examine the trends in wages that accompanied the employment shifts described previously.

Traditionally, the high levels of wage inequality in South Africa and the relatively large returns to skilled workers are explained by the high levels of inequality in education and experience (Bhorat 2000). While education and experience account for a large portion of the apparent wage inequality, there are other (related) factors that may also be influencing the wage structure over time that are not directly related to skills. In particular, technological change and the impact of international trade may also be affecting wages and having an impact on returns to different occupations based on the tasks involved those occupations (Edwards 2003).

The recent international literature on skills-biased technological change explores the idea that new technologies have not just depressed wages for low-skilled workers and raised wages for high-skilled workers but shows that wages have fallen specifically for those involved in performing routine or 'offshorable' tasks, a group often made up of workers in the middle of the distribution (Autor et al. 2003; Goos & Manning 2007; Acemoglu & Autor 2011). This view of technological change moves beyond the high/low skilled categories and identifies occupations as a key channel through which wages are affected. The contention is that in addition to skill-levels, the tasks performed in different occupations are closely linked to changes in the wage structure over time, where technological change and international competition have decreased returns to certain tasks. For example, jobs which require cognitive skill and creative problem-solving or face-to-face interaction are unlikely to be automated or threatened by international competition, while routine tasks on an

assembly line or information processing jobs face higher risks in this regard.

In order to explore how occupational tasks may be playing a role in wage changes in South Africa, we examine not only how the returns to occupational tasks have changed over time but also how these changes play out at different points along the income distribution. We expect to see that for those jobs involving tasks that face high risks of automation and international competition, wages have fallen over time. In addition we expect that returns would not be distributed uniformly across the income distribution.

5.1 Methodology

Identifying task categories

Using wage and occupational information we aim to analyse changes in the wage structure over a ten-year period (2001–2011), and we investigate whether these changes can be linked to occupational tasks. In order to do this we identify five 'task categories', which are created to explore the way that different tasks are likely to be affected by technological change and international trade or competition. We create these categories using the four-digit occupation codes in the LFS and QLFS data, known as the South African Standard Classification of Occupations (SASCO). Using these codes we link every identified occupation with one or more of the five task categories below. The choice of these five categories is based on work by Jensen and Kletzer (2010) and in particular follows Firpo et al. (2011). A brief explanation of each category is given here. The first two categories are meant to capture jobs that are likely to be affected by technological change and international competition, while the final three are less likely to be affected.

1. *Information and communication technology (ICT)-related jobs:* Jobs that have high information content and are likely to be affected by technological change through the adoption of new production technologies, or face competition from countries where the same thing can be done more efficiently. These jobs generally include activities such as getting information, analysing data, recording information, and often involve interaction with computers. In the SASCO codes this consists of occupations such as software engineers, computer programmers, typists, data entry, and so on.
2. *Automation/routinisation:* Jobs that are routine in nature and have the potential to be automated, often involving repeated tasks, structured work environments, and where the pace of the job is often determined by mechanical or technical equipment. These jobs could also potentially be at risk through increased trade and import penetration. They include occupations such as textile weavers, engravers, machine operators, and assemblers.
3. *Face-to-face:* Work that relies on face-to-face contact, such as establishing and maintaining personal relationships, working directly with the public, managing people, caring for others, teaching, and work requiring face-to-face discussions. Generally these are jobs that cannot be easily automated or replaced by a competing international firm. Such jobs range from room service attendants, food vendors, labour supervisors and travel guides to therapists and teachers.
4. *On-site:* Jobs that require the worker to be present at the particular place of work, and usually include tasks involving physical work, controlling machines/processes, operating vehicles or mechanical equipment, inspecting equipment, constructing physical objects. Again, these jobs are not easily offshorable and are generally made up of construction workers, machine operators, drivers, mechanics, and various kinds of manual labourers.
5. *Decision-making/analytic:* Work that requires non-routine decision-making abilities, usually tasks that involve creative thought, problem-solving, developing strategies, taking responsibility for outcomes and results. Such jobs cannot easily be automated and are usually at lower risk of being displaced by international competition. Occupations include artists, all types of professionals, managers, and other jobs generally considered to be high-skilled jobs.

Note that certain jobs fall into more than one category, for example many managers would be involved in face-to-face tasks and also in decision-making/analytic tasks. There is thus overlap in the categories. In addition, in some cases, the nature of the LFS/QLFS coding forced us to categorise certain SASCO codes into the same task category, even though we may have thought they belonged in different categories. For instance, we had to combine certain farmers (who would be involved in decision-making) together with farm foremen (who would not necessarily be involved in decision-making) in the decision-making category. Such cross-categorisation may introduce some measurement error into our estimates but the problem was limited to fewer than ten SASCO codes overall.

The relationship between tasks and wages

Examining the relationship between our five task categories and wages builds on earlier results which show increased labour demand in skilled sectors, and the Katz and Murphy decomposition revealing that within-sector forces explain the bulk of the changes in labour allocation. Moving beyond a basic 'returns to skills' analysis, we use the task categories described in section 3.3.1 to examine how different tasks are being rewarded in the South African labour market and the factors that may be driving these shifts. The task categories can be linked to skills, where, as noted above, analytic jobs are more highly skilled while on-site or automated jobs generally require lower-skilled workers.

Our wage regression includes controls for the five task categories as well as the standard controls for factors that strongly influence earning power in

South Africa such as education, race, and age/ experience, thus controlling for individual skills as a predictor of wages. We take this approach in order to attempt to identify wage premia linked to occupational tasks, while controlling for other individual characteristics. A traditional Ordinary Least Squares (OLS) wage regression estimates the wage premium at the mean of the wage distribution. However, since we are also interested in whether the wage premia associated with task categories are different at different points of the wage distribution, we adopt a quantile regression approach. Put differently, we are also interested in whether, for example, the wage premium to automated jobs declined in the middle of the wage distribution (given that we expect that technological change may have resulted in declining wage premia for routinised jobs which tend to be medium-skilled), and therefore employ quantile regressions rather than OLS regressions. Thus, while OLS regressions allow one to estimate wage premia at the mean of the wage distribution, the quantile regression approach allows us to observe wage changes throughout the distribution. In this way we hope to shed some light on the expected impact that technological change and international trade may have had not only on the levels of wages for each task category but also at different points in the wage distribution within each category.

Following Firpo et al. (2011) our conditional quantile regression has the log of monthly wages as the dependent variable and task category as the independent variable, with basic controls included.

$$\begin{aligned} \text{Log of Monthly Wages}_t \\ = \beta_1 + \beta_2 X_t + \beta_3 (\text{Task Category}_t) + \alpha \end{aligned}$$

where t is the year, and X includes controls for age, race, and education. The variable of interest here is the coefficient on β_3 in each occupational category for each decile of the income distribution in any given year. This variable provides an estimate of the returns to each category across each decile of the income distribution for the year in question. We run the regressions for 2001 and 2011. In section 5.2 below, we plot the resulting coefficients for the task categories only, while Appendix 7 provides full

quantile results for 2001 and 2011 for selected quantiles.

5.2 Descriptive statistics

The descriptive statistics below expand on our created task categories. Specifically, we show how the task categories relate to the occupation data, the changes in task employment over the period, and the changes in wages related to tasks over time. Table 9 shows the task categories against occupation categories from the household survey data for 2001 and 2011. We note that the far right-hand column called 'LFS Totals' shows the actual employment totals for each occupation directly from the LFS/QLFS, independent of the overlapping task categories. For example, in the 2001 LFS there were 663 945 managers in South Africa. In contrast the 'Total' column to the left of 'LFS Totals' gives the total number of managers in our five created task categories. It is clear that there is an overlap in the five task categories, where, for example, many managers are involved in face-to-face tasks as well as analytic tasks and are thus included in both task categories. A correlation matrix (Appendix 5) reveals that the strongest correlations (0.41) are between automated and on-site, and analytic and face-to-face. This overlap points to the 'bluntness' of our task category measure. Table 9 explores the composition of these categories in more detail to give a better sense of what occupations each one includes.

Table 9 shows that the ICT category consists of occupations that are classified in the household survey data as professionals, technicians, and clerks. These occupations include jobs such as software engineers, computer programmers, typists, data entry workers, and so on. In general, ICT-related jobs are thought to be easily affected by technological change and international competition, because technology is easily transferrable and routine tasks can be easily automated. Looking at automated jobs next, the table shows that, in the main, this task category consists of elementary workers, craft workers and operators and assemblers, and some clerks and technicians. Automated jobs contain elements which could be automated or routinised

Table 9: Occupation categories and occupational tasks: 2001–2011

LFS September 2001												
	ICT		Automated		Face-to-face		On-site		Analytic		Total	LFS totals
	No.	Share	No.	Share	No.	Share	No.	Share	No.	Share		
Managers	0	0%	0	0%	663 227	19%	8 681	0%	663 227	35%	1 335 135	663 945
Professionals	77 922	12%	2 986	0%	249 490	7%	31 776	0%	381 861	20%	744 036	485 829
Technicians	178 638	29%	205 165	5%	531 864	15%	134 110	2%	671 219	36%	1 720 996	1 176 031
Clerks	368 923	59%	1 029 770	26%	356 139	10%	100 998	2%	51 481	3%	1 907 311	1 090 772
Service	0	0%	0	0%	1 034 643	29%	740 526	12%	32 993	2%	1 808 162	1 429 021
Skilled agriculture workers	0	0%	283 450	7%	0	0%	292 128	5%	43 464	2%	619 042	520 699
Craft workers	0	0%	724 015	18%	0	0%	1 297 763	20%	30 134	2%	2 051 912	1 529 375
Operators & assemblers	0	0%	475 869	12%	0	0%	878 239	14%	0	0%	1 354 108	1 127 155
Elementary workers	0	0%	1 311 656	33%	673 791	19%	2 055 714	32%	0	0%	4 041 162	2 252 554
Domestic workers	0	0%	0	0%	0	0%	881 411	14%	0	0%	881 411	881 411
Total	625 483	100%	4 032 912	100%	3 509 154	100%	6 421 344	100%	1 874 380	100%	16 463 277	11 156 792

QLFS Q4 2011												
	ICT		Automated		Face-to-face		On-site		Analytic		Total	LFS totals
	No.	Share	No.	Share	No.	Share	No.	Share	No.	Share		
Managers	0	0%	0	0%	1 157 226	24%	20 220	0%	1 157 226	40%	2 334 672	1 157 833
Professionals	177 053	15%	8 436	0%	415 379	9%	80 129	1%	716 452	25%	1 397 450	769 895
Technicians	217 476	18%	336 415	7%	680 002	14%	206 931	3%	856 331	30%	2 297 154	1 510 919
Clerks	787 136	67%	1 451 840	30%	478 675	10%	122 805	2%	51 449	2%	2 891 906	1 529 944
Service workers	0	0%	0	0%	1 391 023	29%	1 208 292	15%	64 804	2%	2 664 120	1 988 706
Skilled agriculture workers	0	0%	55 868	1%	0	0%	60 361	1%	22 645	1%	138 874	71 800
Craft workers	0	0%	723 277	15%	0	0%	1 476 321	19%	4 431	0%	2 204 031	1 652 057
Operators & assemblers	0	0%	386 750	8%	0	0%	1 010 162	13%	0	0%	1 396 912	1 133 984
Elementary workers	0	0%	1 844 351	38%	661 684	14%	2 733 552	35%	0	0%	5 239 587	2 960 509
Domestic workers	0	0%	0	0%	0	0%	886 883	11%	0	0%	886 883	886 883
Total	1 181 665	100%	4 806 937	100%	4 783 989	100%	7 805 655	100%	2 873 338	100%	21 451 588	13 642 530

Source: StatsSA (LFS 2001–2007 and QLFS 2008–2011), authors' calculations

and are thus also potentially at risk from technological change and global competition.

Face-to-face jobs are jobs that cannot be easily automated or replaced by a competing international firm, since these jobs have face-to-face components. This includes some lower paid jobs in elementary and service occupations (for example, service attendants, food vendors, labour supervisors/foremen), but it also includes higher paid occupations such as managers, professionals, technicians and clerks. On-site jobs, in the fourth column, are those which are not easily offshorable since they have an on-site component. The table shows that jobs with an on-site component are numerous and span all occupation categories, but are mainly found in elementary, craft, operator, and domestic occupations. These include construction workers, machine operators, drivers, mechanics, various kinds of manual labourers and domestic workers. The final task category consists of jobs with an analytic or decision-making component, and the majority of these higher-skilled jobs are found in professional, managerial and technical occupations.

Table 9 shows some interesting results: firstly, the on-site category accounts for the largest category of workers in all years. This is unsurprising given that this category spans a wide range of occupation types since most jobs have some on-site component. Analytic and ICT jobs, which mostly consist of better-skilled workers (professionals, technicians, and clerks), account for the smallest shares of employment by task category, that is, 2.9 and 1.2 million of the 21.4 million task categories in 2011. In turn, automated and face-to-face jobs account for about 4.8 million of the 21.4 million task-based jobs in 2011.

Secondly, Table 9 shows that in each of the years there is considerable overlap between tasks. For instance, while the actual employment total in 2011Q4 stands at 13.6 million our total for the task categories measures stands at 21.5 million. The difference between the two is made up of those occupations that have been coded into more than one of the five categories. These overlap results are not surprising, since many jobs fall into more than one task category identified. For instance, certain

machine operators would fall into the automated category as well as the on-site category.

Table 10 reveals broad employment trends for each task category over time. It shows the relative dominance of on-site employment; most employment in South Africa falls into our on-site category. Sectors which dominate this category are manufacturing, construction and trade, domestic workers, and the majority of farm workers. A graph (not shown here) illustrates that the trend in on-site employment rises from 2001 to 2008 when the economy was growing relatively quickly, and shows a noticeable decline beginning at the end of 2008 when the impact of the recession began to be felt in the South African labour market. In the last two years on-site employment stabilised and an overall upward trend is evident.

Table 10: Employment changes, by task categories: 2001–2012

Task Category	2001	2011	% Change
ICT	664 119	1 091 338	64%
Automated	4 432 177	4 660 485	5%
Face-to-face	3 530 171	4 754 412	35%
On-site	6 819 508	7 702 578	13%
Analytic	1 883 114	2 879 530	53%

Source: StatsSA (LFS 2001–2007 and QLFS 2008–2012), authors' calculations

Thus on-site employment trends mirror overall employment trends quite closely, and this is unsurprising given that a large share of overall occupations in the economy have an on-site component. Though not shown here, it is worth noting that the share of on-site jobs in total jobs has declined in the period between 2001 and 2012: the descriptive analysis shows a stable or declining share of employment for elementary workers, craft workers, operators and assemblers and domestic occupations – the occupation categories within which on-site employment is concentrated – and it is thus unsurprising that the overall share of on-site employment in total task employment has decreased in the period.

In turn, Table 10 shows that the ICT, face-to-face and analytic categories display a significant overall upward trend. The jobs in these task categories

have larger shares of higher-skilled workers. Finally, jobs involving automated tasks have remained relatively stable between 2001 and 2012, while jobs in the on-site category have increased by 13% from a large base.

Table 11 takes a brief first look at wage data over the period for each of the task categories. The table firstly shows that ICT-related jobs and analytic jobs have the highest average wages, while jobs with potential for automation and on-site jobs are associated with lower wages. Jobs involving face-to-face contact are in the middle of this distribution. The results for ICT-related jobs and analytic jobs are expected, since there is a dominance of better-skilled workers in these task categories, as shown in Table 9. In turn, automated jobs and on-site employment is dominated by lower-skilled elementary workers, craft workers and operators and assemblers, thus accounting for the lowest average wages among these groups.

Examining the wage trends over time indicates that face-to-face, automated and on-site jobs saw the largest average wage increases over the period, while analytic and ICT-related jobs experienced the lowest increases over the period. These results appear to indicate that the low-earning categories have seen relatively larger increases in wages than higher earning jobs, and this may, in part, be due to increased protection for poorer workers through

minimum wages. These preliminary descriptive results, however, do not control for productivity-related characteristics of workers, including education, experience, race and so on.

A closer look at wages is provided in Appendix 6, where we disaggregate wages by task category and industry for 2001, 2007 and 2011. This provides a more detailed picture of average wages, and the broad shifts that have taken place over the period under review. Looking across each row reveals the average wages within each industry, by task category. For example, in the agricultural industry in 2001, jobs classified as on-site had an average log monthly wage of 5.92 while analytic jobs in the industry earned 8.21 on average. The data shows rising wages for all task categories in the agricultural industry, particularly for those in automated and on-site categories; this may be due in part to the impact of the minimum wage. In contrast, looking down a column indicates how wages within a task category differ by industry.

It is again clear, for example, that ICT-related and analytic jobs are associated with the highest wages, although substantial increases in wages for the other three task categories are evident. An important question that requires more detailed analysis is whether wage trends in South Africa reveal that skilled (or scarce skill) sectors, along with those sectors which are afforded government or union

Table 11: Log of monthly wages, by task categories: 2001–2011

	ICT	Automated	Face-to-face	On-site	Analytic
2001	8.13	6.88	7.18	6.62	8.21
2002	8.21	6.77	7.37	6.55	8.18
2003	8.11	6.85	7.29	6.60	8.22
2004	8.14	6.92	7.37	6.70	8.28
2005	8.13	6.96	7.28	6.74	8.21
2006	8.19	6.94	7.38	6.74	8.29
2007	8.20	7.05	7.51	6.86	8.31
2008	n/a	n/a	n/a	n/a	n/a
2009	n/a	n/a	n/a	n/a	n/a
2010	8.23	7.38	7.76	7.14	8.42
2011	8.25	7.40	7.87	7.17	8.55
% Change	1.4%	7.5%	9.6%	8.3%	4.1%

Source: StatsSA (LFS 2001–2007 and QLFS 2008–2011), authors' calculations

Notes:

1. The wages are log of monthly wages.

2. The wages above are real wages deflated to 2001 prices.

protection, are earning wage premiums at the expense of those sectors which are not protected or those facing the pressures of global competition. The descriptive data lends some weak support to this hypothesis, for instance in the case of agricultural and manufacturing, where the former appears to have benefitted from state protection while international competition may be putting pressure on manufacturing wages. However, given aggregate nature of this descriptive data it is difficult to identify clear trends in this regard. In the next section, we investigate the premia associated with the task categories more comprehensively by using quantile regressions which control for productivity-related characteristics of workers.

5.3 Returns across the wage distribution

A quantile regression allows us to model the relationship between a set of predictor variables (in our case, task categories) and a dependent variable (in our case, wages) over specific percentiles (or quantiles) of the wage distribution. The sample for the quantile regression results presented below comprises of all working-age employed individuals who provided earnings information in the two surveys. In both years (2001 and 2011), earnings are measured by the log of the total monthly wages. Our model includes controls for education, age/experience and race. We specify a set of splines for the education level of workers and a set of splines for age, which serves as a proxy for experience. Standard dummies for race, with African as the base case, are also included in our estimation. The full regression results are included in Appendix 7 and reveal that the coefficients on the standard controls are as expected. The quantile regression results for the task categories are shown in Figure 3, where the coefficient of log wages is plotted for each decile of the distribution.

For those in automated or routine occupations, the results show small positive returns for workers in the middle of the distribution in 2001 but negative premia for those at the bottom of the distribution (10th quantile) and lower returns for those at the top of the distribution (60th to 90th quantiles). The positive returns in the middle of the distribution in

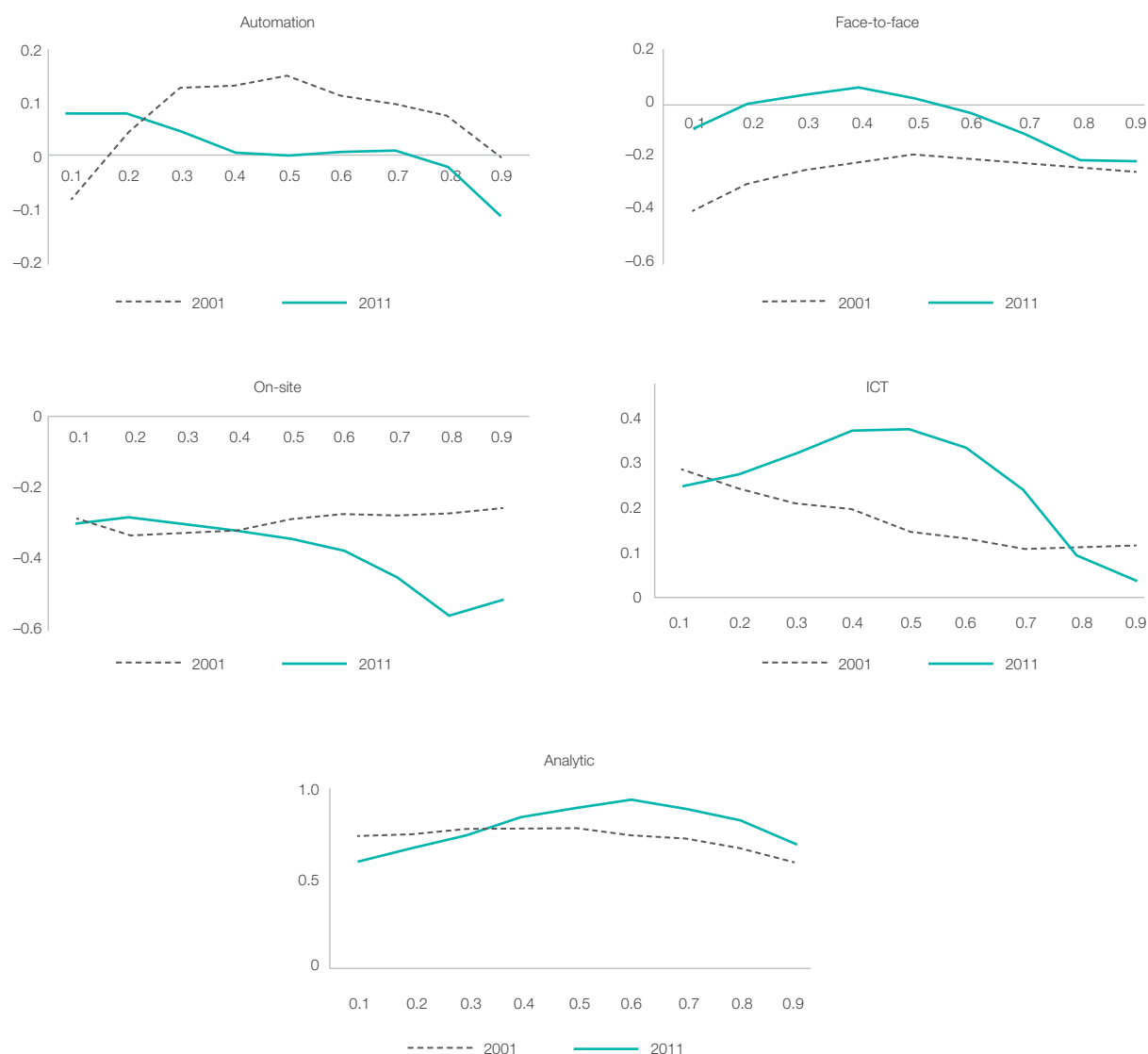
2001 would include technicians, clerks, craft workers, and operators and assemblers. Importantly, the figure shows that over time the returns to automated jobs fell, particularly in the middle of the distribution. This is the first piece of evidence suggesting that technological innovation and international competition may be impacting on the demand, and consequently wages, for those involved in routine work. These effects may have been felt in industries such as clothing and textiles, which have suffered as a result of increased international competition.

In 2001, workers through most of the distribution with a face-to-face component to their work faced lower than average returns. This changed in the period between 2001 and 2011, with the premia to those in the face-to-face increasing for most of the distribution below the 80th percentile. Jobs requiring face-to-face contact are less likely to be replaced by changing technologies and global competition. Thus, the results from the face-to-face graph present the second piece of evidence of the tasks which are insulated from potential impacts of technology and international competition on wages.

We expect that the wages of workers with an on-site component would be lower than the wages of workers with no on-site component, since the on-site category is dominated by craft workers, operators and assemblers, elementary workers and domestic workers. As expected, the figure shows that workers that have an on-site component to their jobs earn less than those without an on-site component. The figure shows that over time the premia to jobs that require one to be on-site have decreased for the upper half of the distribution. Interestingly the lower half of the distribution remains unchanged. This may be due in part to the introduction of minimum wages to 11 sectors, implemented by and large in the early 2000s, with steady wages increases every few years. The intervention represents an exogenous 'policy shock' which appears to be stabilising wages at the bottom of the distribution.

The ICT and analytic categories are dominated by medium to higher-skilled workers. Unsurprisingly then, the figure shows that workers in ICT jobs earn

Figure 3: Task wage premia, by quantiles: 2001–2011



Source: StatsSA (LFS 2001 and QLFS 2011), authors' calculations

a wage premium over those not in ICT jobs, though the wage premium to ICT jobs over non-ICT jobs declines as one moves up the distribution. Over time, the premium for ICT workers increased significantly between the 10th and 80th quantile.

Finally, the last graph in Figure 3 shows, as expected, that jobs with an analytic or decision-making component to them are associated with the largest wage premia, and these premia are highest for those in the middle and upper-middle of the wage distribution. Workers in this category include managers, professionals, technicians, clerks and other skilled workers. Over time, the results show a slight increase at the upper end of the distribution.

This section has attempted to give an overview of changes in the South Africa wage structure over a recent ten-year period. In particular the aim has been to investigate whether there is any evidence of specific occupational tasks serving as a channel through which wages are influenced. The descriptive overview revealed some expected evidence of wage inequality being linked to particular occupational tasks, where jobs involving tasks that require greater levels of skill are associated with higher wages. To some extent this shows evidence of skills-bias.

Overall the conditional quantile results show several interesting trends: first, workers in ICT-related jobs, and those in the analytic category earn higher wages

throughout the distribution than workers in the other three categories. This is unsurprising, given that these two task categories are dominated by medium to higher-skilled occupations which have been in high demand in the period. Furthermore, for analytic jobs – which are dominated by managers, professionals and technicians – the premium increased between the 40th and 80th quantiles over the 2001–2011 period, and this is in line with a high demand for these occupations in the period. Increasing skills intensity thus appears to be matched by rising wages for higher skilled tasks.

Second, for both the automated and on-site categories, there have been declines in the wage premia over time. For those in jobs with automated components, the decline was particularly large in the middle of the wage distribution (between the 30th and 80th quantiles), with positive premia turning

negative above the 70th quantile. Similarly in jobs that have an on-site component returns have fallen over the period for those above the 40th quantile. The stability of wages at the bottom of the distribution may be due to the introduction and extension of minimum wages for workers in several low-earning sectors, including domestic workers and farmworkers. Thus, the declining wage premia for those in automated jobs appears to support the hypothesis that technological change and globalisation has led to a decrease in the demand for jobs consisting of tasks that can be automated or are at risk due to international competition.

Third, jobs with a face-to-face component saw increasing returns over the period. This movement is also in line with the international literature which suggests that jobs in this task category face lower risks from international competition and offshoring.

6 CONCLUSION

This report examined broad labour market trends in South Africa with a focus on the nature of employment growth and the resulting impact on wages. Overall, employment growth over the 2001–2012 period was mostly as a result of employment growth between 2001 and 2007. We found that employment gains made during the mid-2000s were completely decimated by the recession with employment at the end of 2010 returning to levels last seen in 2006, though employment levels have since begun to recover somewhat. Thus, the recession had a severe and lasting impact on employment levels in the economy.

Furthermore, there are several other markers of employment growth in the period: first, employment within the primary sectors collapsed in the period with agriculture and mining together losing over 700 000 jobs, resulting in large scale employment losses among the lower skilled.¹⁸

Second, the manufacturing sector did not witness any increase in employment in the period. In terms of production and exports then, South Africa remains a resource-based economy with no significant globally competitive light manufacturing sector and this is a key concern. The emergence of labour-abundant countries like China and India has squeezed emerging countries like South Africa out of low-skilled exports while skills constraints in the South African economy pose a challenge as far as development of more sophisticated manufacturing industries is concerned. Exports in South Africa are, as a result, typically unsophisticated and concentrated mainly in resource-based products, with little movement towards a significant amount of higher technology production and exports (DPRU 2012). A globally competitive light manufacturing sector in South Africa could provide a possible growth engine.

Third, growth has mainly been created within tertiary sectors such as financial services and community services. The increase in financial services employment has largely been within the business activities (NEC) sub-sector, which may reflect labour brokering employment. In turn, public sector employment has grown faster than private sector employment with the public sector accounting for 15% of total employment in 2012. However, growing employment within the public sector has its limits, since increasing public sector employment is not seen to be an efficient or effective way to increase employment in the South African economy (IMF 2012).

Fourth, as a result of employment growth being driven mainly by the tertiary sectors in the period, high- and medium-skilled occupations such as managers, professionals and service and sales workers have seen significant employment gains. In turn, craft and trade workers, and operators and assemblers experienced no significant employment growth, and the economy experienced a declining proportion of medium-skilled workers in the primary and secondary sectors. The relative demand for occupation groups from the Katz and Murphy decompositions match well with the findings above, and furthermore show that within-sector shifts dominate over between-sector shifts in explaining the profile of relative demand. This supports the claim that technological changes, among other factors, have played an important role in employment trends.

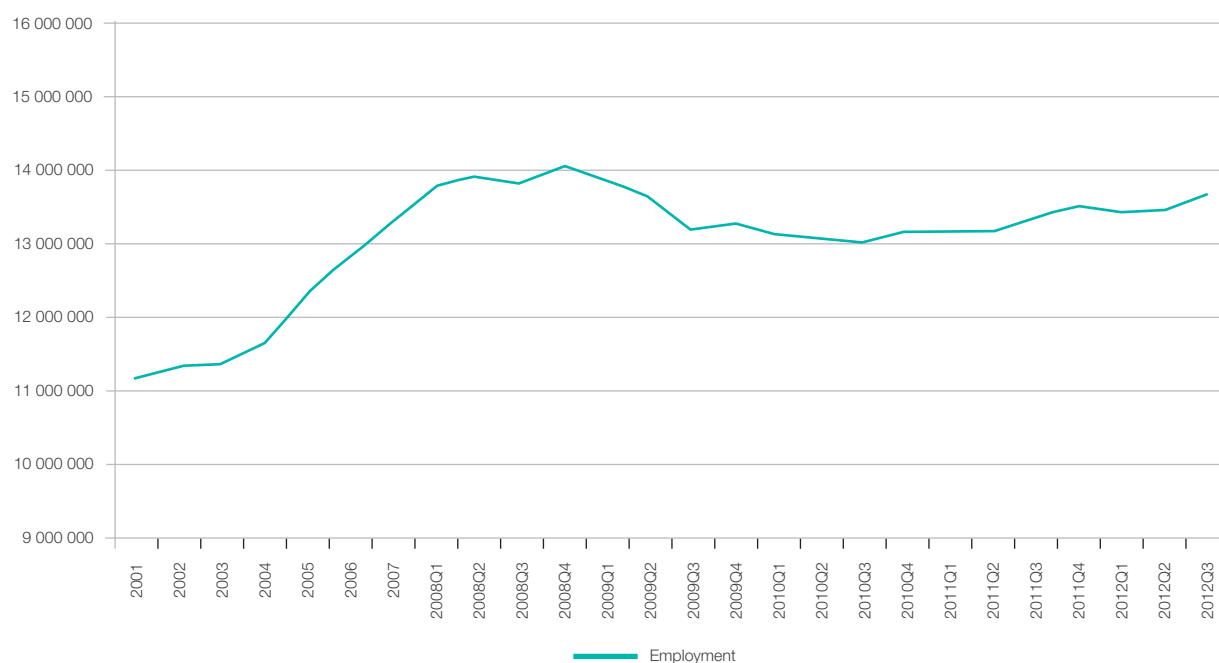
Thus, global competition, increasing capital intensity, the shrinkage of primary sector employment as well as technological change have all resulted in increasing skills intensity in the South African labour market. We would expect these changes to be associated with increasing wage premia for higher-

skilled workers, as well as declining wage premia for workers in jobs that are affected by global competition and technological change. The quantile regression results show that – when controlling for age/experience, race and education – jobs that involve automated or routine tasks and those with an on-site component (largely lower- to medium-skilled jobs) have experienced a drop in wage levels over time across most of the income distribution. Thus, wage premia to occupational tasks appear to be influenced by structural changes such as technology and international competition.

Importantly too, at the bottom of the wage distribution, wages in the on-site category rose slightly. This group consists of domestic workers, elementary workers, operators and assemblers and also a significant number of clerks, service workers and craft workers. The stability of wages for those at the bottom of the wage distribution may thus, in part, be due to the extension of minimum wages to several low-paid sectors, including domestic workers and farmworkers.

APPENDICES

Appendix 1: Employment in the South African economy, 2001–2012Q3



Source: StatsSA (LFS 2001–2007 and QLFS 2008–2012), authors' calculations

Appendix 2: Decoding the business activities of the NEC sub-sector of financial services: 2001–2012

	2001	2012	2001	2012	Growth (2001–2012)	
	Number		Share		Number	Percent
Monetary intermediation	150 007	122 584	14.5%	6.7%	-27 423	-18.3%
Insurance and pension funding, except compulsory social security	107 853	109 438	10.4%	6.0%	1 585	1.5%
Legal, accounting, bookkeeping and auditing activities ¹⁹	116 861	155 932	11.3%	8.6%	39 071	33.4%
Business activities NEC ²⁰	398 022	900 863	38.4%	49.6%	502 841	126.3%
Other	262 526	528 560	25.4%	29.1%	266 034	101.3%
Total financial services	1 035 269	1 817 377	100.0%	100.0%	782 108	75.5%

Source: StatsSA (LFS 2001 and QLFS 2012), authors' calculations

Note:

1. We were unable to ascertain whether the changes in employment of the sub-sectors within the financial services sector were significant.

Appendix 3: Occupation changes within financial and business activities: 2001–2012

	Financial services			
	Business activities		Other	
	No. change	Share of change	No. change	Share of change
Managers	6 297	1.3%	84 135	30.1%
Professionals	20 150	4.0%	140 751	50.4%
Technicians	20 938	4.2%	8 988	3.2%
Clerks	35 274	7.0%	-49 791	-17.8%
Service and sales workers	229 930	45.7%	21 706	7.8%
Skilled agricultural workers	-19 405	-3.9%	0	0.0%
Craft and trade workers	7 402	1.5%	35 197	12.6%
Operators and assemblers	17 429	3.5%	9 589	3.4%
Elementary workers	185 266	36.8%	28 689	10.3%
Total	502 841	100.0%	279 267	100.0%

Source: StatsSA (LFS 2001 and QLFS 2012), authors' calculations

Note:

1. We were unable to ascertain whether the changes in employment of the occupation groups within the business activities NEC sub-sector of financial services were significant.

Appendix 4: Occupation increases by sector: 2001–2012

	Manager	Professional	Clerk	Service and sales	Skilled agriculture and fishing	Craft and trade	Operator and assembler	Elementary	Domestic	Total
Agriculture	2%	1%	-2%	1%	84%	-1%	-279%	-38%	0%	-21%
Mining	-1%	2%	-5%	-1%	0%	-82%	-417%	4%	0%	-8%
Manufacturing	8%	6%	0%	2%	0%	-32%	-10%	12%	0%	4%
Electricity	-1%	2%	0%	-1%	0%	3%	-16%	1%	0%	0%
Construction	12%	6%	9%	0%	0%	109%	45%	28%	0%	17%
Trade	27%	9%	49%	7%	0%	56%	61%	9%	0%	21%
Transport	7%	5%	6%	1%	0%	-1%	528%	11%	0%	12%
Financial services	19%	29%	-5%	40%	6%	34%	104%	41%	0%	31%
Business activities	1%	6%	12%	37%	6%	6%	67%	36%	0%	20%
Other	18%	22%	-17%	3%	0%	28%	37%	6%	0%	11%
Community services	25%	41%	52%	52%	9%	14%	88%	32%	0%	42%
Private	0%	0%	0%	0%	0%	0%	0%	0%	100%	4%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Source: StatsSA (LFS 2001 and QLFS 2012), authors' calculations

Appendix 5: Task category correlation matrix: 2001 & 2011

	2001				
	Analytic	ICT	Automated	Face-to-face	On-site
Analytic	1				
ICT	0.1058	1			
Automated	-0.0354	0.2139	1		
Face-to-face	0.4189	-0.0369	0.0058	1	
On-site	-0.0523	-0.052	0.4103	0.1564	1

	2011				
	Analytic	ICT	Automated	Face-to-face	On-site
Analytic	1				
ICT	0.1117	1			
Automated	0.0312	0.2547	1		
Face-to-face	0.414	-0.0301	0.0316	1	
On-site	0.0346	-0.0425	0.4115	0.1392	1

Source: StatsSA (LFS 2001 and QLFS 2011), authors' calculations

Appendix 6: Log monthly wages, by industry and task category: 2001, 2007 & 2011

2001					
	ICT	Automated	Face-to-face	On-site	Analytic
Agriculture	7.66	5.87	7.45	5.92	8.21
Mining	8.28	7.56	8.60	7.56	9.18
Manufacturing	8.35	7.23	8.25	7.40	8.34
Utilities	8.20	7.71	8.20	7.75	8.60
Construction	7.86	7.03	8.15	6.83	8.69
Trade	7.96	7.07	6.57	6.47	7.86
Transport	8.28	7.78	8.00	7.65	8.39
Financial services	8.27	7.92	7.91	7.24	8.70
Community services	8.18	7.78	7.90	7.50	8.18
Domestic	n/a	n/a	5.98	5.93	n/a
2007					
	ICT	Automated	Face-to-face	On-site	Analytic
Agriculture	7.57	6.47	7.81	6.27	8.25
Mining	8.26	7.79	8.65	7.78	8.72
Manufacturing	8.27	7.30	8.36	7.39	8.55
Utilities	8.05	8.13	8.45	7.86	8.96
Construction	7.90	6.92	8.59	6.91	8.69
Trade	7.90	7.07	6.84	6.80	7.82
Transport	8.59	7.87	7.88	7.55	8.46
Financial services	8.52	7.94	7.81	7.29	8.86
Community services	8.02	7.72	7.95	7.35	8.26
Domestic	n/a	n/a	6.38	6.29	n/a
2011					
	ICT	Automated	Face-to-face	On-site	Analytic
Agriculture	8.49	7.36	7.19	7.76	8.09
Mining	8.29	8.38	8.01	8.48	9.08
Manufacturing	8.43	7.66	8.11	8.01	8.66
Utilities	8.17	8.43	8.09	8.40	8.91
Construction	8.66	7.42	8.57	7.30	9.02
Trade	8.33	8.91	8.56	8.36	7.83
Transport	8.32	7.94	8.04	8.67	8.41
Financial services	8.76	8.72	8.28	8.29	8.87
Community services	8.22	8.57	7.88	8.78	8.38
Domestic	n/a	n/a	6.49	8.02	n/a

Source: StatsSA (LFS 2001 & 2007 and QLFS 2011), authors' calculations

Appendix 7: Quantile regressions, select quantiles: 2001 & 2011

	2001			2011		
	q10	q50	q90	q10	q50	q90
White	0.714*** (0.0910)	0.864*** (0.0234)	0.733*** (0.0154)	0.529*** (0.115)	0.721*** (0.0121)	0.626*** (0.0167)
Coloured	0.647*** (0.0897)	0.304*** (0.0135)	0.173*** (0.0152)	0.693*** (0.0674)	0.262*** (0.0111)	0.145*** (0.0130)
Asian	0.599*** (0.175)	0.600*** (0.0292)	0.442*** (0.0179)	0.961*** (0.212)	0.567*** (0.0229)	0.498*** (0.0506)
High school	0.254*** (0.0529)	0.796*** (0.0148)	0.681*** (0.0127)	0.277*** (0.0613)	0.595*** (0.00891)	0.585*** (0.0115)
Higher education	0.910*** (0.117)	1.216*** (0.0281)	1.042*** (0.0206)	0.878*** (0.0874)	1.361*** (0.0167)	1.069*** (0.0199)
Experience 15 years	0.477*** (0.0488)	0.512*** (0.0196)	0.405*** (0.0186)	0.478*** (0.0730)	0.292*** (0.0129)	0.302*** (0.0140)
Experience 25 years	0.613*** (0.0785)	0.713*** (0.0170)	0.577*** (0.0240)	0.503*** (0.0945)	0.409*** (0.0100)	0.491*** (0.0198)
Experience 35 years	0.444*** (0.0530)	0.688*** (0.0166)	0.614*** (0.0179)	0.277*** (0.0779)	0.465*** (0.0158)	0.596*** (0.0184)
Experience 45+	-0.135 (0.104)	0.309*** (0.0587)	0.476*** (0.0455)	0.185* (0.104)	0.227*** (0.0431)	0.537*** (0.0466)
ICT	-0.0351 (0.328)	0.0815*** (0.0249)	0.000247 (0.0254)	0.501** (0.196)	0.108*** (0.0186)	-0.0307 (0.0259)
Automated	-0.298*** (0.0618)	-0.0269** (0.0137)	-0.0364** (0.0154)	-0.707*** (0.0503)	-0.148*** (0.0125)	-0.0967*** (0.0120)
No face-to-face	0.374*** (0.0591)	0.510*** (0.0152)	0.471*** (0.0132)	0.373*** (0.0859)	0.455*** (0.0101)	0.527*** (0.0137)
No on-site	0.161** (0.0643)	0.292*** (0.0122)	0.291*** (0.0153)	0.317*** (0.0736)	0.325*** (0.0140)	0.297*** (0.0191)
No analytic	-0.522*** (0.0804)	-0.832*** (0.0136)	-0.660*** (0.0186)	0.0237 (0.103)	-0.507*** (0.0142)	-0.557*** (0.0152)
Constant	3.598*** (0.104)	6.126*** (0.0183)	7.223*** (0.0323)	3.467*** (0.116)	6.593*** (0.0202)	7.547*** (0.0268)
Observations	51 309	51 309	51 309	49 335	49 335	49 335
Pseudo R squared	0.2294	0.3302	0.3245	0.2282	0.2879	0.3095

Source: StatsSA (LFS 2001 and QLFS 2011), authors' calculations

Notes:

1. The data are weighted using 2001 Census weights.
2. Standard errors are in parentheses.
3. The dependent variable is log of monthly wages.
4. *** – significant at the 1% level.
5. The sample includes all those between 15 and 65 who are employed and have non-missing wage data.
6. The reference variable for race is African, and we used splines for education and experience.
7. The use of 'No face-to-face', 'No on-site', 'No analytic' follows Firpo et al. (2011).

ENDNOTES

1. More specifically, the QLFS takes a much more stringent approach to identifying discouraged workseekers than the LFS. As a result of this, the number of discouraged workseekers declines dramatically in the QLFS compared to the LFS, and the number of broadly unemployed and the broad unemployment rate is also lower in the QLFS (Yu 2013).
2. Specifically, we transformed bracket responses into point responses by random allocation to a uniform distribution within the bracket to maintain variation.
3. See the figure in Appendix 1 for more annual employment data for the 2001–2012 period.
4. The broad definition of the labour force includes discouraged workseekers, while the narrow/official definition excludes discouraged workseekers.
5. We discuss only the narrow labour force participation rate, since the broad rates are not comparable between the LFS and QLFS as a result of the QLFS adopting a much more stringent definition of discouraged workseekers.
6. The size of the bubbles indicate the share of that sector's employment in total employment in 2001.
7. We note that employment numbers for the mining industry from the household surveys (LFS and QLFS) are lower than numbers from firm-based data. Furthermore, the underestimation of employment within the mining and quarrying sector in the QLFS relative to the firm-based data is substantially larger than in the LFS compared to firm-based data. The QLFS thus seems less able to capture mining employment than the LFS (DPRU 2013).
8. In this figure and the rest of the report, we use shortened names for the sectors. The sectors' full names are as follows: Agriculture, Hunting, Forestry and Fishing; Mining and Quarrying; Manufacturing; Electricity, Gas and Water Supply; Construction; Wholesale and Retail Trade; Transport, Storage and Communication; Financial Intermediation, Insurance, Real Estate and Business Services; Community, Social and Personal Services; and Private Households, Extraterritorial Organisations, Representatives of Foreign Governments and other Activities not adequately defined.
9. We refer to this sub-sector simply as the business activities sector in the rest of the paper.
10. More specifically, the business activities NEC sub-sector of the financial services sector includes the following: labour recruitment and provision of staff; activities of employment agencies and recruiting organisations; hiring out of workers (labour brokering); disinfecting and exterminating activities in buildings; investigation and security activities; building and industrial plant cleaning activities; photographic activities; packaging activities; credit rating agency activities; debit collecting agency activities; stenographic, duplicating, addressing, mailing list and similar activities; business brokerage; interior design; fashion design; demonstration and exhibition activities; editorial, translation and interpretation activities; telephone answering activities; agencies representing people in motion pictures and other entertainment or sports attractions; and other business activities.
11. The growth rates used in this calculation are average annual growth rates.
12. All those who indicated that they work for the central government, provincial government or local government are regarded as falling within the public sector.
13. See Appendix 2 for the full table.
14. The helpers and cleaners occupation category includes helpers and cleaners in offices, hotels and other establishments.
15. For example, if a person is employed through a labour broker on a construction site or in a mine, it is likely that the person would report their sector of employment as construction or mining, rather than financial and business services.
16. Rodrik (2006) also considers whether rising wage costs may have contributed to the decline in the sector, but finds that once real remuneration is decomposed into a skills upgrading and a residual component, it can be found that the residual skills-adjusted remuneration fell in the 1990s relative to the 1980s, thus making it unlikely that rising wage costs were responsible for the decline in manufacturing from the 1990s onwards.
17. Light manufacturing includes food processing and beverages, garments, leather products, metal products and wood products (World Bank 2012).
18. We note though that employment numbers for the mining industry using household survey data are lower than employment numbers for the industry using firm-based data (see DPRU 2013).
19. The legal, accounting, bookkeeping and auditing activities sub-sector includes the following: legal, accounting, bookkeeping and auditing activities; tax consultancy; market research and public opinion research; business and management consultancy.
20. The business activities N.E.C. sub-sector of the financial services sector includes the following: labour recruitment and provision of staff; activities of employment agencies and recruiting organizations; hiring out of workers (labour brokering); disinfecting and exterminating activities in buildings; investigation and security activities; building and industrial plant cleaning activities; photographic activities; packaging activities; credit rating agency activities; debit collecting agency activities; stenographic, duplicating, addressing, mailing list and similar activities; business brokerage; interior design; fashion design; demonstration and exhibition activities; editorial, translation and interpretation activities; telephone answering activities; agencies representing people in motion pictures and other entertainment or sports attractions; and other business activities.

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LABOUR MARKET
INTELLIGENCE PARTNERSHIP

Occupational Shift and Shortages: Skills Challenges Facing the South African Economy

This report examines labour market trends in South Africa, focussing on the nature of sectoral and occupational employment growth trends, and their impact on wages. Unemployment has been a constant feature of South Africa's economy. The mismatch between high-skilled demand and an over-supply of low-skilled workers has been exacerbated by deepening capital intensity, and the historical shift away from the primary sector towards the secondary and tertiary sectors. The result is an intensification of a skills-biased labour demand trajectory.

Katz and Murphy's decomposition technique is used to interrogate whether between-sector or within-sector forces play a greater role in the labour demand for workers in different occupations. The analysis highlights the changing returns to occupational tasks, by exploring the way that different tasks are likely to be affected by internal (technological change) or external (international trade or competition) factors.

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The Labour Market Intelligence Partnership (LMIP) is a collaboration between the Department of Higher Education and Training, and a Human Sciences Research Council-led national research consortium. It aims to provide research to support the development of a credible institutional mechanism for skills planning in South Africa. For further information and resources on skills planning and the South African post-school sector and labour market, visit <http://www.lmip.org.za>

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