

How Much Labor do South African Exports Contain?

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Abstract: Like many emerging economies, South Africa has identified exports as an engine for more inclusive, job-intensive growth to combat unemployment. Yet there has been much debate over the employment impact of international trade for South Africa, which is concentrated in minerals and other commodities. This paper uses a newly developed World Bank database—the Labor Content of Exports—with South African Labor Force Survey data to measure how trade has supported jobs and wages between 2001 and 2011. It shows that minerals exports, which propelled export growth as well as export earnings, are not job intensive and as a result supported minimal job growth. Minerals have also increasingly become an enclave sector with few backward linkages to the domestic economy. The labor impact of manufacturing exports, on the other hand, is felt primarily in input-providing sectors, where indirect manufacturing employment is nearly 4.5 times greater than direct manufacturing employment. Labor in services sectors absorbed more than half of the growth in wage income from exports over the 2000s, primarily by supplying inputs to other sectors' exports. In GVC-intensive manufacturing sectors, the paper documents a shift in the labor content away from direct manufacturing to indirect services, which has been biased towards skilled labor. The analysis confirms the importance of taking a sectoral perspective and distinguishing between the direct and indirect contributions when analyzing the impact of exports on labor.

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1. Introduction

Export growth can be a powerful avenue to increase employment and earnings, both directly within exporting firms and indirectly through these firms' demand for goods and services from the broader domestic economy. The extent to which exports support domestic labor depends on several factors, including the labor-intensity of export sectors and the linkages of exporting firms to domestic, input-supplying firms. Differences in the skills-intensity across sectors can also mean distributional implications of export growth. Surprisingly, though, only a scant literature provides empirical support that the composition of exports matters for their labor impacts, as opposed to the more prominent literature on the nexus between the sectoral composition of exports and economic growth, or between import liberalization and labor impacts. For example, the boom in exports to the United States following the US–Vietnam Bilateral Trade Agreement of 2001 was particularly beneficial to wages of unskilled workers, reduced the skill premium, and was a key driver of poverty reduction in Vietnam because it was concentrated in unskilled, labor-intensive manufacturing sectors, most notably textiles (Fukase 2013, McCaig 2011).² At the other end of the spectrum, commodity exports are often concentrated in capital-intensive sectors that pay high wages but with few linkages to the rest of the economy and typically support relatively small levels of domestic employment (Berry 2008). The paucity of this literature is surprising, given that many countries' industrial policy is predicted on the basis that promotion of exports supports employment and wage growth.

A case in point is South Africa, which liberalized trade and promoted exports with this view (Behar 2010a, Edwards et al. 2008). The results, however, have been mixed. Trade liberalization and other domestic reforms during the 1990s preceded a significant expansion in exports, which also rose as a share of production and consumption. Employment growth remained poor, and greater inequality accompanied an increasing skill and capital intensity of production (Bhorat and van der Westhuizen 2012, Edwards and Behar 2005, Thurlow 2006). This phenomenon of export-led “jobless growth” stimulated considerable research on the impact of trade on labor and inequality in South Africa, with the results largely inconclusive. Some studies found that trade liberalization negatively affected employment, specifically in manufacturing; others that skill-biased technology change was behind low employment growth and rising inequality and that the impact of trade on labor was small; and others that trade-induced growth changed the structure of production, contributing to technological change, a higher skill intensity of production and increased inequality (Edwards 2004, Edwards 2001, Jenkins 2008, Edwards and Behr 2005, Thurlow 2006, Pauw et al. 2007). South Africa has since identified export growth coupled with export diversification—by improving non-traditional export performance, particularly in more sophisticated, value-added products—as an engine for faster, job-intensive growth to combat unemployment (World Bank 2014). Continued efforts to uncover the impact of trade on labor in South Africa and the factors behind this ‘jobless growth’ are therefore needed to better understand the possible role that expanding exports in traditional versus non-traditional export sectors can play for job creation.

In this paper we measure how South Africa's exports supported jobs and wages over the last decade, and document export-led, ‘jobless growth’. Between 2001 and 2011, the total number of jobs supported by South Africa's exports declined from 3.0 million to 2.9 million, despite strong growth in exports (10.3%

² In addition, changes in labor earnings—rather than in demographic trends, public transfers, or remittances—have been the main source of poverty reduction in developing countries that achieved dramatic declines in poverty over the last decade (Azevedo et al. 2013).

annually) as well as the wages paid to produce exports (7.9% annually). We show that the composition of South Africa's exports is partly behind these trends: minerals exports, which propelled export growth as well as wage growth, are not job intensive and as a result supported significantly less job growth. We also show that export composition matters for the impact on labor: while minerals have increasingly become an enclave sector with few backward linkages to the domestic economy, the labor impact of manufacturing exports in South Africa is increasingly felt in input-providing sectors, particularly services sectors, which had distributional implications for skilled labor.

Our analysis is enabled by a newly developed World Bank database—The Labor Content of Exports (LACEX) (Cali et al. 2016)—that measures the contribution of labor to a given country's domestic production and exports, measured as employees' compensation (wages) or the number of jobs. Using input-output tables, exports and production data from the Global Trade Analysis Project (GTAP) and employment data from the International Labour Organization (ILO), the LACEX database represents a methodological innovation for developing countries. We consider aggregate exports as well as sectoral exports for South Africa and compare them to other emerging and middle-income countries and the other BRIC (Brazil, Russia, India and China) in particular. We also consider how exports contribute to labor market outcomes separately through their direct and indirect linkages (including both forward and backward linkages), and distinguish between skilled and unskilled labor. By considering the fuller labor implications of exports for the economy, our data allows us to evaluate the extent to which traditional versus non-traditional exports indeed support incomes and jobs.

The paper has three key findings. First, the sectoral composition as well as the labor intensity of exports in South Africa provides a nuanced understanding of the observed export-led, 'jobless growth'. The LACEX data combined with South Africa's Labor Force Survey data suggests that much of the labor content of exports is shaped by the minerals sector. Between 2001 and 2011, minerals exports grew 22.2% annually, wages supported by minerals exports grew 24.6% annually, but jobs supported by minerals exports grew by only 3.9% annually.³ South Africa is one of the middle-income countries in the sample with the lowest number of jobs associated with exports, and the quantity of jobs and the labor value added per unit of exports has diminished overall. Decompositions show that the observed decline in the labor intensity of exports is driven by exports becoming less labor intensive (labor-intensity effect), only slightly amplified by South Africa shifting to less labor intensive exports (composition effect). While this is generally consistent with unbundling of production globally, where exports contain more foreign inputs, the data also show that exports in South Africa are becoming more capital intensive and less labor intensive: a decline in the share of total labor value added in gross exports has been accompanied by an increase in the share of capital value added in gross exports.⁴

Second, our findings highlight the importance of considering the indirect labor impacts of export growth through the forward and backward linkages across sectors. For example, similar to Kerr et al. (2014), our data show that direct manufacturing exports are not job-intensive and direct manufacturing (and economy-

³ Direct wages supported by minerals exports grew 33.4% annually, but direct jobs supported by minerals exports contracted by 16.8% annually.

⁴ These findings are consistent with the labor-saving technology changing across countries (see, for example, Kumar and Russell (2002) and Berman (2000)). Behar (2010a) shows that the elasticity of substitution between capital and labor has been negative in South Africa, also supporting our finding of a substitution away from labor toward capital for production.

wide) jobs have been declining. But manufacturing becomes labor-intensive once taking into account its backward linkages to input-providing sectors. In fact, manufacturing employs about two thirds of export-oriented workers in South Africa. However, more than three quarters of these jobs were in sectors providing inputs into manufacturing, up from two thirds in 2001. In contrast, in 2011 the indirect wages represented only one third of all wages supported by minerals exports, compared to two thirds in 2001. This confirms that South Africa's commodities exports are increasingly an enclave sector, where most of the labor value added is generated directly within the sector with little backward linkages with the rest of the economy. The increasing importance of indirect jobs and wages in South Africa has instead been felt in the services sectors. Services sectors absorbed 55% of the growth in labor income from exports over the 2000s, of which four fifths was through forward linkages.⁵ This confirms other literature that services' contribution to exports is primarily through forward linkages (Francois et al. 2015). This high percentage is consistent with the fact that more than half of the additional labor value added in South Africa over the 2000s has been indirect.

Third, the increasing importance of indirect jobs and wages in South Africa, coupled with differences in the skills-intensity across sectors, appears to have had distributional implications through skills demand. We focus in on the labor impact of non-resource intensive manufacturing exports, particularly in sophisticated, value-added products traditionally governed in GVCs, to examine what growth in non-traditional export sectors could mean for labor outcomes. A case in point is the automotive sector, a value chain that South Africa became increasingly integrated in over the 2000s, which enabled rapid growth of South African motor vehicle exports (Engel 2015). Consistent with an increasing import content of exports, a key feature of GVC participation, the labor intensity of automotive exports declined. But export growth propelled a significant increase in the wages supported by automotive exports, almost trebling between 2001 and 2011. Although direct wages paid in the automotive sector increased modestly between 2001 and 2011 (3.6% per year), wage growth from motor vehicle exports happened mainly in upstream input sectors, especially services sectors, due to extensive backward links to the domestic economy (15.4% per year). The substitution of direct manufacturing jobs to indirect services jobs in the motor vehicle GVC has been biased towards skilled labor, suggesting skilled job creation may have happened in the services sector through backward linkages (as services are relatively more skilled intensive). This trends contrasts a declining skills intensity of exports in aggregate (though South Africa maintains one of the largest skills ratio relative to peer countries).

This paper is related more broadly to the literature on the labor impact of exports. Other recent efforts to quantify the labor and jobs content of exports across countries tend to focus on high-income economies (Timmer et al. 2013, Jiang and Milberg 2013, Stone et al. 2011). A burgeoning literature on the impact of export shocks on conflict also provides empirical support for a differential effect of export shocks across sectors depending on their relative labor intensity (Dube and Vargas 2013, Berman and Couttenier 2015). A positive shock to labor-intensive sectors increases the opportunity cost of conflict because it benefits mainly laborers, while the opposite is true for extractive sectors, which do not have much impact on wages. There has also been an attempt to estimate the sectoral labor effects of the trade contraction following the 2008 global crisis using social accounting matrices in a Leontief multiplier model, specifically in South

⁵ Obinyeluaku and Sako (2014) find that in South Africa the elasticity of employment with respect to real output in the services sector appears to be greater than that of manufacturing. One explanation for the rising share of employment in the service sector is that manufacturing industries increasingly outsource their services activities to firms specialized in the provision of such services. These results are consistent with those of this paper.

Africa and India (Kucera et al. 2012). The industry-level changes in exports on industry-level changes in employment was mediated by its indirect and income-induced effects as well as differences in labor-intensity of production across sectors. Los et al. (2015) also use input-output analysis to show that the composition of export growth mattered for job growth and ultimately structural transformation in China.

The remainder of this paper proceeds as follows. Section 2 briefly describes the World Bank database on the labor content of exports and the methodology to measure the wages and jobs content. Section 3 presents the findings of labor and jobs content of aggregate production and exports in South Africa relative to peer countries. To control for compositional effects, Section 4 presents these results at the sectoral level first in South Africa and second relative to peer countries. Section 5 narrows the focus even further to GVC-oriented sectors to understand how changes in labor content relate to changes in GVC-participation in South Africa. Section 6 concludes with policy implications.

2. Data

The main data we use in the analysis is the newly developed World Bank Labor Content of Exports (LACEX) database. The database encompasses information on the contribution of labor to a given country's domestic production and exports, measured as employees' compensation (wages) or the number of jobs. The LACEX database has been computed by Cali et al. (2016) on the basis of a panel of global input-output tables and other aggregate data spanning intermittent years from 1995 to 2011 from GTAP and employment data from ILO.⁶ The input-output tables in the GTAP dataset allow one to exploit a form of social accounting data—a variation on the social accounting matrix (SAM) where incomes are shown in the rows of the SAM and expenditures are shown in the columns (see Hertel (2013) and McDougal (2001)). The structure of the underlying social accounting data provides a comprehensive and consistent record of national income accounting relationships between different sectors, including intermediate and final demand linkages. These are used to construct country-specific measures of the contribution of labor to the value added contained in a given country's domestic production and exports.⁷ The resulting dataset covers 24 sectors (6 services sectors, 3 primary sectors and 15 manufacturing sectors), over 100 countries, and intermittent years between 1995 and 2011. As such, the data allows to examine the labor content of South Africa's exports at the aggregate and sectoral levels, including exports associated to trade traditionally governed within GVCs.

Specifically, in order to obtain these labor value added measures, two intermediate multiplier matrixes need to be calculated from the social accounting and other aggregate data. The first is the Leontief inverse matrix, which measures the inputs contained in a unit of final output, and includes both direct and indirect inputs across all sectors of the economy. The second is a diagonal matrix with elements equal to the compensation of employees' shares of the sector's total output. Using these two intermediate matrixes as multipliers of a diagonal matrix with elements equal to either the sector's domestic production or exports, one can obtain

⁶ GTAP represents a massive combined effort of international institutions and universities. Over time, the dataset has grown to include more countries and more sectors. The latest version, GTAP 9, has data on 129 countries/regions and 57 sectors (Narayanan 2012). To maintain backward compatibility, Cali et al. (2016) start with the 1997 structure of regions and sectors, and carry this forward in aggregation of more recent iterations of the dataset. The GTAP website also provides extensive documentation on the underlying data structure, its sources, and the GTAP model structure for each release (www.gtap.org).

⁷ In the remainder of the paper we refer interchangeably to total labor value added content, wages and compensation to employees.

the compensation of employees' shares of final outputs or exports. Appendix 1 provides more details and formalizes these calculations.

Using the same method, we can isolate the jobs content of exports by replacing the underlying labor value added share in production with the number of jobs contained in production, which can be derived from ILO employment data or country-specific data sources. ILO employment statistics contain data for a number of countries, including South Africa, for 11 macro sectors. In order to get a more refined sectoral disaggregation, we also match the GTAP data with employment statistics from South Africa's labor force surveys. This allows the examination of a different type of disaggregation across 16 sectors.

With this methodology we can split the *total* contribution of labor (either the labor value added or the number of jobs) to final output and exports into its *direct* and *indirect* components based on the linkages with the rest of the economy. The direct component measures the wages paid or number of jobs a sector uses to produce its own output or exports directly. The indirect component measures the wages paid or number of jobs a sector contributes to other sectors' output or exports—if measured by forward linkages—or the wages paid or number of jobs a sector uses from other sectors to produce its output or exports—if measured by backward linkages. *Forward linkages* are the indirect contribution of a sector when considering the contribution of that particular sector as an input to other sectors' domestic production or exports. This treats the particular sector as an upstream activity, and measures how much labor a particular sector is used by all other sectors. *Backward linkages* are the indirect contribution of a sector when considering the contribution of all other sectors to that particular sector's value added. This treats the particular sectors as a downstream activity, and measures how much labor a particular sector uses from all other sectors. These contributions can be further split between skilled and unskilled employees. As such, the paper can consider not only the wages paid and jobs employed directly within export sectors, but also the linkages with the rest of the economy that South Africa's exports support. That is particularly important for a large middle-income economy like South Africa, where such indirect linkages are typically more important.

The labor value added of exports is measured as nominal values in US\$ (denoted LVAX), and as a share of gross exports (LVAX share), which is a measure of the labor intensity of a country's or sector's exports. The jobs content of exports is measured as the number of jobs (denoted JobX), and relative to gross exports (JobX share), which is a measure of the job intensity of a country's or sector's exports. We also use measures of the labor value added and job content of domestic production (denoted LVAD and JobD) for comparisons.

3. Economy-wide Labor Content of Exports

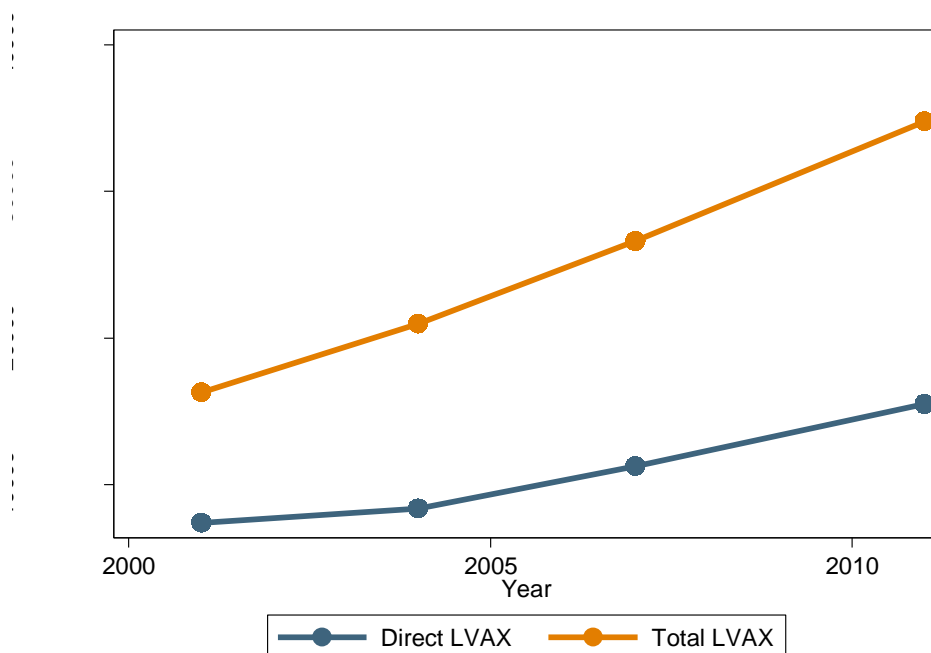
We begin our analysis of how exports support labor in South Africa by looking at aggregate trends in the total labor value added and jobs content. We measure across all sectors of the economy when looking at the country-wide labor and jobs content of exports, including services, industry and agriculture. We measure how the total labor value added and jobs content of South Africa's exports has changed since 2001, in nominal values and relative to gross exports. Without yet taking a sectoral perspective, we uncover sources of these changes by decomposing them into direct versus indirect contributions, as well as capital versus labor content of exports. We also look to see whether exports have become more or less important for wages and jobs in South Africa, relative to total domestic production as well as total employment.

a. Labor Value Added

The LACEX data show that the total labor value added contained in South Africa's exports has been growing robustly and steadily since 2001 (Figure 1). Growth in all the wages paid to produce exports including those to produce domestic inputs of exports—considering the indirect linkages—was 7.9% annually, reaching \$34.7 billion in 2011 (up from \$16.3 billion in 2001).

The labor value added supported by the indirect linkages with export activities is relatively more important and grew slightly faster than the labor value added directly supported by exports themselves. Growth in the wages paid to produce exports *directly* over the last decade was 7.7% annually in nominal terms, reaching \$15.4 billion in 2011 (up from \$7.4 billion in 2001). Growth in the wages paid to produce exports *indirectly* was 8.1% annually, reaching \$19.3 in 2011 (up from \$8.9 billion in 2001).

**Figure 1: Direct and total labor content of exports, South Africa
2001-2011**



Source: Authors' elaboration based on LACEX.

However, labor value added per unit of exports in South Africa has declined since 2001 (Figure 2 and Table A1), witnessed in both the direct and indirect LVAX shares in spite of the nominal value of both direct and indirect LVAX increasing. In 2001, each \$100 of gross exports generated \$41 of domestic wages (of which \$21 came directly from the export sector, with the remaining \$19 coming through backward linkages to the domestic economy), while by 2011 this figure had reduced to \$33 (\$16 directly and \$17 indirectly). The more pronounced decline in the direct than the indirect LVAX share is a result of the slightly higher growth and greater importance of the indirect labor value added in South Africa's exports.

This \$33 is well below that of China, which has greatly increased its domestic labor per unit of exports, and Brazil. The labor intensity of South Africa's exports is in line with India, which has also followed a similar

trajectory to that of South Africa.⁸ The only BRIC country with a labor share in gross exports below that of South Africa is Russia, an oil and gas dependent exporter. South Africa's labor share has also fallen below the world average of \$36. On the other hand, South Africa registers a higher labor content than other middle-income countries, including Colombia, Chile, Thailand and Turkey (Peru is an exception).⁹

Unskilled labor value added dominates in South Africa and other comparator countries, and to a larger extent than the rest of the world, although South Africa has a slightly higher share of skilled wages in gross exports than its middle-income country comparators. Table A1 splits the total labor value added share by skilled and unskilled wages. The share of skilled export wages in total export wages declined in South Africa as well as all comparator countries between 2001 and 2011, with the exception of China. Nevertheless, the skilled-unskilled labor value added ratio remains the highest in South Africa (0.3) relative to all its comparators, but below the rest of the world (0.5).

To help understand better the impact of trade on labor in South Africa, we decompose the change in the LVAX share into the actual change in the labor value added in sectoral exports of South Africa (pure labor-intensity effect) and the change in the composition of exports across industries (export-composition effect).¹⁰ We find that between 2001 and 2011 the change in the labor intensity of the exporting industry when the export composition is kept constant was negative, amounting to a decline of \$7.6 of domestic labor value added per \$100 of gross exports. The change in the export composition when the labor intensity of the exporting industries is kept constant was negligible through slightly negative, responsible for a further decrease of \$0.3 of domestic labor value added per \$100 of gross exports. Thus the observed decline in the LVAX share is driven by exports becoming less labor intensive, which has only been slightly amplified by the shift of South African exports towards less labor intensive sectors.

⁸ This pattern is in line with China's increasing export content of domestic value added due to backward linkages, as documented by inter alia Kee and Tang (2016).

⁹ Nine countries were chosen as comparators for South Africa. The first group includes the BRIC countries of Brazil, Russia, India and China. These countries are all deemed to be at a similar stage of newly advanced economic development, which South Africa has since been included with. The second group includes other emerging and middle-income countries of Colombia, Chile, Peru, Thailand and Turkey. These countries were chosen because they have achieved a similar level of economic development, economic, population size, and/or export structure as South Africa.

¹⁰ In order to disentangle the direct and indirect components, we decompose the change in the labour value added share in exports as follows. First, define L_i as total labor value added in exports (in US\$) in sector i and LS_i its ratio to gross exports ($LS_i=L_i/X_i$) with X as gross exports. The LS for the entire economy is:

$$LS_{TOT} = \frac{\sum_{i=1}^N L_i}{\sum_{i=1}^N X_i} = \sum_{j=1}^N \left[\frac{L_j}{\sum_{i=1}^N X_i} \right]$$

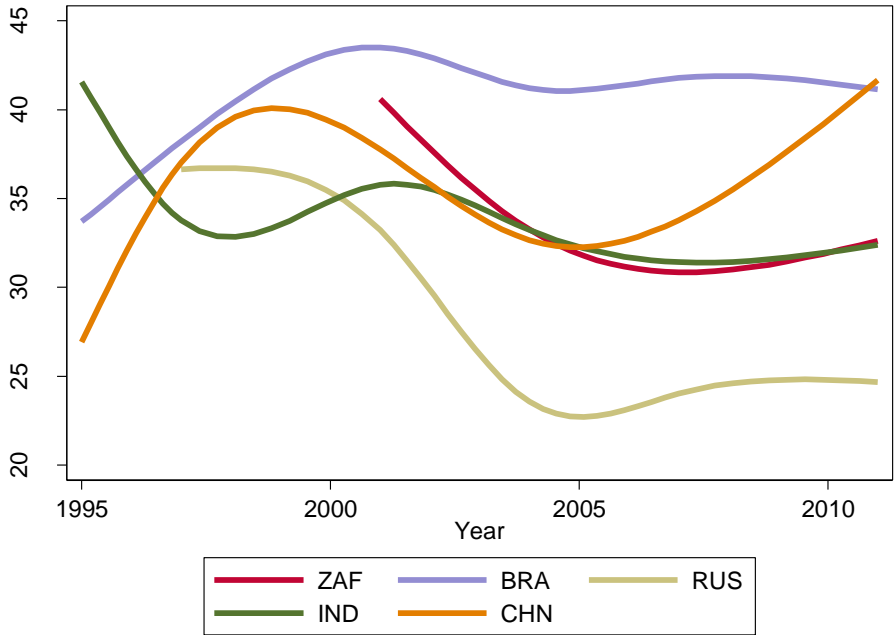
If we multiply the term in parenthesis by X_j/X_j , then we can re-write that as: $\sum_{j=1}^N \left[LS_j \frac{X_j}{\sum_{i=1}^N X_i} \right]$. Then the difference between time 0 and 1 is defined as:

$$\sum_{j=1}^N \left[LS_{1j} \frac{X_{1j}}{X_1} \right] - \sum_{j=1}^N \left[LS_{0j} \frac{X_{0j}}{X_0} \right] = \left[\sum_{j=1}^N \left[LS_{1j} \frac{X_{1j}}{X_1} \right] - \sum_{j=1}^N \left[LS_{0j} \frac{X_{1j}}{X_1} \right] \right] + \left[\sum_{j=1}^N \left[LS_{0j} \frac{X_{1j}}{X_1} \right] - \sum_{j=1}^N \left[LS_{0j} \frac{X_{0j}}{X_0} \right] \right]$$

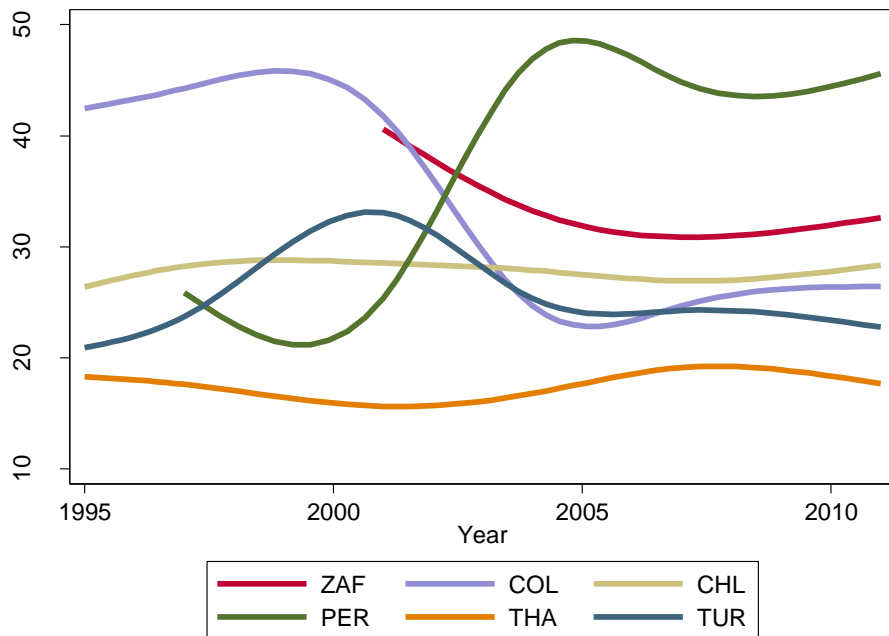
The first term is the labor intensity effect, the second term is the export composition effect.

The fall in the share of labor value added relative to gross exports is consistent with unbundling of production globally and South Africa becoming more integrated in GVCs (discussed below), where exports tend to be characterized by a greater import content.¹¹ But the data also show that exports in South Africa are becoming more capital intensive, contributing to the decline in the domestic labor value added share of gross exports. There has been a substitution away from labor to capital for domestic export production in South Africa: the decline in the share of total labor value added of exports has been accompanied by an increase in the share of domestic capital value added in gross exports. The capital content went from being lower than the labor content of exports in 2001 (35% vs. 41%) to being higher in 2011 (43% vs. 33%) (Table A2). This generalized decrease in the labor value added in sectoral exports is consistent with labor-saving technological changes across developing countries (see, for example, Kumar and Russell (2002) and Berman (2000)). Behar (2010a) shows that the elasticity of substitution between capital and labor has been negative in South Africa, supporting this finding of a substitution away from labor toward capital for production. The share of capital in South Africa’s gross exports is average among the middle-income countries of the sample, and closest to that of Brazil.

**Figure 2: Total labor content per \$100 of gross exports
1995-2011**



¹¹ These two effects are not necessarily unrelated. For example, the requirement of GVCs to meet strict quality standards often leads to increased mechanization, and the scale economies possible from accessing larger global markets may make capital investments more viable.



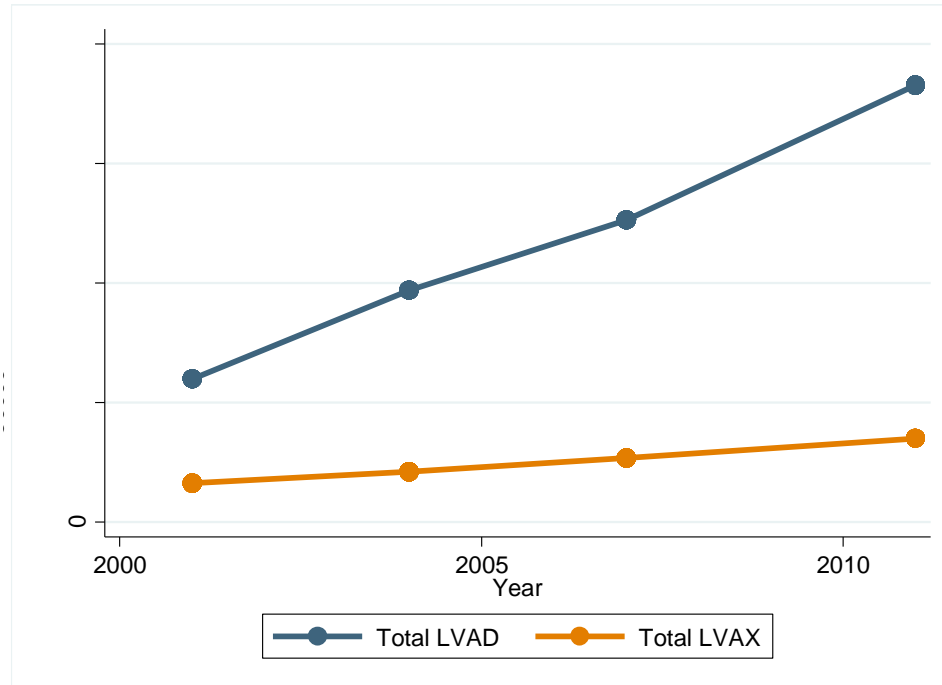
Source: Authors' elaboration based on LACEX.

Exports have become less important for wages in South Africa relative to total domestic production. Not only has the labor value added supported by exports declined relative to gross exports, it has also declined relative to total domestic labor value added (Figure 3). Growth in all the wages paid to produce final output including those to produce domestic inputs of final output—considering the linkages—was 11.8% annually, reaching \$182.9 billion in 2011 (up from \$59.7 billion in 2001). Growth in all the wages paid to produce exports was substantially lower (7.9% annually). As a result, \$19 of each \$100 of labor value added generated from total domestic production was exported in 2011, versus \$27 in 2001.

This trend in labor value added reflects a broader trend whereby non-export production has outperformed export production, and exports have declined relative to domestic production. This is consistent with a general underperformance of South Africa's exports over the past decade, which have made limited inroads into global markets and lagged behind those of peers in minerals, non-minerals and services (World Bank 2014, Matthee et al. 2016). This is also likely a by-product of Dutch Disease induced by the commodity boom and amplified by the relatively high labor content of mineral exports (discussed below), which boosts the spending effect of the commodity boom.

Nevertheless, exports continue to be more labor intensive than domestic production in South Africa, and the labor intensity has evolved similarly for both. As noted above, in 2001 each \$100 of gross exports generated \$41 of domestic wages, versus \$27 of domestic final output. By 2011, this figure had reduced to \$33 for exports and \$21 for domestic final output.

Figure 3: Total labor content of exports and domestic production, South Africa 2001-2011



Source: Authors' elaboration based on LACEX.

b. Jobs

The slower growth in the labor value added of exports compared to domestic final output is mainly due to the fact that the export sector has been slowly shedding jobs. The LACEX data combined with South Africa's Labor Force Survey data show that between 2001 and 2011, the total number of jobs supported by South Africa's exports declined from 3.0 million to 2.9 million, despite positive growth in exports (10.3% annually) as well as the wages paid to produce exports (7.9% annually). This finding confirms previous literature that exports in South Africa have not been job-creating (Chinembiri 2010, Smet 2013).

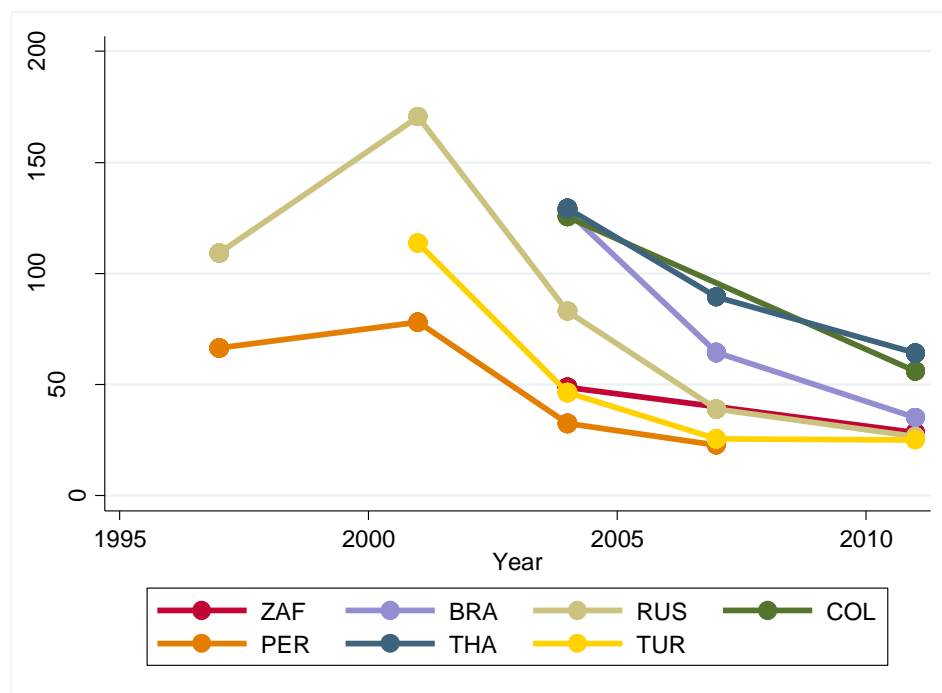
The LACEX data allows us to consider not only the direct impact of exports on jobs but the indirect impact, by considering the backward linkages with the rest of the economy that exports support. In fact, the LACEX data combined with South Africa's Labor Force Survey data highlight the importance of considering both the direct and indirect contributions for understanding how exports support jobs in South Africa: only two-in-five jobs generated by exports were generated directly in 2011. Failing to account for the indirect jobs presents only a partial view of how exports contribute to labor outcomes in South Africa and other countries throughout the world, which have become more important over time. The direct number of jobs supported by South Africa's exports declined from 1.47 million to 1.15 million between 2001 and 2011, but the indirect number of jobs increased from 1.51 million to 1.71 million. However, the increase in indirect jobs was not enough to offset the decline in direct jobs. Because export growth has been more positive for labor in input-providing sectors, studies that only consider the jobs and wages to directly produce exports will underestimate how jobs growth has accompanied export growth.

These trends have also translated into a reduction of the total number of jobs contained in \$1 million of gross exports (Figure 4 and Figure A1). South Africa moved from having 49 jobs per \$1 million exports in

2004 to 29 jobs in 2011, the result of declines in both the direct and indirect job intensity of exports.¹² While this is a sizable reduction, South Africa maintained a lower rate of job reduction per unit of gross exports than most other comparator countries. But in spite of this less-dramatic reduction, South Africa remains one of the middle income countries in the sample with the lowest number of jobs associated with \$1 million of exports—either directly or indirectly. That is explained partly by export composition, where the mining and energy sector that dominates South Africa’s exports tends to employ fewer workers per unit of gross exports than other sectors, and partly by the lower job intensity of all sectors but mining and energy (discussed below). We control for this effect by performing a similar decomposition as above, and find that the decline in both the direct and indirect job intensities between 2004 and 2011 was also the result of a job-intensity effect, rather than a composition effect.

On the other hand, South Africa has a higher share of jobs contained in exports relative to total employment than any other comparator country barred Thailand (Figure 5 and Figure A2). As a share of total employment, 8% of the workforce is employed directly by exports, and another 15% of the workforce indirectly. Yet this ratio is in decline—in 2004 more than 1 in 4 jobs were directly or indirectly supported by exports, but by 2011 this ratio was just above 1 in 5 jobs.¹³

**Figure 4: Total jobs per \$1 million of gross exports
2004-2011**

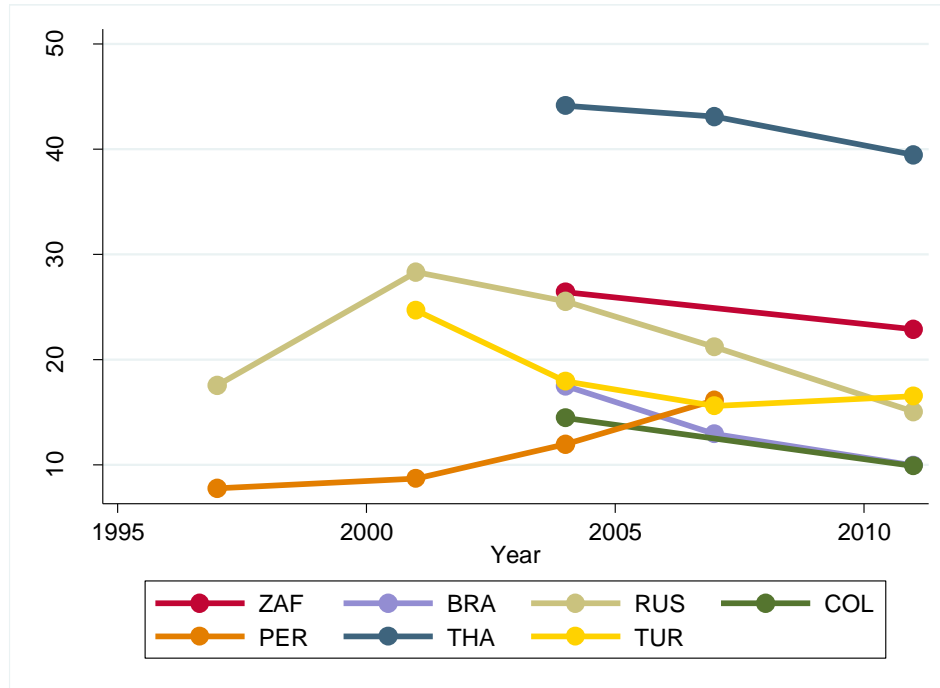


Source: Authors’ elaboration based on LACEX.

¹² The direct number of jobs per \$1 million of gross exports fell from 18.3 to 9.1 between 2004 and 2011 and the indirect number of jobs per \$1 million of gross exports also fell from 30.5 to 18.6.

¹³ The direct number of jobs contained in exports relative to total employment fell from 9.9% to 7.9% between 2001 and 2011, the indirect number of jobs contained in exports relative to total employment fell from 16.5% to 15.0%, and the total number of jobs contained in exports relative to total employment fell from 26.4% to 22.9%.

**Figure 5: Total job content of exports as a share of total employment
2004-2011**



Source: Authors' elaboration based on LACEX.

4. Labor and Jobs Content of Exports across Sectors

South Africa's leading exports are concentrated in commodities, which are technologically sophisticated and highly capital intensive. This has positive implications for competitiveness, but the direct links to employment growth and poverty reduction are questioned (World Bank 2014). By taking a sectoral perspective, we assess how the composition of South Africa's exports matters for their labor impacts, if this helps explain export-led, 'jobless growth' observed over the 2000s (Economist 2010), and what growth in non-traditional export sectors could mean for labor outcomes.

Aggregate trends mask a wide heterogeneity in the labor value added and jobs content of exports across sectors. In particular, we show how the composition of South Africa's exports drive the above aggregate results, which provides a nuanced understanding of this 'jobless', export-led growth in South Africa. We also show how commodity exports versus manufacturing and services exports support jobs and wages different, which depends on whether we consider the direct versus indirect content as well as the forward versus backward linkages.

a. Within South Africa

i. Labor Value Added

Natural resource sectors—which tend to be capital intensive—generate most of South Africa's labor value added contained in its exports. Figure 6 shows that in 2011 the leading export sectors in terms of total labor content were minerals, metals, machinery and equipment, and ferrous metals. Minerals contributed over \$6 billion in wages—or one fifth of South Africa's total labor value added contained in its exports—by far the

largest contributor to wages among export sectors. This reflects the large value of gross exports and a relatively high—and growing—labor intensity of exports vis-à-vis other sectors (discussed below). Adding energy extraction, chemical, rubber and plastic products, and other metals, these seven sectors accounted for 62% of South Africa’s total labor value added contained in its exports and 67% of gross export values.

The importance of natural resource sectors for shaping South Africa’s LVAX is even more striking when considering their growth contributions. Between 2001 and 2011, these seven capital-intensive, natural resource sectors contributed 95% of the growth in the total labor value added contained in South Africa’s exports and 71% of export growth. Minerals exports alone contributed close to half (43%) of the growth in South Africa’s LVAX, where wages supported by minerals exports grew 24.6% annually between 2001 and 2011, compared to wages supported by non-minerals exports that grew 6.2% annually.

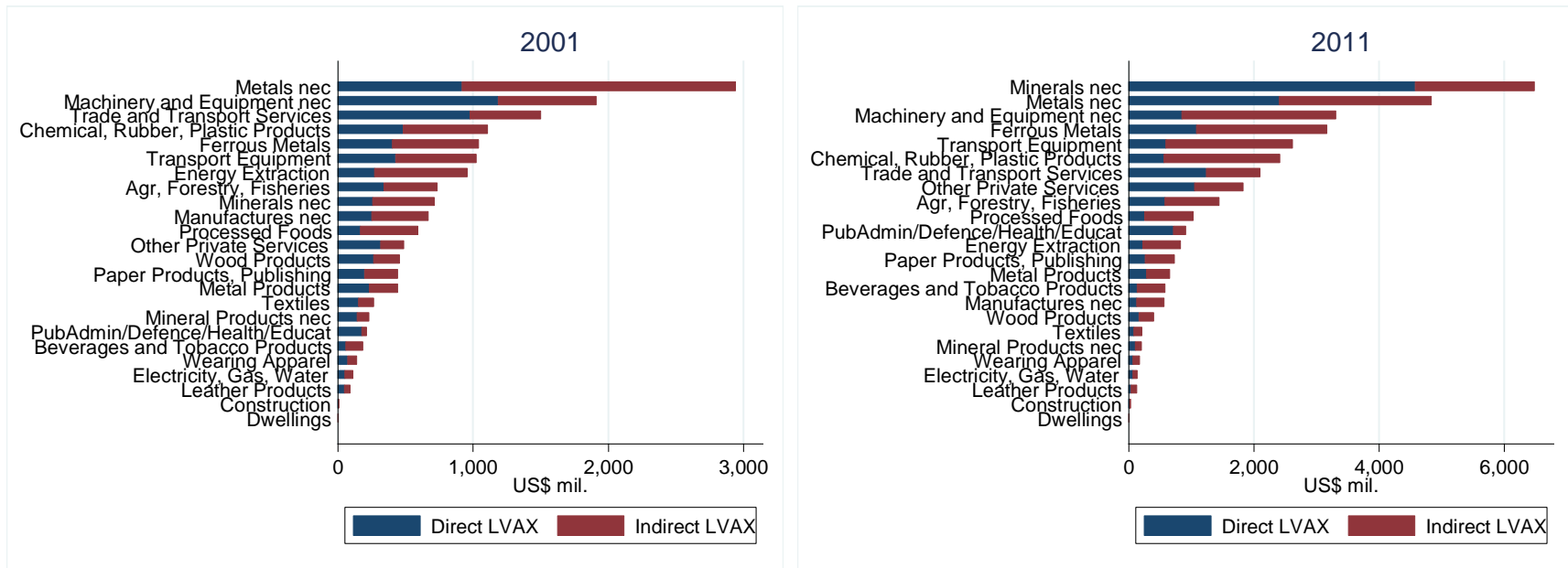
Figure 6 shows that the importance of backward linkages for how exports support jobs and wages also varies across sectors. Consistent with its enclave-type characteristics, the minerals sector primarily generates domestic labor value added directly within the sector’s exports, as opposed to its backward linkages with input sectors. On the other hand, around three quarters of the total labor contained in exports of machinery and equipment and of transport equipment is due to labor used by domestic suppliers of these sectors. Indeed, while the minerals sector generates the most direct labor value added, due to its dominance in the export basket and relatively high labor intensity, its weak backward links with the domestic economy limit its overall employment impact.

South Africa’s commodities exports have increasingly become an enclave sector, where more and more of the labor value added is generated directly within the sector. In 2011, the indirect LVAX represented only one third of total LVAX supported by minerals exports, compared to two thirds in 2001. In contrast, South Africa’s manufacturing exports have increasingly supported indirect wages, with the indirect LVAX share increasing from 57% to 65%.

In line with aggregate results, labor value added associated to exports tends to be biased towards unskilled workers in most sectors. Only in public administration, defense, health and education exports and other private services exports is the unskilled-skilled labor value added split about even (Figure A3).¹⁴ This is the case whether considering total labor value added computed through the backward or forward linkages method (not shown), explained by the relatively high importance of direct labor value added in these sectors. At the other extreme, agriculture, forestry and fishing has the lowest share of skilled labor content of total labor content in gross exports.

¹⁴ We use 2007 as the split for 2011 is not compatible with previous years.

**Figure 6: Direct and indirect labor content of exports across sectors, South Africa
2001 vs. 2011**



Source: Authors' elaboration based on LACEX.

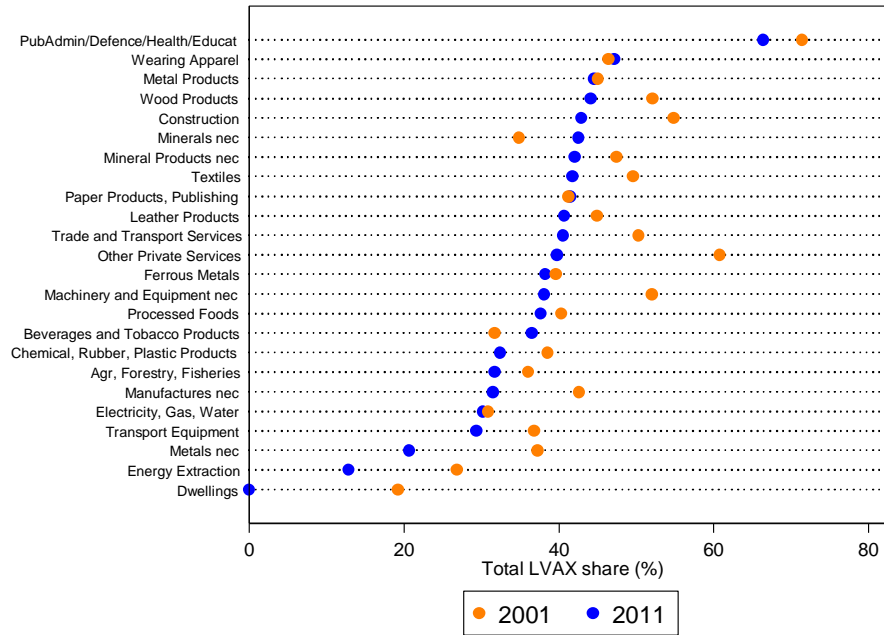
Exploring the labor intensity of exports shows that the labor content per \$100 of exports also varies across sectors for 2001 and 2011 (Figure 7). Mining's dominance reflects not only the large value of mining exports but, surprisingly, also their high labor intensity relative to other export sectors in South Africa and other mining exports of peer countries. On average, minerals exports in the latter generate \$30 of labor value added per \$100 of gross exports vis-à-vis \$43 in South Africa. This helps explain the high wage growth associated with minerals export growth in South Africa. In fact, the labor share of minerals exports is among the highest of all countries in the database (Figure A5).

Our decompositions above showed that the observed decline in the labor intensity of exports between 2001 and 2011 is driven by exports becoming less labor intensive (labor-intensity effect), rather than South Africa shifting to less labor intensive exports (composition effect). In fact the labor intensity of nearly all sectors' exports has declined, with the exception of minerals. Surprisingly, minerals exports have become more labor intensive between 2001 and 2011, unlike other countries in the world. The increasing labor intensity of minerals exports was due entirely to an increase in the intensity of labor directly supporting minerals exports, rather than labor supporting exports via their backward linkages. There was a significant increase in the direct LVAX share, more than doubling from \$13 to \$30 per \$100 of gross exports, while the indirect LVAX share declined by almost half, from \$22 to \$12 per \$100 of gross exports. Exports of beverages and tobacco products have become more labor intensive between 2001 and 2011.

This finding is consistent with micro evidence based on annual reports from listed mining firms, which suggests that between 2001 and 2011, wages as a percent of total costs in South Africa's mining sector almost doubled, from 20% to 35% (Gwatidzo and Benhura 2013). South Africa's top minerals exports in 2011 were unwrought gold (HS 710812, accounting for 10% of total goods exports) and unwrought platinum (HS 711011, accounting for 7% of total goods exports). South African gold and platinum production is highly unionized, which helped drive these wage increases.

Smaller export sectors instead generate labor value added more intensely through their backward linkages. For example, wearing apparel has a very high intensity of labor in its exports. Each \$100 of gross wearing apparel exports generates \$43 of wages, of which \$18 go the workers directly producing these goods. At the lower end of the spectrum, \$100 of metal exports generate only \$21 of labor value added, shared equally between the direct and indirect components.

Figure 7: Total labor content per \$100 of gross exports across sectors, South Africa 2001 vs. 2011



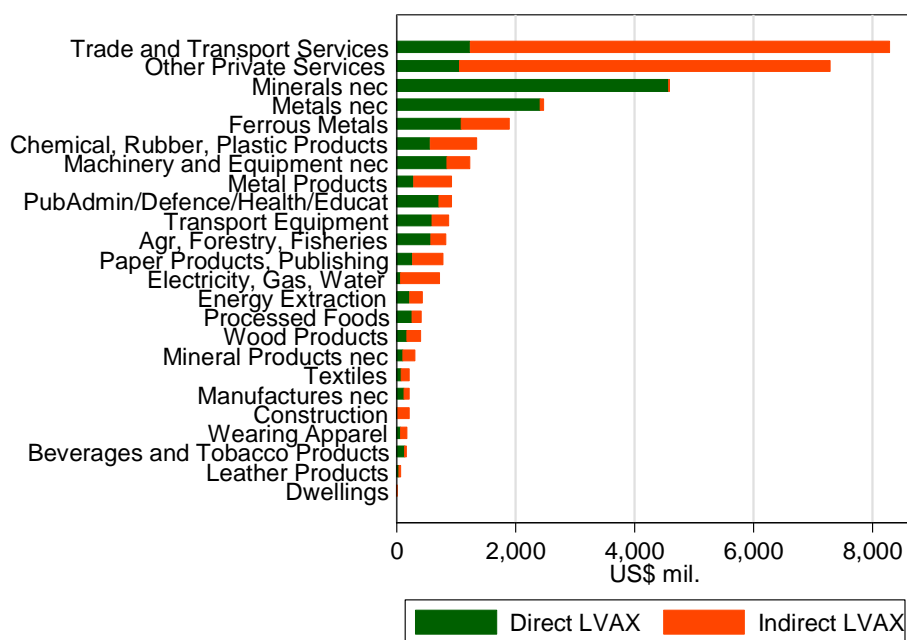
Source: Authors' elaboration based on LACEX.

The forward linkages from input-providing sectors to exporting sectors reveals that South Africa exports play a key role in supporting services jobs. Services sectors absorb a much larger share of labor value added from other sector's exports than they generate directly via their own exports. Figure 8 shows how much the labor of each sector is used by other sectors for their exports (i.e., the forward linkages). The picture again is very different, highlighting an asymmetry that is typical of many economies: services sectors, while being relatively small contributors to the direct labor content of exports, are the most important contributor of labor to exports when accounting also for the forward linkages. For example, in 2011, trade and transport services and other private services paid over \$8 and \$7 billion in export-related wages, respectively, higher than any other sector. Most of these wages (85% and 86%, respectively) were paid to provide inputs to exports in other sectors, especially manufacturing, rather than exporting directly. This confirms other literature that services' contribution to exports is primarily through forward linkages (Francois et al. 2015).

Due to the structure of forwards linkages, wage growth following export growth in South Africa was focused in services sectors. We find that services sectors absorbed 55% of the growth in labor income from exports over the 2000s, of which four fifths was through forward linkages. This high percentage is consistent with the fact that more than half of the additional labor value added in South Africa over the 2000s has been indirect.¹⁵

¹⁵ Consistent with other literature (Farole 2015), Figure 8 also suggests that the domestic value chains in South Africa appear to be relatively short. While the goods sector shows strong backward linkages in the domestic economy, particularly through services, it also has very weak forward linkages. For example, labor in the minerals and metals sectors are hardly employed to produce inputs for other exporting sectors, indicating very limited domestic connectivity downstream. Perhaps even more surprising, labor in machinery and equipment is also not involved in the

Figure 8: Direct and indirect labor content of exports across sectors, forward linkages, South Africa 2011



Source: Authors' elaboration based on LACEX.

ii. Jobs

Replacing the underlying labor value added share in production (from national accounts contained in GTAP) with the number of jobs contained in production (from ILO) we can isolate the number of direct and indirect jobs contained in exports, illustrated in Figure 9 for 2011. Due to differences in sectoral aggregations across data sources, we can only group the sectors into 11 macro sectors.

Manufacturing dominates the ranking.¹⁶ In 2011, manufacturing exports contributed 1.9 million jobs. But its importance comes mainly through its backward linkages to the domestic economy. For example, similar to Kerr et al. (2014), our data show that direct manufacturing exports are not job-intensive and direct manufacturing jobs have been declining. But manufacturing becomes labor-intensive once taking into account its backward linkages to input-providing sectors. In fact, manufacturing employs about two thirds of export-oriented workers in South Africa. However, the vast majority of these jobs are in sectors providing inputs into manufacturing (1.5 million indirectly and 0.4 million directly): the indirect employment impact

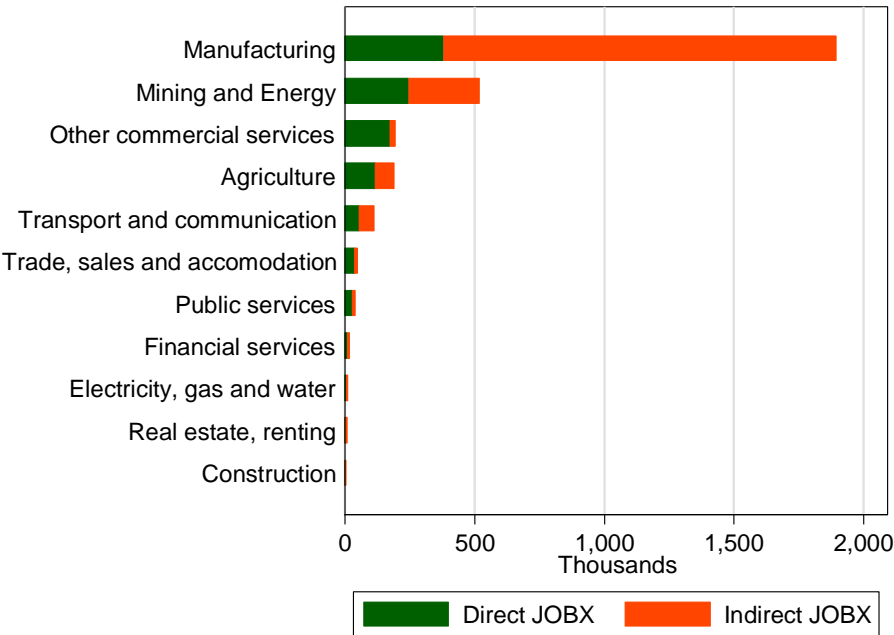
production to supply other exporting sectors, although the machinery and equipment sector has a large labor content in exports. The majority of the sector's wages are paid to employees producing equipment to be directly exported (even though doing so requires inputs from other domestic sectors of the economy, as illustrated in Figure 6). This asymmetry suggests a mismatch between the domestic supply of machinery and the demand for machinery from the domestic minerals, metal and manufacturing sectors.

¹⁶ Differences in sector classifications between GTAP and ILO data requires us to use an aggregated definition of manufacturing when measuring the jobs content of exports, which includes manufacturing or casting of basic iron and steel and non-metallic minerals products, for example. This is consistent with the ISIC classification of the manufacturing sector (ISIC 15-37).

of manufacturing exports (jobs in industries providing inputs into manufacturing exports) is nearly 4.5 times greater than the direct manufacturing employment.

Aside from real estate and renting, manufacturing has the lowest direct job intensity of exports, with 6 jobs directly supported per \$1 million in exports. The indirect job intensity of exports is instead higher than all other sectors, at 22 jobs indirectly supported per \$1 million in exports. Overall, the total job intensity of manufacturing exports is about average, but below agriculture and other services sectors. The job intensity of mining and energy, on the other hand, is among the lowest. Figure A4 shows the direct and indirect jobs per \$1 million of gross exports for 2011.

Figure 9: Job content of exports across macro sectors, South Africa 2011



Source: Authors’ elaboration based on LACEX.

One drawback of the classification is that manufacturing is a very broad and heterogeneous category. In order to explore this heterogeneity further, we use sectoral employment data from South African labor force surveys instead of ILO, shown in Figure 10. Machinery, other metal products and ferrous metal products become the largest sector in terms of the number of jobs contained in its exports (which was all contained within the broad manufacturing sector in Figure 9).¹⁷ It also witnessed the largest increase in jobs contained in exports across all sectors between 2001 and 2011, from 837,000 to 992,000 jobs. This growth was entirely explained by jobs in input-providing sectors; in 2011, indirect jobs represented three quarters of the total jobs contained in machinery, metal products and ferrous metal exports.

As noted above, the job intensity of minerals exports is more limited, and jobs supported by minerals exports grew by only 3.9% annually between 2001 and 2011 (compared to wage growth that grew 24.6%

¹⁷ The sector ‘ferrous metals’ includes manufacture of basic iron and steel and casting of iron and steel, which by its ISIC concordance is considered manufacturing (ISIC 27) rather than minerals (ISIC 12-14).

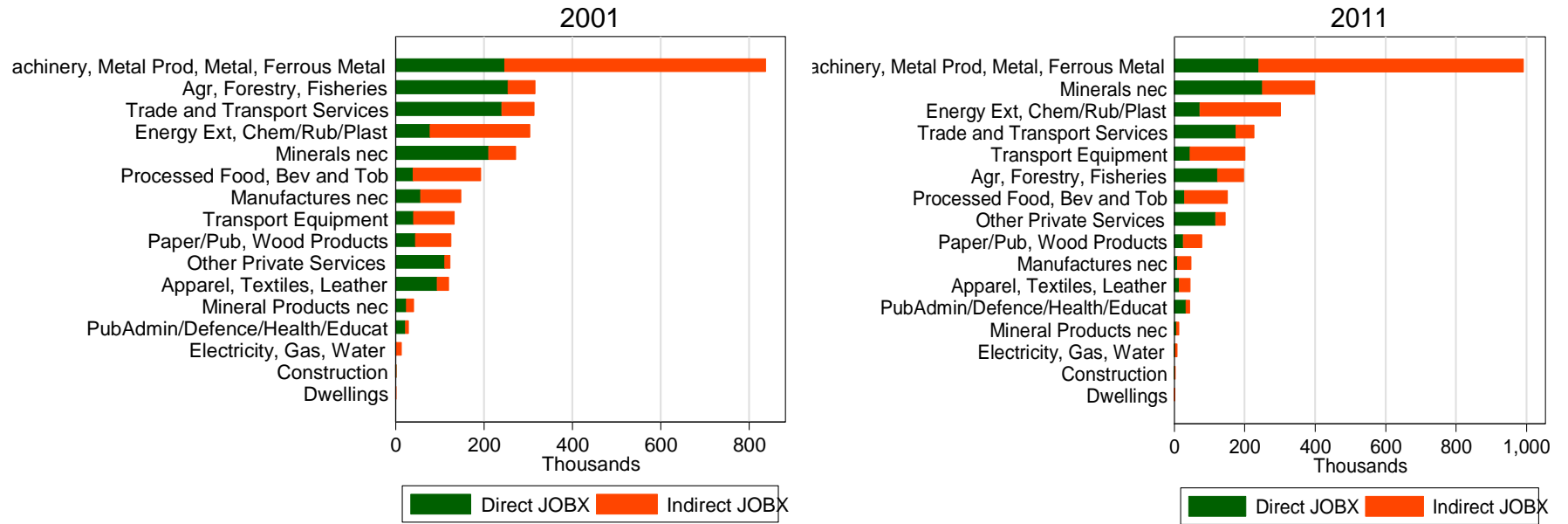
annually). Nevertheless, the number of jobs contained in minerals exports increased from 273,000 jobs in 2001 to 400,000 jobs in 2011.¹⁸ This growth was also almost entirely explained by jobs in input-providing sectors, though the growth rate of indirect jobs was much slower than that experienced by machinery and metals.

On the other hand, export jobs in agriculture fell dramatically in the 2000s, from over 300,000 to less than 200,000 jobs between 2004 and 2011, as did jobs contained in trade and transport services exports. These trends—a rising number of jobs for capital-intensive exports and a declining number of jobs for labor intensive exports—may help explain the declining labor intensity of exports highlighted in Figure 2 above. They also are consistent with other findings in the literature that exports have performed least well in manufacturing sectors that are labor-intensive (World Bank 2014, Matthee et al. 2016), which is also likely a by-product of Dutch Disease induced by the commodity boom and amplified by the relatively high labor content of mineral exports, which boosts the spending effect of the commodity boom.

Nevertheless, the proceeding analysis and other literature also suggests that the relatively low labor content of South African exports seems to be due not only to a composition effect, but also a generally low use of domestic labor in production relative to other countries. In fact, the factor content of South Africa's export basket is associated with products with human capital and especially physical capital intensity far beyond those in South Africa's endowments (Hollweg and Ruppert Bulmer 2014, Alleyne and Subramanian 2001).

¹⁸ Adding this result to the above finding that the number of jobs supported by exports of minerals is limited suggests exports support high wages in the minerals sector (around US\$18,000 per average worker per year if dividing the direct LVAX in minerals by the direct number of jobs in minerals).

**Figure 10: Direct and indirect job content of exports across refined sectors, South Africa
2001 vs. 2011**



Source: Authors' elaboration based on LACEX and South African labor force surveys.

b. Across Countries

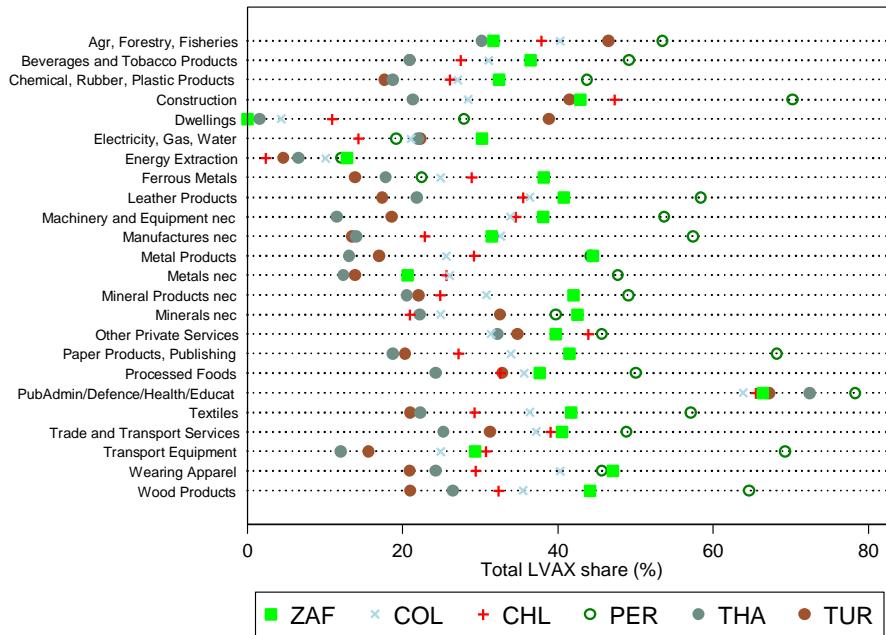
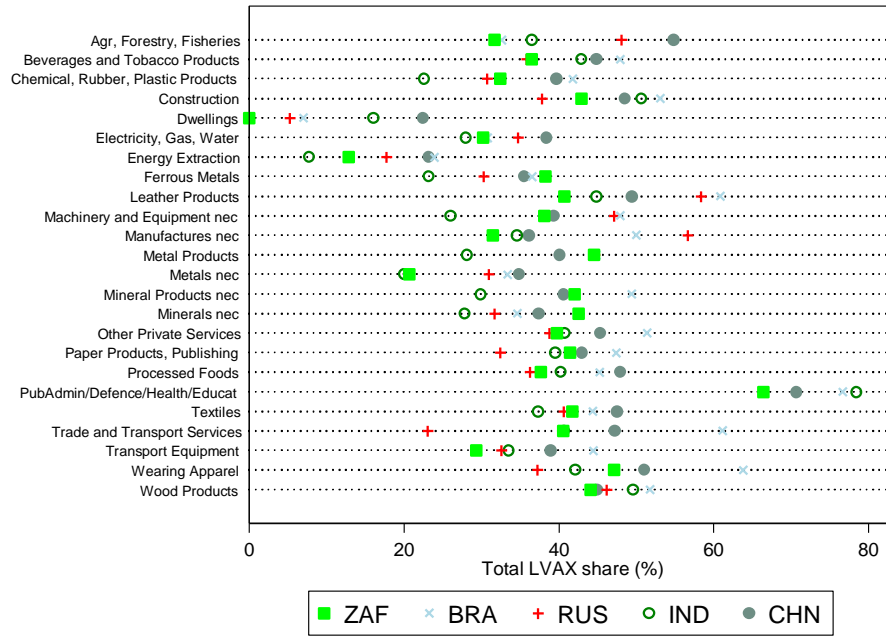
i. Labor Value Added

As observed in Section 3, South Africa has a lower share of total labor content in gross exports than most of the BRIC countries, but it has a higher share than most other comparators. To investigate to what extent this may be due to a composition effect, Figure 11 shows a comparison for similar sectors across comparator countries (in terms of total labor value added per \$100 of gross exports). This comparison confirms that South Africa generally has a lower share of labor in exports across sectors than its BRIC comparators (first panel), while it generally has a higher share across sectors relative to the other comparator countries (second panel). The exception is exports of the minerals sector in South Africa, which are the most labor intensive among any of its comparators. This suggests that the aggregate result is not mainly driven by the compositional nature of exports.

Figure A5 shows this comparison across all countries for 2001 and 2011 for the three largest South African export sectors. In machinery and equipment, South Africa's labor content as a share of exports declined relative to the average in the other countries, although it remains still slightly above the level expected given its income per capita. In metals, the country has moved from being above to being below the expected share of labor in export and in 2011 it was also below most comparator countries. In minerals on the other hand, South Africa's labor intensity of exports has markedly increased and by 2011 it had the highest share of labor in exports not only among the comparator countries but vis-a-vis most other countries in the world.

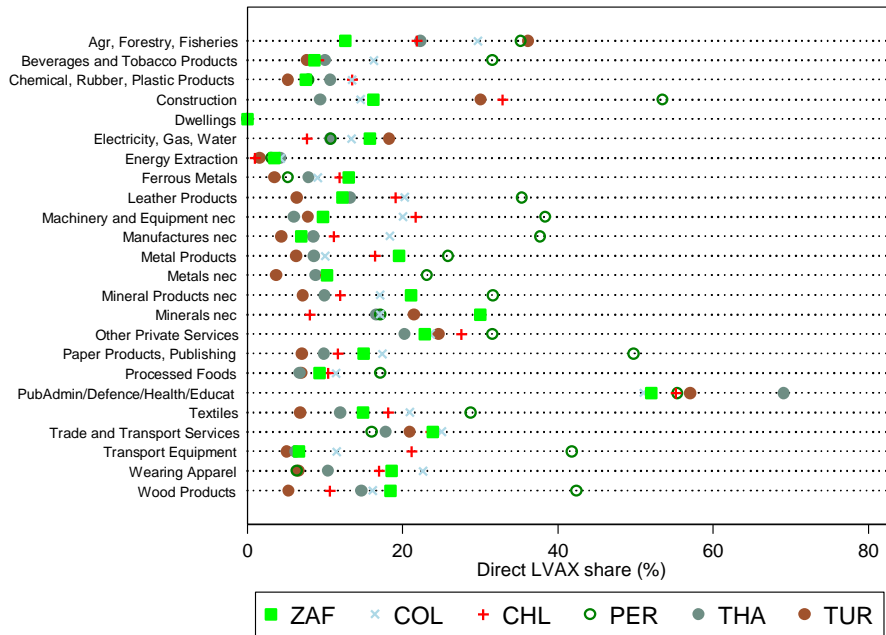
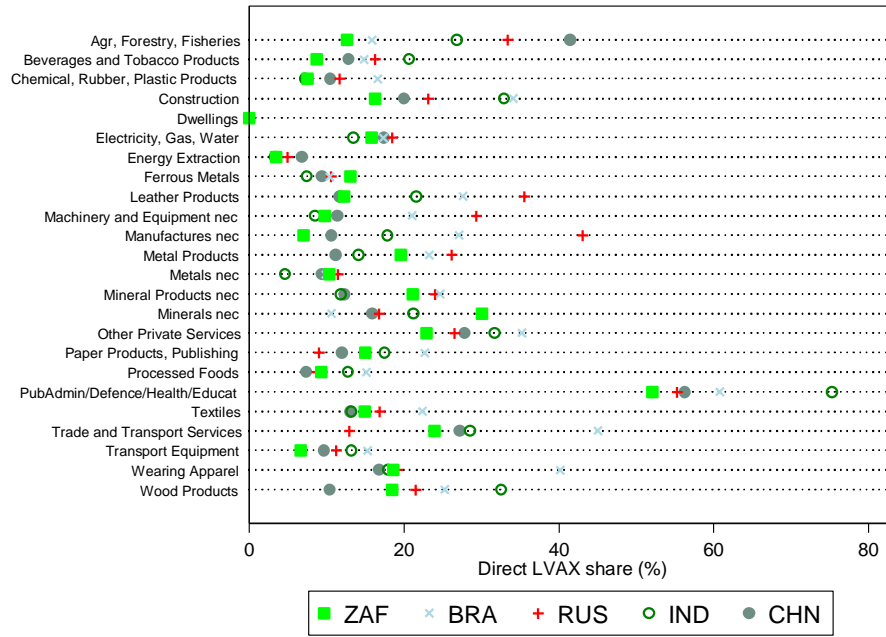
In Figure 12 we assess whether this difference in performance is due to direct value added or indirect value added via backward linkages. Figure 12 repeats Figure 11 except for the direct LVAX shares across sectors and countries. In Figure 6 we observed that labor value added contained in South Africa's minerals exports was primarily direct labor content with weak backward linkages. The direct LVAX share continues to be above all other countries for minerals as well as for ferrous metals. In other sectors, however, the direct LVAX share is no longer higher than other non-BRIC comparators, implying that South Africa's high LVAX share relative to other countries is due to backward linkages, rather than the direct content (with the exception of minerals).

Figure 11: Total labor content per \$100 of gross exports across sectors 2011



Source: Authors' elaboration based on LACEX.

Figure 12: Direct labor content per \$100 of gross exports across sector 2011



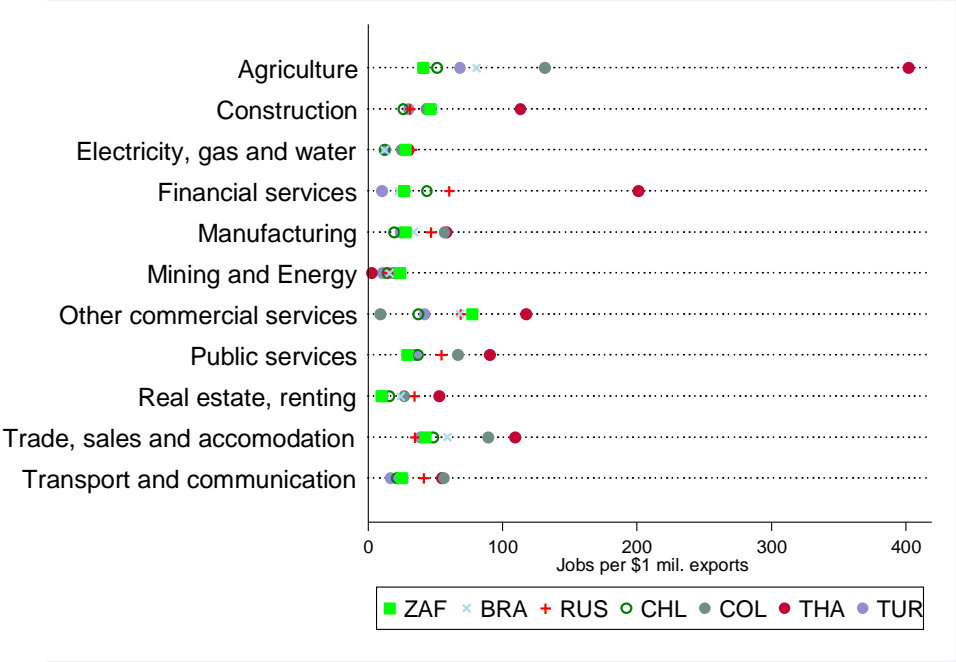
Source: Authors' elaboration based on LACEX.

ii. Jobs

The job intensity of South Africa's manufacturing exports continues to be low vis-a-vis comparator countries, while the job intensity of mining and energy is higher than all other countries. The following two figures show a comparison of the job intensity of exports across sectors and comparator countries (in terms

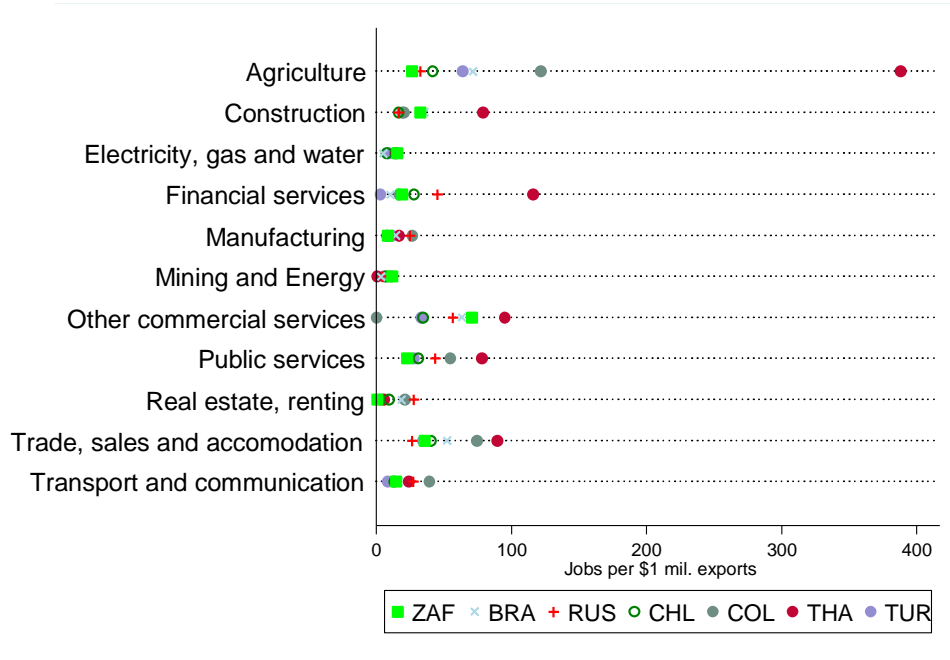
of the total number of jobs per \$1 million of gross exports in Figure 13 and the direct number of jobs per \$1 million of gross exports in Figure 14). Unlike the labor value added intensity of exports (which was lower than the BRIC countries but higher than other comparators), the job intensity of exports tends to be lower than all comparators, with the exception of mining and energy. Again with the exception of mining and energy, the direct job intensity of exports tends to be lower than comparators across sectors.

Figure 13: Total job content per \$1 million of gross exports across macro sectors 2011



Source: Authors' elaboration based on LACEX.

Figure 14: Direct job content per \$1 million of gross exports across macro sectors 2011



Source: Authors' elaboration based on LACEX.

5. Labor Content of Exports in Global Value Chains

In this section we narrow our focus and measure the labor content of non-resources intensive manufacturing exports traditionally governed in GVCs, to examine how growth in non-traditional export sectors has impacted the level and nature of labor in South Africa. South Africa has become more integrated in GVCs, and is looking to upgrade in GVCs as an avenue to generating higher quality jobs (Farole 2015). GVCs are fundamentally about restructuring the location of economy activity: what used to be produced under one factory roof may now take place across a number of different countries. This has fundamental impacts on where jobs go, who gets them, and what types of jobs they are (Farole 2015). A priori, the net impact of joining and upgrading in GVCs on labor markets in developing countries is unclear and not well studied in the literature,¹⁹ as it can occur in opposite directions through a variety of channels.²⁰

Separating the domestic content from the foreign content contained in a country's exports—as achieved in the LACEX data—is a necessary step when disentangling the impact of production across multiple borders. However, when defining GVC-trade as value addition across different geographical locations governed by

¹⁹ Exceptions include Kucera et al. (2012).

²⁰ For example, the requirement of GVCs to meet strict quality standards often leads to increased mechanization, and the scale economies possible from accessing larger global markets may make capital investments more viable. Less labor intensive methods of production may result, lowering the number of jobs for a given volume of output/exports. GVCs may also have distributional consequences in terms of the nature of skills demand and their implications for wages. On the other hand, if greater foreign value added in exports leads to an increase in total exports, by complementing the domestically available intermediate products and skills, it may lead to higher demand for labor in an industry. However, if it substitutes domestic production, it can lead to a lower share of domestic value added in exports and thereby lower labor demand. As another alternative, it could substitute the direct labor within an industry, but complement the indirect labor (Farole 2015).

a lead firm, we are unable to distinguish between GVC and non-GVC trade in the LACEX due to its sectoral level of aggregation. Instead, we focus on important GVC sectors globally: motor vehicles, textile and apparel, electronic equipment, and food products. We assess how South Africa's level of GVC participation in these sectors has changed over the last decade, and link this to changes in the direct and indirect labor intensity (Figure 15), labor content (Figure 16) and the skills mix (Figure 17 and Figure 18) in South Africa's GVC exports.

South Africa's participation in these GVC-oriented sectors has been varied. Using data from the UNCTAD-Eora GVC database, between 2001 and 2011 South Africa's participation in the automotive GVC—measured by foreign content embodied in South Africa's exports as a buyer and South Africa's content embodied in foreign exports as a seller—more than tripled and GVC participation remained the second highest for manufacturing. In contrast, South Africa remained weakly integrated in the wearing apparel GVC, and GVC participation fell to one of the lowest for manufacturing. More generally, domestic apparel manufacturing has been in decline over the past 15 years due to increased import competition, a process that accelerated significantly when South Africa acceded to the WTO's Agreement on Textiles and Clothing in 1994 (van der Westhuizen 2006). Nevertheless, it's classically one of the most GVC-intensive sectors globally, and an important sector for unskilled labor.

A high import content of exports is a key feature of GVC participation as a buyer, and as expected the labor intensity of motor vehicle exports declined sharply in South Africa. Automotive exports contributed around \$37 of domestic labor per \$100 of exports in 2001, and declined to below \$30 in 2011, well below that of Brazil and China, where the labor content instead increased, and India, where it remained stable. Enhanced participation in the automotive GVC—as both a buyer and a seller—fueled rapid growth of South Africa's motor vehicle exports (Engel 2015), and more than compensated the decline in domestic labor intensity: the total labor content of motor vehicles exports increased significantly, almost tripling from \$862 million to \$2.3 billion between 2001 and 2011. Nevertheless, the growth in total labor value added (in USD) between 2001 and 2011 in South Africa was also lowest among these countries, growing annually on average at 10.4%, compared to 33.0% in China, 30% in India, and 13.5% in Brazil.

The significant growth in wages supported by motor vehicle exports occurred primarily as a result of the sector's extensive backward linkages to the domestic economy. Direct wages paid to produce automotive exports increased modestly between 2001 and 2011, averaging 3.6% per year, and the direct labor content per \$100 of gross exports more than halved. Instead, wage growth was largely concentrated in upstream input sectors, including other manufacturing sectors but primarily services sectors. Indirect wages paid to produce automotive exports increased annually by 15.4%, causing the indirect-to-direct labor value added ratio to increase from about one half to more than two thirds over the decade.

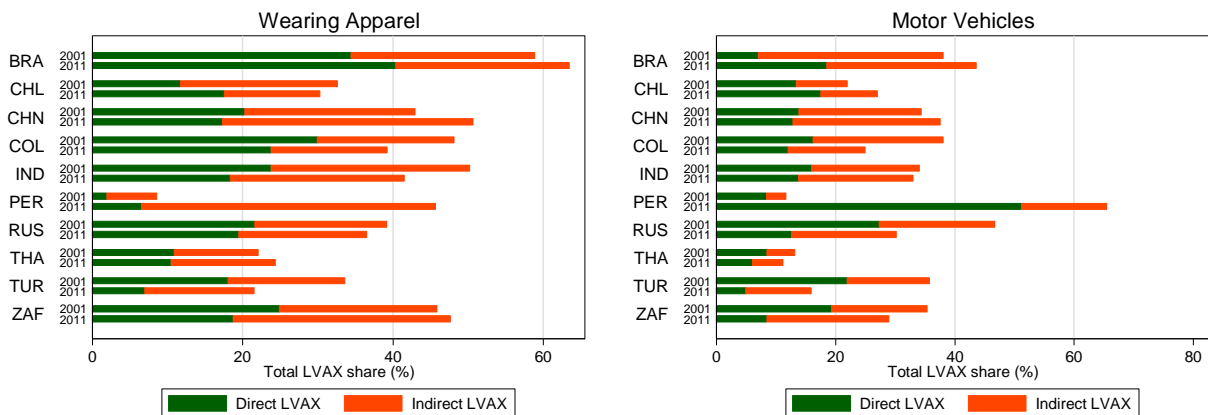
This greater need for services is consistent with greater GVC participation. Exporters increasingly make use of foreign inputs (reducing the labor value added paid directly to motor vehicle workers). But coordinating these inputs requires more intensive use of (mainly domestic) services, including financial services, transport and logistics, and other business services (Farole 2015), and overall the net result for wage growth in South Africa was positive. This finding reinforces the importance of services for a competitive manufacturing sector, whose production is increasingly fragmented across countries (Lanz and Maurer 2015).

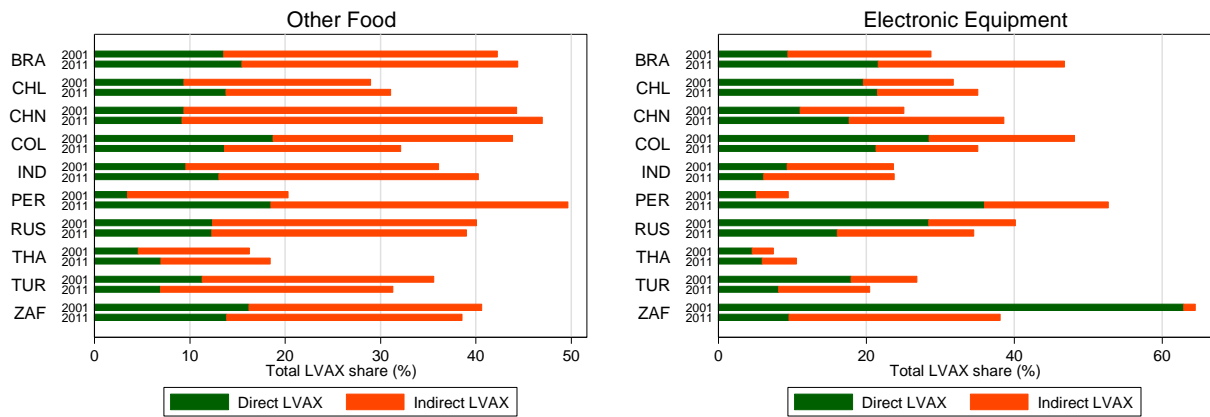
Though slight, the labor content of wearing apparel exports increased over the 2000s—both in nominal values and as a share of gross exports. In nominal values, the wages paid to produce wearing apparel exports in South Africa continue to be lower than in comparators—consistent with low GVC integration. As a share of gross exports, the labor intensity of wearing apparel exports has become higher than most comparators, with the exception of Brazil and China. This suggests a generally high use of domestic labor in production even by international standards (as confirmed above—whereby each \$100 dollars of gross exports generates \$43 of wages), and is consistent with the observed decline in GVC participation on the buying side.

Similar to what was observed for motor vehicle exports, the increase in export-wages in wearing apparel was concentrated in upstream input sectors, including services, due to the backward linkages to the domestic economy. Both in nominal values and as a share of gross exports, the direct content of wearing apparel exports decreased while the indirect content increased over the 2000s in South Africa. Direct wages are behind the large labor content in Brazil’s wearing apparel exports, while the indirect content explains China’s high labor intensity, in line with recent evidence (Kee and Tang 2016).

The labor content of South Africa’s exports in the food products GVC also increased slightly between 2001 and 2011, both in nominal values and as a share of gross exports. While indirect wages paid to produce food products exports are more important than direct wages across countries, most comparators show a higher indirect content per \$100 of exports than South Africa. The domestic labor contained in South Africa’s electronic equipment exports dropped substantially, despite an increase in the indirect content. Nevertheless, the labor intensity of electronic exports remains relatively high, behind only Peru and Brazil.

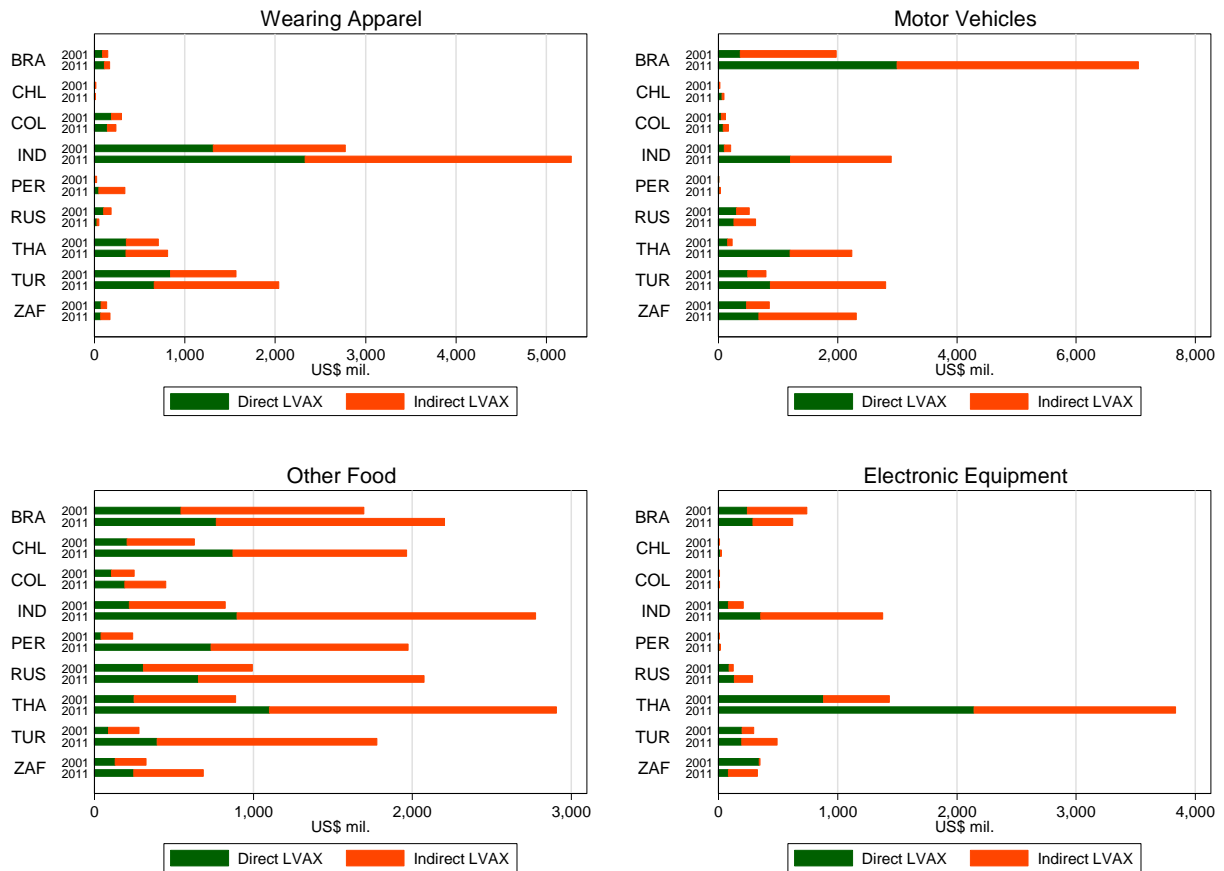
Figure 15: Direct and indirect labor content per \$100 of gross exports in GVC-intensive sectors 2001 vs. 2011





Source: Authors' elaboration based on LACEX.

Figure 16: Direct and indirect labor content of exports in GVC-intensive sectors 2001 vs. 2011



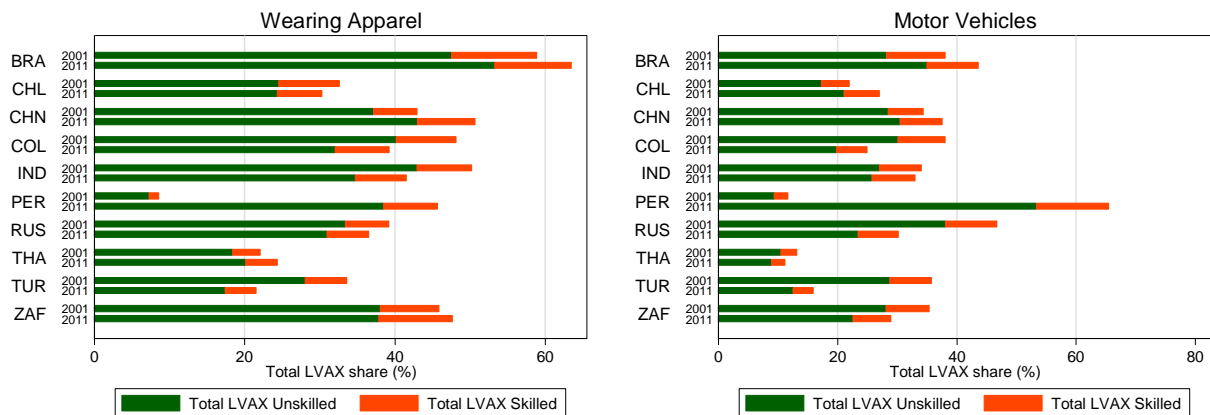
Source: Authors' elaboration based on LACEX.

The increasing importance of indirect wages that accompanied South Africa's GVC integration, coupled with differences in the skills-intensity across sectors, appears to have had implications on skills demand. Figure 17 and Figure 18 replicate the above graphs but with the skilled-unskilled instead of the direct-indirect split. The share of skilled wages is in general higher in South Africa than in most other comparators

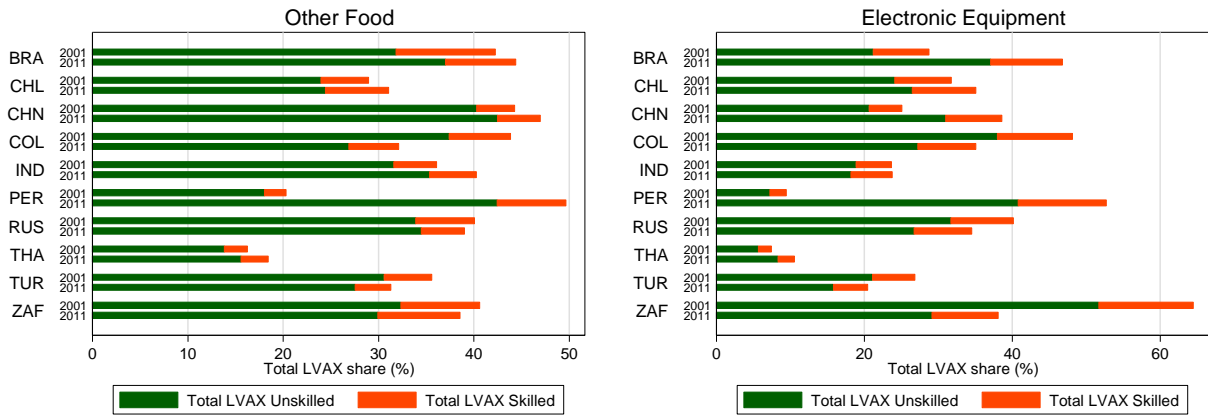
in all four sectors except motor vehicles (where the share of skilled wages appears to be lower in South Africa than in comparators). Nevertheless, job creation in GVC exports has generally been biased in favor of skilled workers. In the motor vehicle, wearing apparel and other food GVCs, the relative contribution of skilled labor to each \$100 of gross exports has increased significantly over the decade. However, the relative contribution has somewhat declined in electronic exports. Behar (2010b) shows that skilled labor complements unskilled labor in South Africa’s manufacturing sector, supporting our findings that skilled labor is used in the indirect production of (unskilled) export sectors.²¹

These findings suggest that GVC integration is likely to have distributional consequences, which may in fact accelerate the underlying skills bias that are already prevalent in South African export production. The substitution of direct manufacturing jobs to indirect services jobs has been biased towards skilled labor. Coupling this with the strong shift toward indirect services employment suggests that skilled job creation may also happen through the services sector’s forward linkages (given that services are relatively more skilled intensive). This increase in the demand for skills in the export sector is consistent with the rising inequality experienced by South Africa throughout the period (Bhorat and van der Westhuizen 2012). It is also consistent with labor saving technological changes. Opening to trade increases capital flows through FDI, which improves production technologies, and this biases skilled workers who are needed to use these technologies.

Figure 17: Skilled and unskilled labor content per \$100 of gross exports in GVC-intensive sectors 2001 vs. 2011

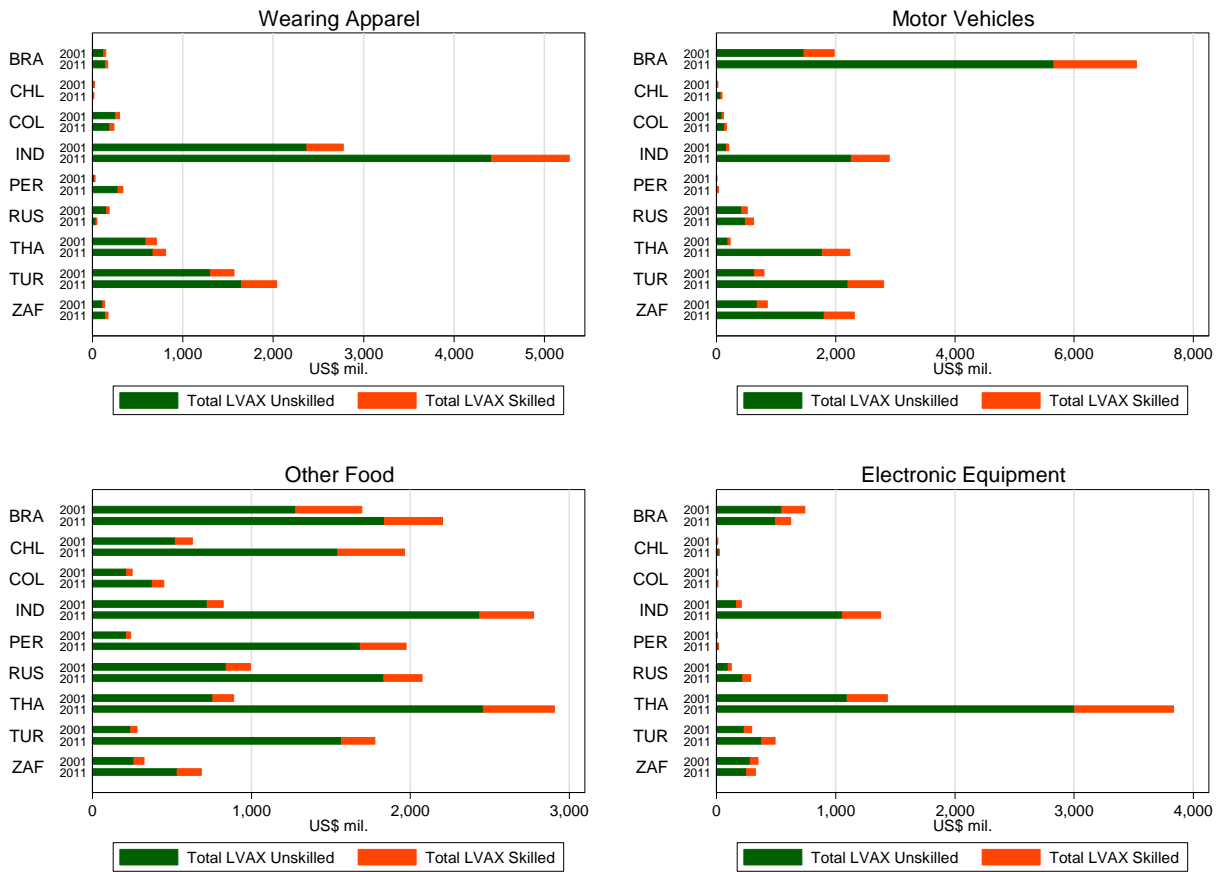


²¹ Edwards and Behar (2005) also find evidence that trade liberalization and technological change have affected the skill structure of employment, where export orientation is positively associated with the skill intensity of production.



Source: Authors' elaboration based on LACEX.

Figure 18: Skilled and unskilled labor content of exports in GVC-intensive sectors 2001 vs. 2011



Source: Authors' elaboration based on LACEX.

6. Conclusions

This paper has used the newly developed World Bank's Labor Content of Exports database to provide some novel evidence on the wages and jobs in South Africa's exports. Like many emerging economies, South

Africa has identified exports as an engine for more inclusive, job-intensive growth to combat unemployment. Yet there has been much debate over the inclusiveness and broader socio-economic impact of international trade for South Africa, which is concentrated in minerals and other commodities. The database offers a unique opportunity to examine how South Africa's exports have supported jobs and wages, both directly and through domestic linkages between sectors of the economy, and compare those to other lower-middle and middle-income countries.

On aggregate, we find that export growth has been associated with positive labor-market outcomes in terms of wages, but negative job growth. Between 2001 and 2011 the total number of jobs supported by South Africa's exports declined from 3.0 million to 2.9 million, despite strong growth in exports (10.3% annually) as well as the wages paid to produce exports (7.9% annually). We argue that the composition of South Africa's exports helps explain this incidence of export-led, 'jobless growth'.

Consistent with its enclave-type characteristics, our results confirm that the minerals sector primarily generates domestic labor value added directly within the sector's exports, as opposed to its backward linkages with input sectors. Nevertheless, much of the labor content of exports is shaped by mining, which despite being capital intensive generates most of South Africa's labor value added contained in its exports. Although minerals experienced growth in the number of jobs contained in exports, it was significantly smaller than wage growth, and the mining and energy sector tends to employ fewer workers per unit of gross exports than other sectors. In addition, other labor-intensive exports may be penalized by the growth in commodity exports through the appreciation of the real exchange rate.

Our data also show that exports in South Africa have become less labor intensive, where the quantity of jobs and the labor value added per unit of exports has diminished overall. South Africa remains one of the middle-income countries in the sample with the lowest number of jobs associated with exports, due not only to a composition effect, but also to a generally low use of domestic labor in production relative to peer countries. Exports have also become more capital intensive in South Africa and we see a substitution away from labor to capital in the data. While this is consistent with labor-savings technologies, it may also reflect distortions that favor capital for production (Behar 2001a).

Overall, manufacturing exports appear to be more job-intensive. In fact, manufacturing employs about two thirds of export-oriented workers, whose jobs are mainly in the services sectors through backward linkages. Services absorbed 55% of the growth in labor income from exports over the 2000s, of which four fifths was through forward linkages. Supporting a competitive services sector will thus be important for promoting services jobs as well as manufacturing exports.

South Africa has since identified export diversification into in more sophisticated, value-added products as an engine for faster, job-intensive growth to combat unemployment. The estimates in this paper shed light on the extent to which such a strategy has supported labor by focusing on the labor content of non-resource intensive manufacturing exports traditionally governed in GVCs. We found that GVC participation enabled rapid growth of exports and wages, which more than compensated the decline in domestic labor intensity. Wage growth of GVC-exports happened mainly in services sectors via backward linkages, which has been biased towards skilled labor. These findings suggest that GVC integration likely had distributional consequences, which may have in fact accelerated the underlying skills bias that are already prevalent in South African export production. To the extent that unemployed workers are more likely to be unskilled, this may have implications for the ability of future export-growth to combat unemployment.

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Appendix 1: The direct and indirect value added generated by export sector

This section illustrates how Calì et al. (2016) generate the (direct and indirect) value added associated with each sector-country using the panel of global input-output tables from GTAP. The methodology follows Francois et al. (2013), which forms the basis for the computation of the compensation of employees. Calì et al. (2016) begin by denoting a representation of intermediate and final demands as follows:

$$Y = Z - AZ \quad (1)$$

In equation (1), the term Y denotes a final demand vector, Z denotes a gross output vector, and A denotes a matrix of intermediate use coefficients, which can be calculated using data from input-output tables. Equation (1) therefore defines final output with respect to intermediate input requirements.

The first matrix that is calculated is the widely used Leontief inverse matrix, also known as the multiplier matrix M . With some manipulation Calì et al. (2016) arrive at the Leontief inverse matrix:

$$Z = (I - A)^{-1}Y = MY \quad (2)$$

The multiplier matrix M measures the inputs contained in a unit of final output. This M matrix contains both direct and indirect inputs. In particular, if assigning the sector indexes i, j to the M matrix, then a representative element of the M matrix, M_{ij} , gives the direct and indirect inputs (and thus receipts) of sector i linked to each unit (for example each dollar) of sector j receipts in the data. This implies real production activities measured by value of output. For our purposes, it provides a means to trace through these income flows, the flow of gross activity (and eventually labor value added) from intermediate to final goods and services, ostensibly across borders as well as sectors. Because linkages will vary by industry, each industry will be characterized by different multipliers.

Next, Calì et al. (2016) need to calculate a diagonal matrix that measures the labor value added (compensation of employees) share of total gross output, which can be calculated using data from SAMs. To focus on labor value added, rather than gross activity, Calì et al. (2016) note first that in terms of gross output values Z , some share of this involves labor value added within each sector. Calì et al. (2016) define \hat{B} as the diagonal matrix indexed over i, j with diagonal elements equal to the compensation of employees' shares of output Z . These shares can be split between types of workers (e.g. skilled/unskilled).

Calì et al. (2016) then use M and \hat{B} to provide a breakdown of the flow of labor value added across activities in the form of the matrix V :

$$V = \hat{B}M \quad (3)$$

Similar to the Leontief inverse matrix itself, the V matrix identifies the inputs of labor value added in each sector related to a unit of final demand.

Using the V matrix as a multiplier for exports and final outputs, one can obtain the total labor value added of exports and final outputs, respectively. Calì et al. (2016) multiply V by the diagonal matrix \hat{Y} whose non-zero elements are the vector of final demand. The resulting matrix yields a breakdown of economy-wide labor value added (both direct and indirect) (the primary component of Gross National Product on a source basis). Similarly, by multiplying V by the diagonal matrix \hat{X} whose non-zero elements are the national export vector, Calì et al. (2016) recover the labor value added content of exports X (both direct and indirect):

$$G = V\hat{Y} \quad (4)$$

$$H = V\hat{X} \tag{5}$$

The G matrix and the H matrix thus give us the set of linkages, both direct and indirect, between value added across sectors for total domestic demand and export demand, respectively.

To calculate the jobs content of exports, Calì et al. (2016) replace the diagonal matrix of the compensation of employees in total output \hat{B} with the equivalent matrix of employment in output \hat{E} , which is obtained by the number of employees per total output Z . By replacing \hat{B} with \hat{E} in equation (3), Calì et al. (2016) can compute the matrix $J = \hat{E}M$ and then derive the counterparts of the G and H matrixes in terms of jobs contained in output and exports.

Table A1: Total labor value added in each \$100 of gross exports

		1995	1997	2001	2004	2007	2011
ZAF	Skilled			9.03	8.11	7.55	7.69
	Unskilled			31.57	25.14	23.32	24.94
	Total			40.60	33.25	30.87	32.63
BRA	Skilled	6.88	8.55	11.51	8.82	9.30	8.69
	Unskilled	26.82	29.67	32.00	32.39	32.48	32.47
	Total	33.70	38.22	43.51	41.21	41.78	41.16
RUS	Skilled		6.83	6.12	4.87	5.15	5.15
	Unskilled		29.82	27.10	18.71	18.87	19.54
	Total		36.65	33.22	23.58	24.02	24.69
IND	Skilled	8.61	5.97	6.83	7.47	7.62	7.04
	Unskilled	32.97	27.82	28.96	25.77	23.81	25.34
	Total	41.58	33.79	35.79	33.24	31.43	32.38
CHN	Skilled	4.15	5.60	5.89	5.55	5.87	7.43
	Unskilled	22.77	31.43	31.88	27.10	27.92	34.22
	Total	26.92	37.03	37.77	32.65	33.79	41.65
COL	Skilled	7.20	8.74	7.82	4.30	4.43	4.55
	Unskilled	35.26	35.52	33.97	20.37	20.26	21.87
	Total	42.46	44.26	41.79	24.67	24.69	26.42
CHL	Skilled	5.28	5.63	6.30	6.44	6.33	6.56
	Unskilled	21.12	22.63	22.48	21.46	20.60	21.79
	Total	26.40	28.26	28.78	27.90	26.93	28.35
PER	Skilled		5.50	5.44	8.78	8.39	8.13
	Unskilled		20.39	19.92	38.16	36.43	37.45
	Total		25.89	25.36	46.94	44.82	45.58
THA	Skilled	2.85	3.68	2.91	3.43	4.00	3.51
	Unskilled	15.47	13.93	12.74	13.36	15.11	14.15
	Total	18.32	17.61	15.65	16.79	19.11	17.66
TUR	Skilled	3.84	5.13	6.78	5.62	5.32	4.73
	Unskilled	17.06	18.57	26.31	19.72	18.94	18.04
	Total	20.90	23.70	33.09	25.34	24.26	22.77
WLD	Skilled	15	13	13	12	12	
	Unskilled	30	27	26	25	24	
	Total	45	41	39	37	35	36

Source: Authors' elaboration based on LACEX.

Table A2: Capital value added in each \$100 of gross exports

	1997	2001	2004	2007	2011
ZAF		35.4	42.2	40.4	42.9
BRA	47.0	36.5	39.2	39.6	42.1
RUS	39.4	38.1	50.0	50.2	51.2
IND	42.8	41.7	39.9	38.0	36.7
CHN	32.1	33.4	33.5	35.2	33.2
COL	33.8	32.8	50.7	50.4	49.5
CHL	48.0	46.1	44.1	46.4	46.9
PER	53.6	54.9	37.7	38.0	36.6
THA	43.2	37.1	36.3	38.2	35.1
TUR	49.9	40.6	49.9	48.3	45.3

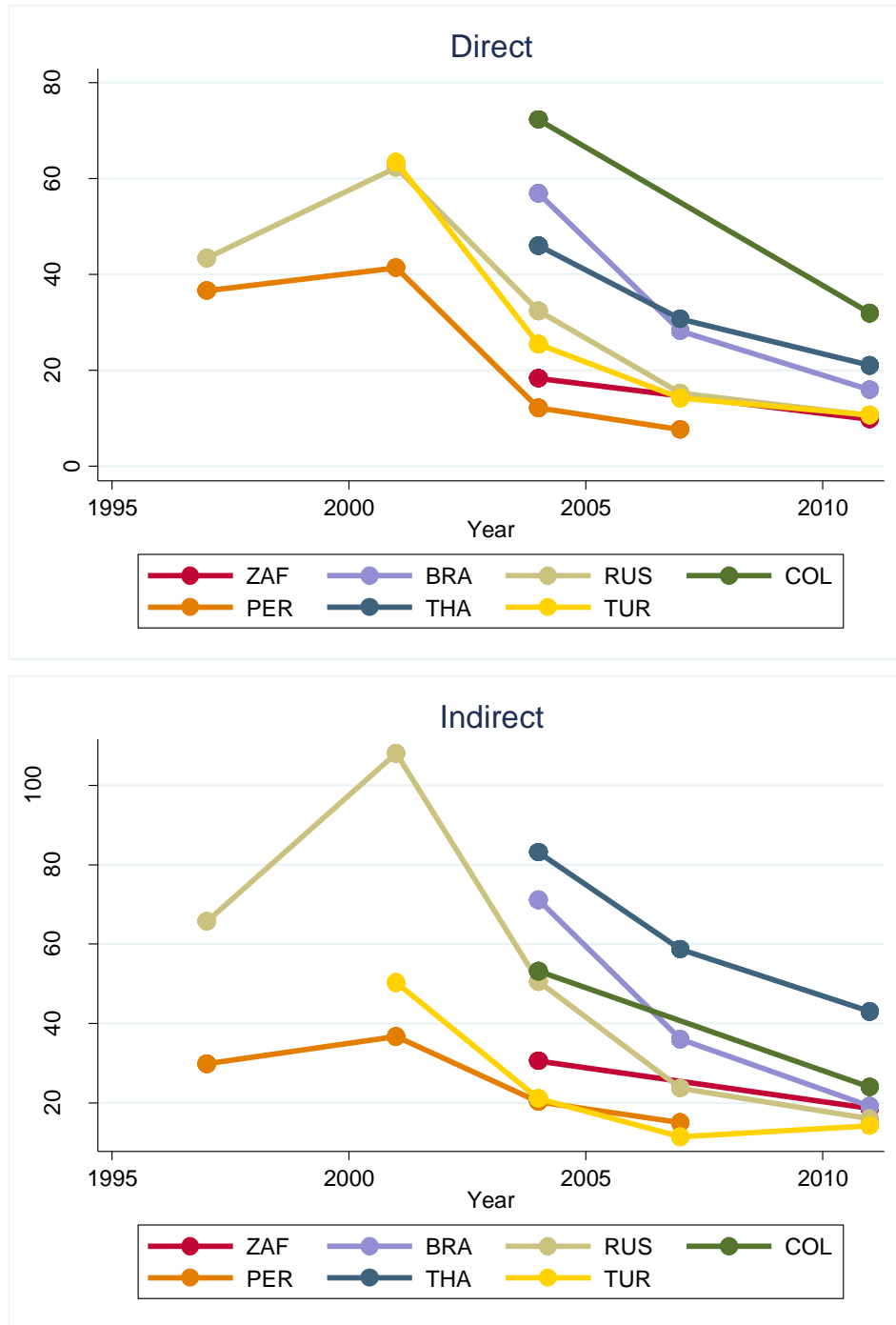
Source: Authors' elaboration based on LACEX.

Table A3: Sectoral correspondences between LACEX and South African Labor Force Survey

Labor value added content	Job content (ILO)	Job content (Labor Force Survey)
Agr, Forestry, Fisheries	Agriculture	Agr, Forestry, Fisheries
Beverages and Tobacco Products	Manufacturing	Processed Food, Bev and Tob
Chemical, Rubber, Plastic Products	Manufacturing	Energy Ext, Chem/Rub/Plast
Construction	Construction	Construction
Dwellings	Real estate, renting	Dwellings
Electricity, Gas, Water	Electricity, gas and water	Electricity, Gas, Water
Energy Extraction	Mining and energy Manufacturing	Energy Ext, Chem/Rub/Plast
Ferrous Metals	Manufacturing	Machinery, Metal Prod, Metal, Ferrous Metal
Leather Products	Manufacturing	Apparel, Textiles, Leather
Machinery and Equipment nec	Manufacturing	Machinery, Metal Prod, Metal, Ferrous Metal
Manufactures nec	Manufacturing	
Metal Products	Manufacturing	Machinery, Metal Prod, Metal, Ferrous Metal
Metals nec	Manufacturing	Machinery, Metal Prod, Metal, Ferrous Metal
Mineral Products nec	Manufacturing	Mineral Products nec
Minerals nec	Mining and energy	Minerals nec
Other Private Services	Financial services, Other commercial services, Tranposrt and communication	Other Private Services
Paper Products, Publishing	Manufacturing	Paper/Pub, Wood Products
Processed Foods	Manufacturing	Processed Food, Bev and Tob
PubAdmin/Defence/Health/Educat	Public services	PubAdmin/Defence/Health/Educat
Textiles	Manufacturing	Apparel, Textiles, Leather
Trade and Transport Services	Transport and communication, Trade, sales and accommodation	Trade and Transport Services
Transport Equipment	Manufacturing	Transport Equipment
Wearing Apparel	Manufacturing	Apparel, Textiles, Leather
Wood Products	Manufacturing	Paper/Pub, Wood Products

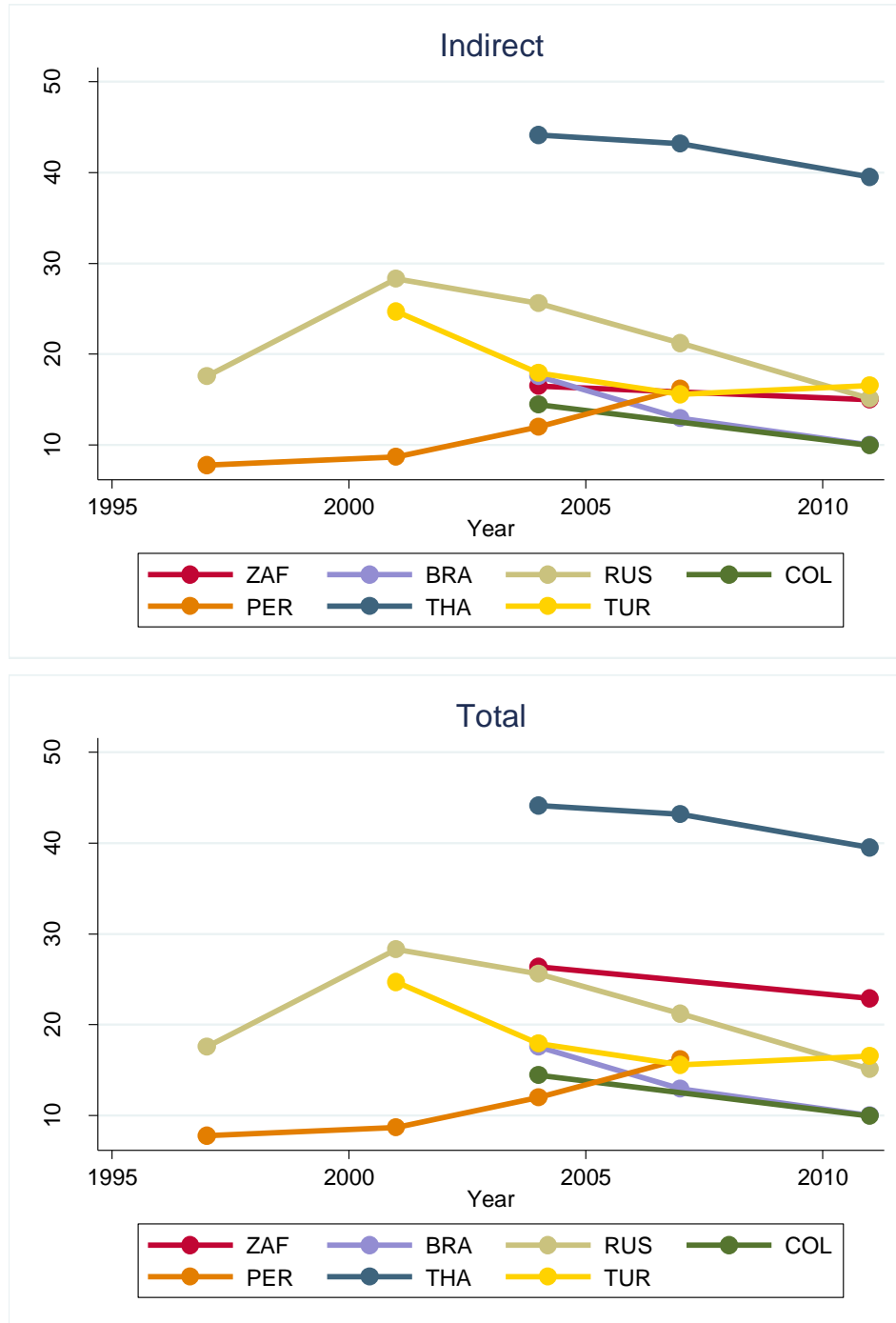
Source: Authors' elaboration.

**Figure A1: Direct and indirect jobs per \$1 million of gross exports
2004-2011**



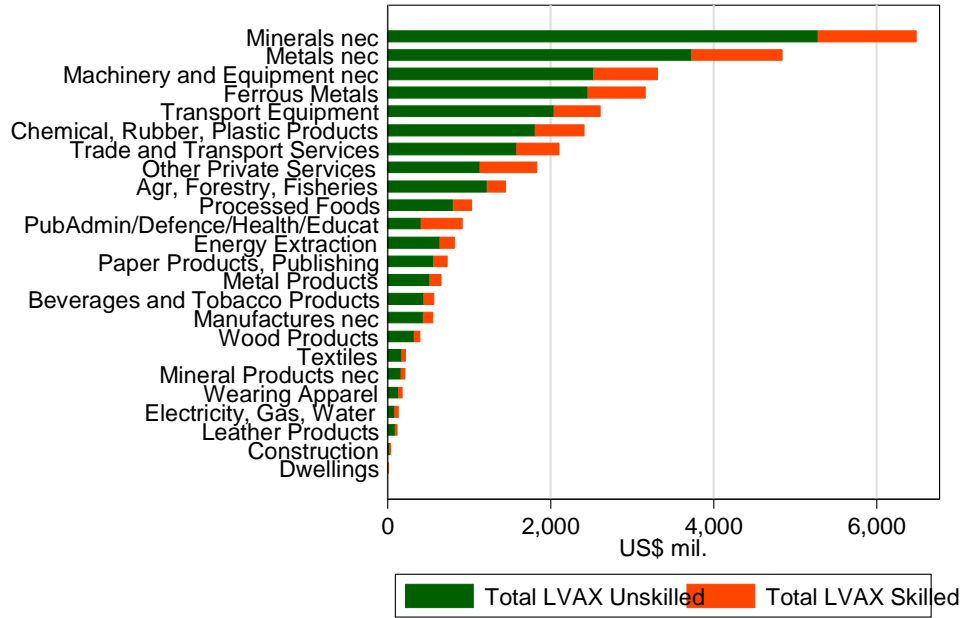
Source: Authors' elaboration based on LACEX.

**Figure A2: Direct and indirect job content of exports as a share of total employment
2004-2011**



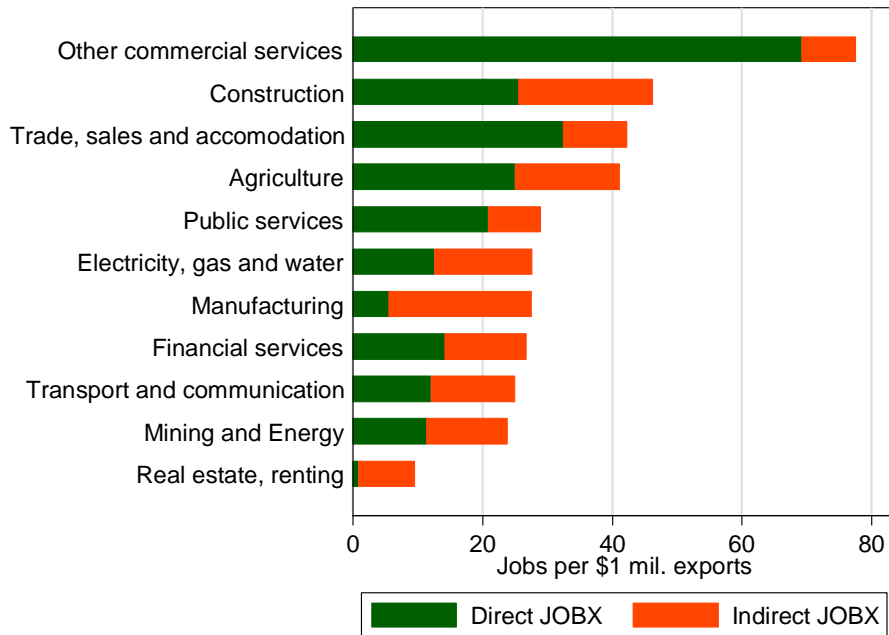
Source: Authors' elaboration based on LACEX.

Figure A3: Skilled and unskilled labor content of exports across sectors, South Africa 2011



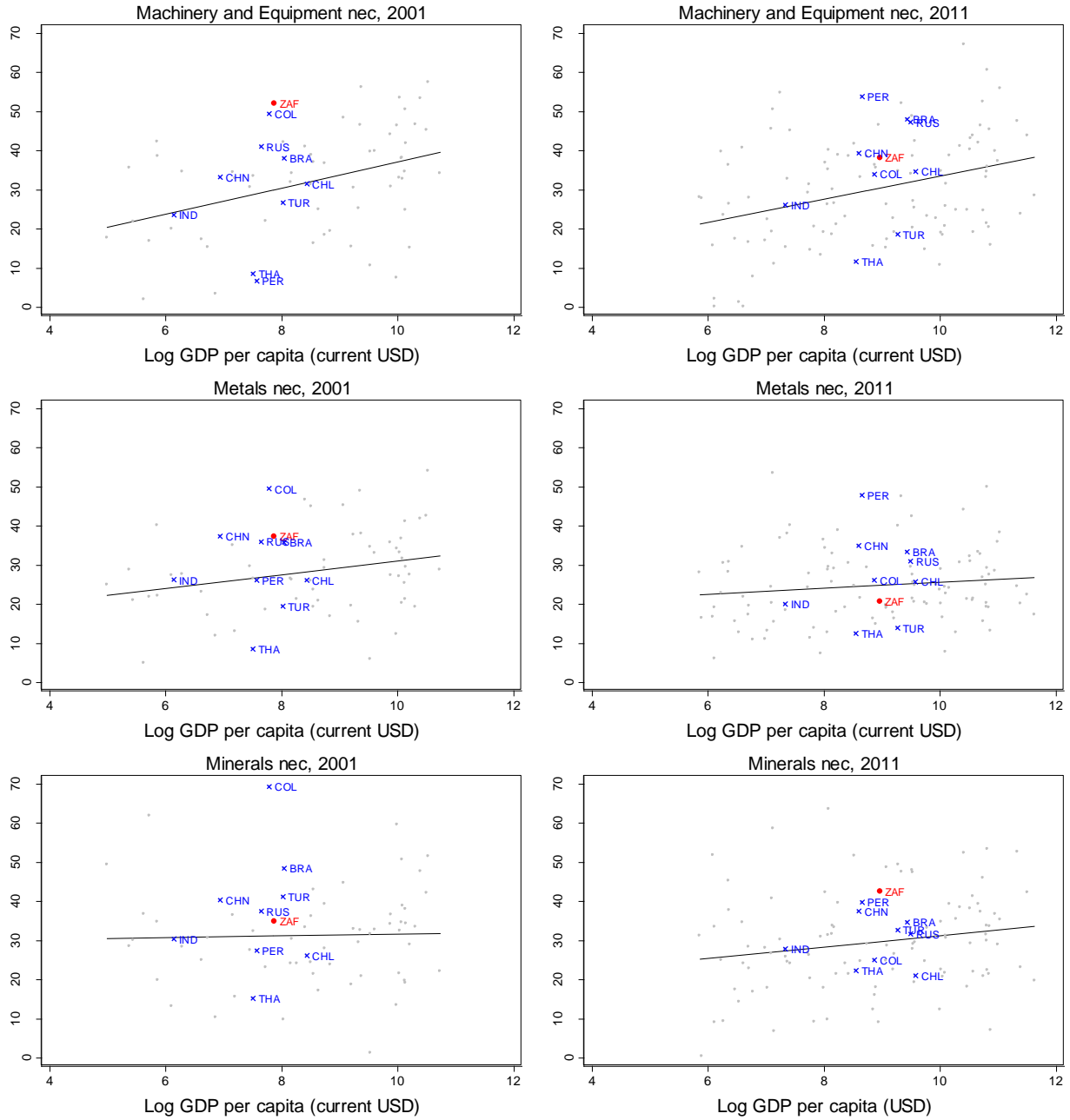
Source: Authors' elaboration based on LACEX.

Figure A4: Direct and indirect job content per \$1 million of gross exports across macro sectors, South Africa 2011



Source: Authors' elaboration based on LACEX.

Figure A5: Total labor content per \$100 of gross exports across sectors and GDP per capita 2001 vs. 2011



Source: Authors' elaboration based on LACEX and World Development Indicators.