Offshoring within South African manufacturing firms: An analysis of the labour market effects[1]

By

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Abstract

The manufacturing sector is important for growth and employment creation. In South Africa, the sector has shown declining growth, poor productivity performance, decreased labour demand and increased imports of intermediate goods (offshoring activities). Offshoring, as documented in the international literature, influences jobs and wages within firms. But, this is nuanced, as it differs in terms of the type of industry and worker. The aim of our paper is to provide this nuanced view of offshoring from a South African perspective. Using firm-level and employer-employee data, we disentangle the impact of offshoring on the labour market in terms of capital- and labour-intensive industries, skilled and unskilled workers and we add another perspective, by considering male and female workers. Offshoring increases the employment of skilled workers in capital intensive firms, while the opposite applies to unskilled workers in both categories. Contrary to international experience, offshoring increases wages in labour intensive, but not in capital intensive firms. As offshoring gains momentum, female earnings increase across all manufacturing firms, while male earnings only show a statistically significant increase in labour-intensive firms.

Keywords: offshoring, firm-level data, employer-employee data, employment, skills, gender, wages

JEL classification: F14, F16

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1. Introduction

Manufacturing is the engine of economic growth (Cantore et al., 2017). Cantore et al. (2017) argue that, although the role of manufacturing in generating growth has been questioned through evidence of, for example, India and the failure of industrialisation in Africa, their evidence shows that manufacturing is still important for economic growth. Thirwall (1983) explains that Kaldor's laws on manufacturing are based on the premise that manufacturing displays dynamic returns to scale. Faster growth in the manufacturing sector leads to faster growth in the economy. Kaldor's laws, which state this relationship between manufacturing growth and GDP growth, have also been tested within an African context by Wells and Thirwall (2004). The authors find that growth in manufacturing is indeed closer associated with GDP growth than sectors such as agriculture and services. However, Cantore et al. (2017) argue that not all types manufacturing value added contribute to growth, and that increased productivity and technological change are key to growth (for example in the case of China).

In South Africa, the manufacturing sector's contribution to GDP has been steadily declining (e.g. 20.4% in 1996 versus 13.5% in 2016) (South African Market Insights, 2018) and has displayed poor productivity performance (albeit heterogeneous between different industries within the sector) (Kreuser and Newman, 2018). Declining growth in the industry has resulted in approximately 250 000 job losses between 2005 and 2014. Of this, the largest decline in jobs was in the textiles industry (91 000). An exception was in the petroleum and chemicals industry, which created 20 000 jobs (StatsSA, 2016). This calls for a nuanced approach in detailing the relationship between manufacturing and employment growth by considering industries as per their intensity level (being capital- or labour intensive) (Zalk, 2014). Indeed, South Africa's economy is highly capital intensive, with costly labour being increasingly substituted by capital. Moreover, labour-intensive sectors have also faced severe competition from low-wage countries after 1995, which resulted in many companies being shut down (World Bank, 2018).

Another trend in the manufacturing sector has been increasing imports of intermediate inputs, for example the South African metals an engineering sector. The percentage increased from approximately 22% 20 years ago, to approximately 35% in recent years (Creamer, 2015). Creamer (2015) explains this trend by detailing rising domestic production costs (including significant increases in electricity and labour) and production volatility (e.g. strikes and power disruptions) as reasons for this trend. This signifies South African manufacturers' increasing involvement in fragmented production networks by engaging in offshoring activities.

As the international literature has shown, these offshoring activities have consequences for manufacturing firms' labour demand (for both skilled and unskilled workers) and wages paid to workers within a firm. For South Africa, this has pertinent importance, as finding the solutions for employment creation within the manufacturing sector in South Africa is challenging, given the current context of the large unskilled workforce. Bhorat and Rhooney (2017), in their analysis of the manufacturing sector, surmise that the manufacturing sector has had a greater demand for skilled workers, relative to semi-skilled and unskilled workers. Indeed, they explain that in absolute terms, "59 000 highly-skilled jobs in manufacturing were created in the South African economy between 2001 and 2014, while 149 000 semi-skilled jobs were lost, and unskilled jobs grew by 9 000" (Bhorat and Rhooney, 2017:9). The question

that arises is to what extent does offshoring play a role in these dynamics? Labour demand and firm dynamics (including entry and exit) are complex within the formal-plus-informal and multi-segment context of the South African labour market. The issue of offshoring is one of the knowledge gaps for efficient and focused policy formulation.

This paper aims to address this gap by answering the following question: "What are the labour market impacts (i.e. wages and employment levels) of offshoring within South African manufacturing firms?" The focus of the paper is both on firm level and worker level. Firm-level analysis informs the extent to which South African manufacturing firms are engaged in offshoring, while the worker-level data provides an indication of the individual wages and number of employees per firm (with different skills levels) subject to offshoring shocks. Understanding the labour market effects of importing activities within fragmented production networks provides first-time firm- and worker-level insights for South Africa that will assist policymakers in laying the path for South Africa's inclusive growth targets, specifically in employment creation within the manufacturing sector.

The paper is outlined as follows: section 2 provides a brief overview of the international literature, section 3 provides the South African literature context, section 4 details the South African manufacturing sector, section 5 contains the data discussion, descriptive statistics and preliminary analysis results, and section 6 concludes.

2. Literature overview

Worldwide, production has become much more fragmented due to firms' increasing offshoring activities (Bandyopadhyay et al., 2017). Different prices for factors allow firms to be efficiency seekers, thereby acquiring better or cheaper resources to enlarge their gains from trade (that arise from specialisation) (Bottini et al., 2007; Hummels et al., 2016). External factors such as lower trade barriers and decreased transport and international telecommunication costs have also contributed to the rise in global production networks (Bottini et al., 2007; Andersson et al., 2016). Offshoring within the manufacturing sector can therefore be defined as the geographical disaggregation of specified production tasks, where component production occurs in a foreign country (Hummels et al., 2016).

How does offshoring affect employment levels and wages? Traditionally, offshoring has been critically viewed within the public domain of developed countries, where it is claimed that low-skilled jobs are exported to developing countries, resulting in large job losses and rising wage inequality (within the home country) (Hsieh and Woo, 2005; Bottini et al., 2007; Hummels et al., 2016). However, the association between offshoring and labour outcomes is not that straightforward. Hummels et al. (2014) (using Danish data) explain that, although offshoring can lead to the displacement of workers (through the importation of an input/intermediate good that was previously produced within the firm), acquiring more cost-effective foreign inputs could have a positive effect through enhanced productivity, which, in turn, leads to higher output, employment levels and wages. However, this is linked to the type of skills level of the worker, where offshoring tends to increase the wages of high-skilled workers and vice versa for low-skilled workers. Feenstra and Hanson (2003) concur with this finding in their study on US data (offshoring results in a lower demand for low-skilled workers and a higher demand, coupled with higher wages, for high-skilled workers).

A vast body of theoretical and empirical literature has emerged on the labour consequences of offshoring over the last two decades (as detailed by Hummels et al., 2016). Andersson et al. (2016) summarise that most of the empirical literature uses industry-level data, where employment data within the industries is garnered on a plant level. They furthermore state that only a limited number of studies employ firm-level data. An even more limited number of studies make use of matched employer-employee data. Hummels et al. (2016) explain that this type of data has only recently been used to study the offshoring effects on labour market outcomes. Such data has information on firm and worker characteristics and allows researchers to track workers over time. In particular, Hummels et al. (2016:44) state that "Matched employer-employee data allow researchers to accurately measure offshoring, and cleanly identify the causal effects of offshoring on wages". A further contribution of this paper is therefore to the international literature in the application of offshoring using employer-employee data within a developing country context. We also add the impact of gender to this perspective, which is an important part of the overall influence of offshoring on labour demand and wages (Peri and Poole, 2012).

We argue that this area deserves specific mention as it is widely accepted that the rapid expansion of manufactured exports of developing countries has impacted female workers far more significantly than their male counterparts (Wood, 1991:168). Wood (1991) revisited the accepted facts surrounding North-South trade and female labour. By calculating the change in the female intensity of manufacturing from the early 1960s to the mid-1980s relative to the change in the female intensity of the non-traded sectors, he found that increased exports from the developing South to the global North have increased the relative demand for female labour in the South (Wood, 1991). Practically speaking, it implies that developing countries that export more to the North employed a rising proportion of females in their manufacturing industry.

A more recent study by Shepherd and Stone (2013) used the World Bank's Enterprise Survey data of 100 000 firms from 115 mostly developing and transition economies. Their results indicated a significant positive correlation between the percentage of female employees and firms with international linkages (used as a proxy for global value chain investment) (Shepherd and Stone, 2013).

The particular institutional context of South Africa's labour relations dispensation may also play a role in the possible influence of offshoring on the gender composition of the labour force in the South African manufacturing sector. As women are regarded as a designated group, this may influence the hiring practices of firms in manufacturing industries to gain the best possible outcome in terms of the provisions and targets of the relevant legislation. This must, however, be tested empirically.

3. South African literature context

Various South African studies have considered the labour market effect of increased exports. Edwards (2001) provides a summary of some of the earlier literature. These include one of the first studies in this field by Bell and Cattaneo (1997). Exports did increase employment in manufacturing between 1985 and 1993, but decreases in the labour coefficients of exports

compared to manufacturing and imports reduced the growth rate of employment as a result of an increase in exports (Edwards, 2001). Edwards (1999) extended the time period to 1997 in order to take the impact of the tariff liberalisation programme initiated in 1994 into account. The results were generally consistent with the Bell and Cattaneo (1997) study. In his 2001 paper, Edwards' results did not support the notion that trade liberalisation was the reason for the decline in employment since the late 1980s; although export-led employment growth was unable to reduce unemployment (Edwards, 2001).

However, no specific reference to the impact of offshoring is available. Pretorius and Blaauw (2005), for example, analysed industry data for the period 1993 to 2001, and found that the higher the ratio of exports to domestic sales, the more workers are employed – but highly-skilled workers and not semi- and unskilled workers. A follow-up study by Pretorius and Blaauw (2018) does consider the impact of imported inputs on industry employment levels. Highly-skilled and skilled employment respond positively to increases in the ratio between imported and local inputs for manufacturing; the same observation is not made for the semi- and unskilled categories of employment.

This paper builds on previous trade- and labour-related studies conducted on the SARS administrative data (see Matthee et al. (2018), Matthee et al. (2017) and Edwards et al. (2018)). Matthee et al. (2018) examine the characteristics of manufacturing exporters, while Matthee et al. (2017) add an understanding of the labour dynamics of this manufacturing sector. Edwards et al.'s (2018) study contains a wider scope by including importers of intermediate inputs. They found that importing intermediates increases exports, especially imports that are sourced from developed countries. They also found that two-way traders (importing inputs and exporting output) are more productive, employ more workers and pay higher wages than exporters only and importers only.

It is here where this paper contributes to and expands the body of existing work on administrative data by investigating offshoring within the South African manufacturing context. As indicated above, the literature on offshoring considers the importation intermediate inputs and it has labour implications for workers in the manufacturing industry.

4. Brief overview of the South African manufacturing sector

The South African manufacturing sector was the fourth largest contributor (13.5%) to economic activity in 2014. Annual growth of the sector declined from 5.9% in 2010 to 0.1% in 2014, although earnings in the industry increased from R634 318 million to just over R2 trillion in 2014. The highest earning sector in the industry is petroleum and chemical products (34%), followed by food and beverages (17%), metals and machinery (17%), transport equipment (15%), other (12%) and wood, paper and publishing (6%). Metals and machinery employ the most workers (21%), followed by food and beverages (19%), petroleum and chemical (15%), other (15%), wood, paper and publishing (11%), textiles and clothing (10%), and transport equipment (9%) (StatsSA, 2016).

The proportion of firms in the sector earning the top 5% increased from 13% in 2010 to 16% in 2014. Income earned by the top 10% firms increases the percentage in 2016 to 26%, indicating a fairly concentrated industry. Large firms contribute 82% of income and employ 46% of the manufacturing workforce. The numbers for medium, small and micro-firms vary

only slightly. The average annual salary of the entire manufacturing sector is R183 417; the highest salaries are earned in the petroleum and chemical sector (R265 871) and the lowest in the textile sector (R69 443).

5. Empirical analysis

5.1 Data

Hummels et al. (2014: 1604) describe broad offshoring as the "total value of imports by manufacturing firm per year" and narrow offshoring as "purchases of inputs belonging to the same industry as that of the producing firm". They continue to state that narrow offshoring takes place when a firm imports goods classified in the same HS4 category than the products that the firm sells – both domestic and internationally. Therefore, the closer the imported products are to the final product, the more likely it is that labour within the firm could have produced it and that job losses may occur if imports increase.

Our broad offshoring measure is provided in the CIT panel as the total rand value of imports (variable name: cust_imp_total). Since the dataset does not provide an indication of the HS4 codes of products sold domestically, we disregard the domestic sales classification criterion and define narrow offshoring firms (narrow offshorers) as those firms for which the HS4 code of their most recurrent/most traded imported product and the HS4 code of their most recurrent exporting product coincide (variables: mainHS4import and mainHS4export). This definition may be more limiting and narrower than the one proposed by Hummels et al. (2014), but very appropriate within the context of the available data.

We investigate the labour market effects of offshoring within South African manufacturing firms on firm level as well as on employer-employee level. Firstly, the CIT-IRP5 panel data V0.4 is utilised for the firm-level analysis. This panel consists of matched firm-level data from three tax forms, namely the company income tax (CIT) form, customs transaction form and worker-level tax form (IRP5 certificates). The following list of variables is utilised; g_sales to measure sales, k_ppe to measure capital, irp5_empl_weight to measure number of employees, x_labcost to measure employee expenses, ISIC4 code to classify the type of manufacturing firm, and HS4 product code of most traded good per firm to create the narrow offshoring dummy (as discussed above). By using the raw IRP5 data, we are also able to create a variable indicating the percentage of employees in a firm earning 'skilled' and 'unskilled' salaries. The skills threshold is determined from Quantec's average nominal salaries for low-skilled and high-skilled workers in the manufacturing industry for 2009 to 2014.

Secondly, to create an employer-employee matched dataset (of the manufacturing sector), the CIT-IRP5 panel data V0.4 on firm-level is matched onto the employee-level data (IRP5 certificates). The raw IRP5 data is adjusted to remove duplicate certificates, multiple job spells and invalid periods worked (see Table A1 in the Appendix). The IRP5 certificates include information on the number of days an individual worked in a specific job (start and end date), their income earned (in South African rand value), their birthdate (from which their age can be determined), and their gender (male of female). As the number of days worked differ between jobs, the monthly wages variable is calculated by taking the income and dividing it by the number of days worked (to get the daily wage equivalent). This is then multiplied by

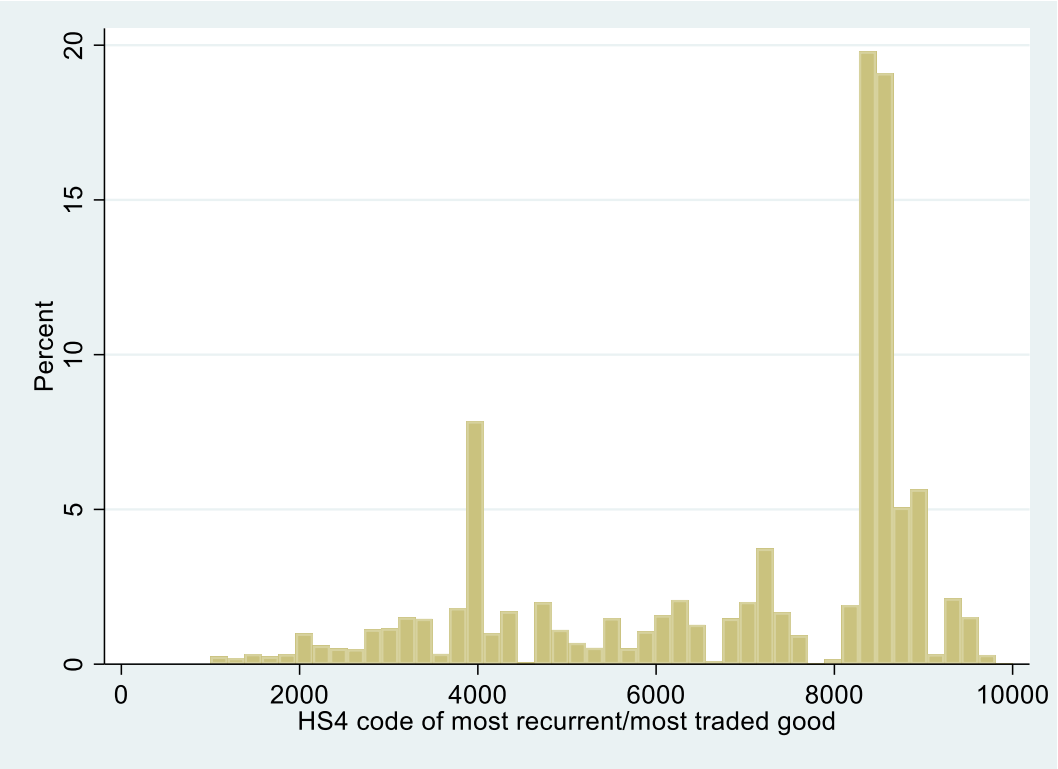
30, to get the monthly equivalent wages. Even though the final panel dataset is from 2010 to 2014, the tenure of each job was calculated by using the IRP5 data from 2009 to 2014. To create a measure of firm size, the number of employees per firm was calculated using a full-time equivalent over each year (i.e. number of days worked across all workers in a firm/365).

5.2 Preliminary results

Offshoring vs narrow offshoring

What do manufacturing firms import? While Danish firms mainly import raw materials (see Hummels et al., 2014), the same is not true for South African manufacturing firms. Information supplied in the firm-level panel identifies the HS4 codes of the most recurrent import product per firm – see Figure 1 below. The vertical axis shows the percentage of firms for which the specific HS4 product code on the horizontal axis is the main import – for all firms across all years in the panel.

Figure 1: Most imported products per HS4 classification



Source: SARS data

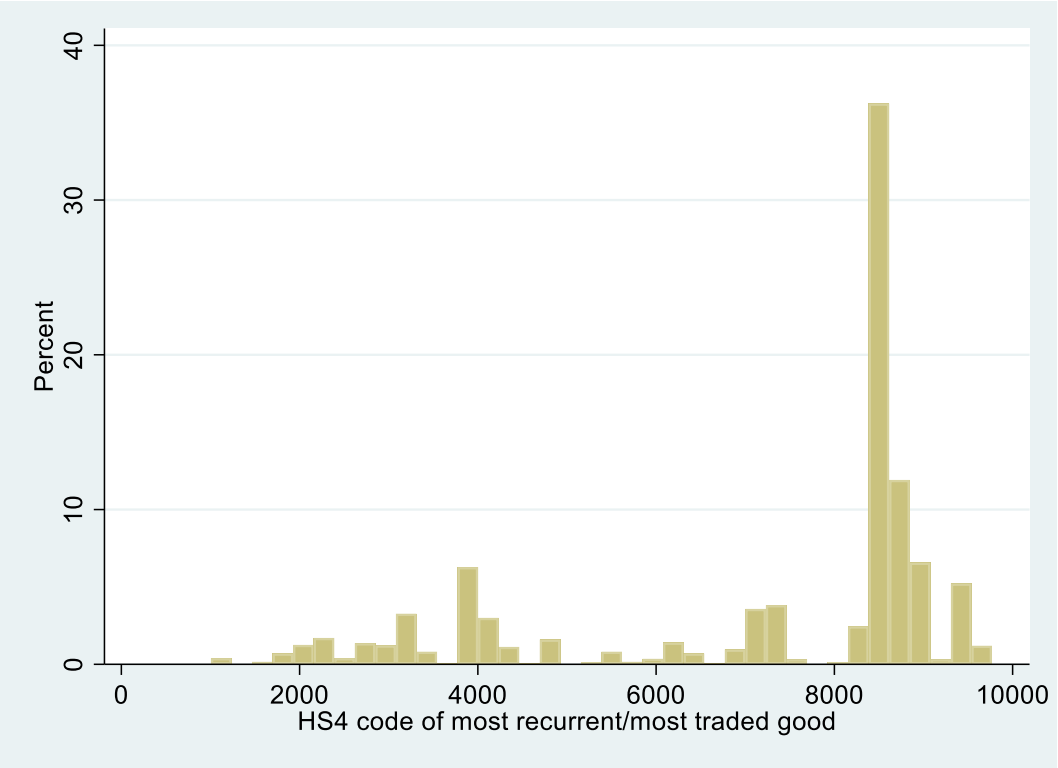
The spikes in Figure 1 appear around the following HS2 categories:

- 84 “Nuclear reactors, boilers, machinery and mechanical appliances; parts thereof”
- 90 “Optical, photographic, cinematographic, measuring, checking, medical or surgical instruments and apparatus; parts and accessories”
- 39 “Plastics and articles thereof”

Raw materials, according to Hummels et al. (2014: 1604), fall in the HS2 categories 01-15, 25-27, 31 and 41. From Figure 1, it is evident that raw materials are not that important in the import basket of South African firms.

Focusing only on the narrow offshorers, Figure 2 displays the HS4 code on the horizontal axis and the percentage of firms involved in narrow offshoring according to our restricted narrow definition.

Figure 2: HS4 codes of products involved in narrow offshoring



Source: SARS data

The major spikes in Figure 2 correspond with the spikes in Figure 1. However, as expected, not all the imported products feature simultaneously as exports. The following products, on HS2 level, are the most often observed in narrow offshoring:

- 84 “Nuclear reactors, boilers, machinery and mechanical appliances; parts thereof”
- 87 “Vehicles; other than railway or tramway rolling stock, and parts and accessories thereof”
- 90 “Optical, photographic, cinematographic, measuring, checking, medical or surgical instruments and apparatus; parts and accessories”
- 88 “Aircraft, spacecraft and parts thereof”
- 85 “Electrical machinery and equipment and parts thereof; sound recorders and reproducers; television image and sound recorders and reproducers, parts and accessories of such”
- 94 “Furniture; bedding, mattresses, mattress supports, cushions and similar stuffed furnishings; lamps and lighting fittings, n.e.s.; illuminated signs, illuminated name-plates and”
- 73 “Iron or steel articles”
- 22 “Beverages, spirits and vinegar”

How many firms are involved? The CIT firm-level data spans over the period 2008 to 2014, with the number of firms increasing every year. Table 1 compares the number of firms in

three different samples between 2009 and 2014. Similar studies involving this panel ignore 2008 due to the financial crisis; however, South Africa only experienced the impact of the global crisis in 2009 – therefore, the regressions are run over the whole period (2008-2014), while the comparison in Table 1 is only done between 2009 and 2014.

The current sample includes a total of 28 755 manufacturing firms in 2009, of which 14.62% imported one or more product and 1.99% engaged in narrow offshoring – with main imports and main exports classified in the same HS4 product code. The number of manufacturing firms increased to 33 345 in 2014. The number of importers and narrow offshorers also increased – but at a faster rate. In 2014, 22.07% of firms were importers and 3.75% narrow offshorers.

Table 1: Comparing number of firms in manufacturing categories over time

	2014					2009				
ISIC4	Manufacturing	All offshorers		Narrow offshorers		Manufacturing	All offshorers		Narrow offshorers	
	# firms	# firms	% of total	# firms	% of total	# firms	# firms	% of total	# firms	% of total
All firms	33345	7358	22.07	1252	3.75	28755	4205	14.62	573	1.99
1010	2938	348	11.84	41	1.40	2597	24	0.92	19	0.73
1011	569	124	21.79	21	3.69	412	80	19.42	7	1.70
1012	51	15	29.41	3	5.88	45	8	17.78	1	2.22
1013	954	335	35.12	31	3.25	860	229	26.63	17	1.98
1014	766	239	31.20	15	1.96	746	162	21.72	6	0.80
1015	362	145	40.06	16	4.42	326	89	27.30	12	3.68
1016	693	95	13.71	14	2.02	648	51	7.87	8	1.23
1017	548	176	32.12	18	3.28	454	82	18.06	4	0.88
1018	1807	251	13.89	34	1.88	1501	95	6.33	6	0.40
1019	781	51	6.53	16	2.05	625	28	4.48	6	0.96
1012	1503	473	31.47	72	4.79	1266	299	23.62	39	3.08
1021	124	46	37.10	11	8.87	123	41	33.33	5	4.07
1022	878	282	32.12	35	3.99	724	148	20.44	17	2.35
1023	1142	174	15.24	25	2.19	1054	97	9.20	7	0.66
1024	1388	296	21.33	39	2.81	1221	165	13.51	24	1.97
1025	3228	723	22.40	128	3.97	2630	380	14.45	51	1.94
1026	568	207	36.44	47	8.27	458	130	28.38	13	2.84
1027	730	162	22.19	24	3.29	570	84	14.74	12	2.11
1028	3588	1082	30.16	229	6.38	3041	687	22.59	113	3.72
1029	4548	501	11.02	114	2.51	3794	328	8.65	66	1.74
1030	852	151	17.72	41	4.81	781	93	11.91	20	2.56
1031	952	157	16.49	36	3.78	877	64	7.30	9	1.03
1032	3482	1211	34.78	232	6.66	3273	784	23.95	106	3.24
1033	893	114	12.77	10	1.12	729	57	7.82	5	0.69

Source: SARS data

In order to refine the analysis, the number of firms is also reported per ISIC4 industry – see appendix for description of each ISIC4 code (table A2). Interestingly, there are offshorers as well as narrow offshorers in each of the industries. Added to that, the percentage of importing firms and narrow offshorers increased in all industries between 2009 and 2014. In 2014, the highest percentage of importers (40.06% of all firms) were in 1015 “Manufacture of leather and related products”, followed by 1021 “Manufacture of pharmaceuticals, medicinal chemical and botanical products” with 37.10% and 1026 “Manufacture of computer, electronic and optical products” with 36.44%. The industries with the least importing firms

were in 1019 “Manufacture of coke and refined petroleum products” (6.53%), 1029 “Vehicles” (11.02%) and 1010 “Manufacture of food products” (11.84%). Narrow offshorers, as a percentage of the total number of firms, were the highest in 1021 “Manufacture of pharmaceuticals, medicinal chemical and botanical products” (8.87%), 1026 “Manufacture of computer, electronic and optical products” (8.27%) and 1032 “Other manufacturing” (6.66%). The lowest percentage of offshorers was in 1033 “Repair and installation of machinery and equipment”, 1010 “Manufacture of food products” and 1018 “Printing and reproduction of recorded media”.

Considering the 1 252 narrow offshorers in 2014, the largest share was from “Other manufacturing” 1032 (18.5%); “Machinery and equipment” 1028 (18.3%); “Metal products” 1025 (10.2%); “Vehicles” 1029 (9.1%); and “Chemicals” 1020 (5.8%) – 56.1% in total. This list corresponds with the specific products (at HS4 level) identified in Figure 2, as those were the main import and export products.

In order to compare key indicators across the three categories of manufacturing firms, Table 2 provides a profile by summarising the mean values across all firms included in the panel across all the years.

Table 2: Mean values for key indicators in the firm level panel

	All manufacturing firms	**All offshorers**	**Narrow offshorers**
Number of firms	229 277.00	48 305.00	7 845.00
Number of workers	33.00	76.99	89.02
Sales	47 100 000.00	155 000 000.00	291 000 000.00
Capital per worker	355 239.40	528 907.90	1 292 008.00
Salary per worker	217 237.40	318 861.20	325 740.50
Net profit	4 532 773.00	14 800 000.00	19 300 000.00
Profit as % of sales	9.62	9.55	6.63
log workers	2.22	2.88	3.16
log sales	15.44	16.64	17.28
log capital per worker	10.03	10.52	10.48
log salary per worker	11.53	11.82	12.05
log net profit	12.52	13.83	14.45

Source: SARS data

Except for net profit, all indicators show the same trend. The mean values for the total sample of manufacturing firms are the lowest; it then increases for the group of firms that import and is the highest for the group engaging in narrow offshoring. In this regard, the mean number of workers employed in manufacturing firms is 33, compared to 77 in importing firms and 89 in narrow offshoring firms. The rand amount of sales also increases across the three columns of Table 2. The mean net profit as a percentage of sales, however, shows a declining trend across the three columns. Narrow offshorers realised a mean value of 6.63% net profit as a percentage of sales compared to a higher 9.62% for all manufacturing firms. The amount of capital per worker increases relatively more between importer and narrow offshorer, while the mean salary per worker for narrow offshorers does not increase proportionally with the

other indicators. This corresponds with Amiti and Davis' (2011) study on Indonesian]manufacturing firms, where they found that exporters pay eight to 28% higher wages, importers pay 15 to 47% higher wages, and two-way traders 25 to 66% higher wages than non-traders do (depending on the controls implemented).

Offshoring and the labour market

Our regression analysis focuses on the number of employees (labour demand) and wages in manufacturing. The theoretical basis for the specification is found in the literature. Andersson et al. (2017) estimate labour demand as a function of the level of capital in the firm as well as the level of output (or production). They further add the relative wage between skilled and unskilled workers when estimating demand specifically for skilled or unskilled workers. Previous studies on this data set also included output as proxy for firm size (see Edwards et al. (2018) and Matthee et al. (2018) as examples). Skilled wage levels in firms are explained by Hsieh and Woo (2005) in terms of outsourcing, capital labour ratio and output. The specification is based on a cost function of a production process with constant returns to scale and treating skilled and unskilled labour as variable cost.

Given the available data, we follow Hummels et al. (2014) and Andersson et al. (2017) to determine the effect of offshoring on labour demand for various types of firms / workers. To capture the relationship between offshoring and the labour market on firm level, we estimate the following regression equation:

$$\log(X)_{it} = \alpha + \beta_1 Imports_{it} + \beta_2\, Imports * narrow_{it} + \beta_3 capital_{it} + \beta_4 sales_{it} + i_i + y_t + v_i + u_{it} \quad (1)$$

Where:

X_{it} – log of firm characteristics, namely: number of workers, percentage of skilled workers, percentage of unskilled workers, salary per worker, number of male and female workers.

$Imports_{it}$ – log value of imports (which is our broad definition of offshoring, which gauges the effect of all imports, irrespective of what the firm exports (we do not have type of products sold domestically to our disposal))

$Imports * narrow_{it}$– Interaction term between imports and the narrow offshoring dummy (this considers the effect of the narrow offshorers, i.e. those firms who import and export in the same HS4 categories)

$capital_{it}$ – log capital

$sales_{it}$– log sales

i_i – Industry fixed effects

y_i – Year fixed effects

v_i– Firm fixed effects

μ_{it} – Error term

We also capture the relationship between offshoring and the labour market on worker level, by estimating the following regression equation:

$$\log(X)_{jit} = \alpha + \beta_1 Imports_{it} + \beta_2 Imports * narrow_{it} + \beta_3 individual_{jit} + \beta_4 capital_{it} + \beta_5 sales_{it} + i_{ji} + y_{jt} + z_{ji} + u_{jit} \quad (2)$$

Where:

X_{it} – individual's monthly earnings

$Imports_{it}$ – log value of imports

$Imports * narrow_{it}$– interaction term between imports and the narrow offshoring dummy

$individual_{jit}$– control for individual characteristics (age and tenure)

$capital_{it}$ – log capital

$\beta_4 sales_{it}$– log sales

i_{ji} – Industry fixed effects

y_{jt} – Year fixed effects

z_{ji}– Job fixed effects

μ_{jit} – Error term

Additional to the above specification, the use of instrumental variables is essential in the analysis in order to address possible endogeneity. A brief explanation of the endogeneity problem follows: This analysis revolves around the impact of imported inputs on a firm's labour demand. A firm can, due to endogenous reasons, import more inputs, which would influence its labour demand. For example, a more productive firm would import more inputs, pay higher wages, export more, and be more capital intensive. Therefore, an endogeneity problem can occur when examining the effect of imported inputs on a firm's labour demand. Are the changes in labour demand due to a firm being more productive, or is it because the firm has started importing more inputs due to an exogenous reason? The solution would be to find an exogenous shock that would result in a firm importing more inputs, irrespective of its productivity and wage structure. This requires the use of an instrument. Usually, a major change in policy would act as such an instrument. However, in the absence of such policy changes (i.e. where the trade environment is stable, without significant changes in trade policy), it is suggested in the literature that an import flow, namely world export supply (WES),

is used (see for example Balsvik and Birkeland, 2012; Hummels et al., 2014; Andersson et al., 2017).

Suppose firm i imports product p from country c. The WES instrument would be country c's export of product p to the rest of the world, minus South Africa, in year t. Now suppose there is a shock that changes the export supply of product p by country c. This shock could be due to an increase in the supply by country c due to more product varieties and better-quality products offered, higher productivity and lower wages and costs. The import of product p by firm i from country c will therefore be affected by this shock – firm i will import more and this will subsequently impact its labour demand. The change in labour demand is then completely exogenous to/does not correlate with the firm's own wage setting and productivity. This will differ across all importing firms, as they each import a different mix of product p.

Hummels et al. (2016) conclude that these instruments are particularly well suited for employer-employee data, where endogeneity is likely to be a serious concern. Similar to Kreuser and Newman (2018) and Matthee et al. (2018), tests will be performed to confirm the validity of chosen instrumental variables. Various F-tests as well as Hansen's J-test will be employed to test for under-identification, weak identification, excluded instruments and over-identification.

We therefore propose to follow Andersson et al. (2017) and Hummels et al. (2014) by using world export demand. We will, in a similar fashion, obtain the data from COMTRADE on an HS4 level for each country-year observation. Anderson et al. (2017:245) explain that to obtain a firm-level instrument, "world export supply (demand) in year t will be multiplied with the offshoring intensity in year t_1 for each firm i matched at the country, c, and product level, p":[2]

$$WES_{it} = \sum_{cp} \frac{M_{i,t-1,c,p}}{Q_{i,t-1}} \times WE_{t,c,p} \quad WID_{it} = \sum_{cp} \frac{E_{i,t-1,c,p}}{Q_{i,t-1}} \times WI_{t,c,p}. \tag{3}$$

To start the empirical analysis, we firstly consider firm-level employment, by estimating equation 1. Table 3 reports regression results from the firm-level panel. Apart from the log of imports, the impact of offshoring is also tested by including an interactive variable, log imports multiplied by narrow offshoring. The first column indicates no significant impact of offshoring on employment for the complete sample of manufacturing firms – despite accounting for firm and industry fixed effects. This may be due to heterogeneity and substantial differences between the various manufacturing industries. We subsequently decided to also run the regressions for two sub-samples of the panel to test whether the impact of offshoring differs between firms with differing capital (labour) intensity. The following two columns therefore report results for labour-intensive and capital-intensive firms, respectively.[3]

[2] This first draft of the paper does not include instrumental variables in the analysis. This is currently work in progress and will be reported in the next version of the paper.

[3] All values sourced from the tax sources are reported in nominal values. Similar to Edwards et al. (2018), the nominal values are used in the regression analysis, combined with year fixed effects.

Table 3: Regression results with log number of workers as dependent variable

	All manufacturing	Labour intensive	Capital intensive	Instrumental variable regression to be completed
log sales	0.320*** (0.016)	0.288*** (0.025)	0.356*** (0.034)	
log capital	0.015*** (0.002)	0.016*** (0.003)	0.012* (0.006)	
log imports	0.003 (0.003)	-0.011** (0.005)	0.015* (0.008)	
log imports*narrow	0.000 (0.001)	0.001 (0.001)	-0.002 (0.002)	
Industry fixed effects	Yes	Yes	Yes	
Year fixed effects	Yes	Yes	Yes	
Firm fixed effects	Yes	Yes	Yes	
Instruments	No	No	No	Yes
Observations	38 637	13 574	7 138	
R-squared	0.575	0.561	0.544	

Source: SARS data
Robust standard errors in parentheses
****p<0.01; **p<0.05; *p<0.1*

Various measures are available to determine the factor intensity of production. Since the data is primarily provided in an accounting and tax environment, we do not base such classification on capital labour ratios calculated from this dataset. As an alternative measure, we use the classification of the South African manufacturing sector as described and employed in Edwards (2001)[4]. Regression results are reported for the total panel of manufacturing firms, as well as for two sub-groups – labour intensive and capital-intensive industries. Results for ultra-labour-intensive and intermediate capital-intensive industries are not reported, as they did not render statistically significant results.

Separate regressions for capital and labour intensive firms do render statistically significant results for offshoring. In labour intensive firms, increased imports lead to employment losses (significant at the 5% level), while the opposite is observed for capital intensive firms (significant at the 10% level). Increased imports lead to employment gains in capital intensive firms. If one considers workers in labour intensive firms to be less skilled than workers in capital intensive firms, this observation corresponds with that of Feenstra and Hanson (2003) when they found offshoring to lower demand for low-skilled workers and higher demand for high-skilled workers in the US. The negative coefficient for firms engaged in narrow offshoring provides some indication that the employment gains are less for this group of importers, probably because the imported product closely resembles the final product sold. It is therefore more likely that imports can replace employment in these firms. This estimate is, however, only significant at 18% and as such this effect is not supported by enough statistical backing.

[4] A list of the ISIC4 classification codes, descriptions and factor intensity classification appears in Appendix A (Table A2).

We secondly consider employment according to skills level. Similar international studies, particularly from Scandinavia, are based on detailed information about individuals: education level, union membership, marital status, etc. The South African IRP5 data/worker-level data contains no such information – and the biggest shortcoming is the lack of an education indicator or skills-level proxy. Previous studies on CIT data used a salary of R20 000 per month as a proxy for skilled workers (see Edwards et al., 2018). We employ an alternative approach. An alternative source of time-series data on the manufacturing sector, Quantec (2018), provides annual data regarding the number of unskilled, semi-skilled and skilled workers employed. They also provide the annual total wage bill for each of these three categories of workers. We used this data to calculate the average monthly salary per worker in the skilled and unskilled categories. Information on worker level, i.e. data from the IRP5 panel, allows us to calculate what percentage of workers falls into these two categories for each firm. For manufacturing firms in this panel, on average, 4.6% of their workers are considered to be skilled and 77.1% to be unskilled – and the trend observed in Table 2 again repeats for the other two groupings. The skilled percentage for importing firms increases to 9.08% and the unskilled decreases to 66.19%; while narrow offshorers employ relatively more skilled workers at 13.13% of the workforce and the fewest unskilled workers at 58.64% of the workforce.

Tables 4 and 5 summarise the regression results of estimating equation 1 with "percentage of skilled workers" and "percentage of unskilled workers" as dependent variables. Because the reporting method/structure for SARS changed in 2010, data from the IRP5 forms is only considered from the 2010 tax year. The number of observations for this part of the analysis is therefore less than for the firm-level analysis reported in Table 3.

Table 4: Regression results with percentage of skilled workers as dependent variable

	All manufacturing	**Labour intensive**	**Capital intensive**	**Instrumental variable inclusion to be completed**
log sales	0.225 (0.271)	0.138 (0.403)	-0.019 (0.714)	
log capital	0.056 (0.058)	0.067 (0.108)	-0.082 (0.126)	
log imports	0.032 (0.064)	0.040 (0.086)	0.362** (0.163)	
log imports*narrow	-0.000 (0.018)	-0.035 (0.030)	-0.080* (0.046)	
Industry fixed effects	Yes	Yes	Yes	
Year fixed effects	Yes	Yes	Yes	
Firm fixed effects	Yes	Yes	Yes	
Instruments	No	No	No	Yes
Observations	31 922	11 208	5 860	
R-squared	0.008	0.039	0.057	

Source: SARS data

Robust standard errors in parentheses
****p<0.01; **p<0.05; *p<0.1*

None of the offshoring indicators is significant in explaining the percentage of skilled workers employed per labour intensive firm. For capital intensive firms, the picture is completely different. Rising levels of imports increase the percentage of skilled workers in capital-intensive firms. Again, as expected, this increase is slightly less for narrow offshorers. The notion that imported inputs lead to technological transfer, more productive workers and up-skilling of workers may provide an explanation for these results.

Table 5: Regression results with percentage of unskilled workers as dependent variable

	All manufacturing	**Labour intensive**	**Capital intensive**	**Instrumental variable inclusion to be completed**
log sales	-0.632* (0.387)	-0.363 (0.630)	-0.690 (0.877)	
log capital	0.009 (0.090)	-0.034 (0.143)	0.319 (0.279)	
log imports	-0.218** (0.093)	-0.295* (0.172)	-0.361** (0.167)	
log imports*narrow	0.014 (0.024)	-0.010 (0.038)	0.118* (0.067)	
Industry fixed effects	Yes	Yes	Yes	
Year fixed effects	Yes	Yes	Yes	
Firm fixed effects	Yes	Yes	Yes	
Instruments	No	No	No	Yes
Observations	31 922	11 208	5 860	
R-squared	0.026	0.003	0.037	

Source: SARS data
Robust standard errors in parentheses
****p<0.01; **p<0.05; *p<0.1*

Table 5 paints a bleak picture for unskilled employment. For manufacturing, overall and in both categories of capital and labour-intensive firms, increased imports are linked to a relative decline in unskilled workers. The decline is less for narrow offshorers than for offshorers in general. This corresponds with the trends in the international literature, in that offshoring is detrimental to low-skilled workers and in favour of high-skilled workers (Bottini et al., 2007).

Thirdly, we consider firm-level salaries. The firm-level panel provides a very crude indicator for salary per worker in the form of total labour cost per firm divided by the number of workers per firm. Table 6 again reports separate results for labour- and capital-intensive firms.

Table 6: Regression results with log salary per worker as dependent variable

	All manufacturing	**Labour intensive**	**Capital intensive**	**Instrumental variable**

				inclusion to be completed
log sales	0.128*** (0.028)	0.118*** (0.029)	0.126** (0.053)	
log capital	-0.006* (0.004)	-0.009* (0.005)	-0.012 (0.010)	
log imports	0.004 (0.004)	0.018*** (0.006)	-0.000 (0.009)	
log imports*narrow	-0.001 (0.001)	-0.003 (0.002)	-0.000 (0.002)	
Industry fixed effects	Yes	Yes	Yes	
Year fixed effects	Yes	Yes	Yes	
Firm fixed effects	Yes	Yes	Yes	
Instruments	No	No	No	Yes
Observations	37 971	13 361	7 003	
R-squared	0.058	0.015	0.079	

Source: SARS data
Robust standard errors in parentheses
****p<0.01; **p<0.05; *p<0.1*

For both sub-groups of firms, salary per worker increases with sales; however, an offshoring effect is only observed for labour-intensive firms. Increased imports are linked to higher salaries in labour intensive firms, with the increase slightly less for narrow offshorers (although only significant at 11.4%). Capital-intensive firms, on the other hand, provide no indication of an offshoring effect on remuneration per worker, as the probabilities of the two estimates both exceed 97%. If one assumes that workers in capital-intensive firms are more skilled relative to labour intensive firms, these results are contrary to international experience. Hummels et al. (2014) reported that offshoring increases the wages of highly skilled workers.

Finally, we analyse worker-level salaries, by estimating equation 2. While the above analysis of salary per worker is based on a crude indicator of salary per worker, data from the IRP5 panel provides a potentially more reliable estimate of individuals' monthly earnings (income). Due to the large number of observations in the combined IRP5 panel, the following results were obtained from a random sample of 20% of the total observations.

Table 7: Regression results with log monthly earnings per worker as dependent variable

	All manufacturing	**All manufacturing**	**Labour intensive**	**Capital intensive**
log sales	0.049*** (0.015)	0.054*** (0.004)	0.097*** (0.008)	0.048*** (0.009)
log capital	0.003 (0.003)	0.002* (0.001)	0.001 (0.001)	0.002 (0.003)
log imports	0.005 (0.004)	0.003*** (0.001)	0.005*** (0.001)	0.002 (0.001)
log imports*narrow	0.000 (0.001)	-0.000* (0.000)	-0.001*** (0.000)	0.001** (0.000)

Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Firm FE	Yes			
Job FE		Yes	Yes	Yes
Observations	576 507	576 507	123 427	126 179
R-squared	0.140	0.100	0.108	0.089

Source: SARS data
Robust standard errors in parentheses
****p<0.01; **p<0.05; *p<0.1*
All regressions include control variables for age and tenure.

The worker-level estimates in Table 7 correspond with those for labour-intensive firms in Table 6. Offshoring seems to increase earnings on individual worker level, while the premium is slightly lower for importing firms involved in narrow offshoring. One possible explanation for these counterintuitive results may be found in the institutional arrangements in the South African labour market and the role of unions in particular. Institutional constraints may have prevented wages (including unskilled ones) from decreasing as much as one would have expected in the wake of a stagnant demand for labour. In fact, in the mining and agricultural sectors, the demand for labour decreased (Banerjee et al., 2006). This occurred at the time of the advent of skill biased technical change, which further decreased the demand for unskilled labour (Banerjee et al., 2006). Evidence of a persistent union wage differential implies that unions are keeping wages higher for their members (Schultz and Mwabu, 1998; Banerjee et al., 2006).

Burger and Yu (2007) also investigated wage trends in post-apartheid South Africa, and found an increase in real wage earnings in the post-transition period for formal sector employees. Unskilled wages increased by 27 per cent between 2002 and 2005. In contrast, increases in the earnings of the highly-skilled appeared to have slowed down in the same period (Burger and Yu, 2007). Lewis (2001) as well as Mazumdar and van Seventer (2002) reach similar conclusions.

Private sector economists such as Mike Schussler identified the same trends as part of his and trade union UASA's employment report of 2017. Schussler argues that the prominent trend to emerge from their research is that the wage gap between the skilled and the unskilled has closed significantly in a number of sectors, including mining, metal, vehicle, trade, motor trade, clothing and government; "For example, the lowest skilled grades in the motor trade went from less than a fifth of the wage of a skilled grade to over a third between 1979 and 2017,.. The semi-skilled grade improved from just below a third of the skilled grade to 44% of the skilled trade in the motor Industry. In effect this means that the unskilled person now has less of a wage gap in relative terms than the semi-skilled grade had in 1979... In the metal industry...the lowest minimum for an unskilled grade increased from less than a third of the skilled artisan to well over half the rate of an artisan...In gold mining, for example, the lowest paid grade went from a fifth that of a junior manager to half that of a junior manager"" (Businesstech, 2017:1).

Labour market outcomes and gender

The latest version of the IRP5 panel data includes information on the gender of the specific taxpayer – a variable that was not available before. This gender variable allows for a more in-depth analysis of the labour market outcomes of offshoring, which is a neglected aspect in the literature (Peri and Poole, 2012). The following section duplicates the analysis done for the manufacturing firms (estimating equations 1 and 2), but now also considering the impact on male and female employment. The results of equation 1 are presented in Table 8 and equation 2 in Table 10.

Table 8: Regression results with log number of male and female workers as dependent variable

	Female employment			**Male employment**		
	All manufacturing	**Labour intensive**	**Capital intensive**	**All manufacturing**	**Labour intensive**	**Capital intensive**
log sales	0.217*** (0.016)	0.200*** (0.024)	0.312*** (0.039)	0.235*** (0.017)	0.227*** (0.029)	0.273*** (0.052)
log capital	0.008*** (0.003)	0.007* (0.004)	0.004 (0.007)	0.014*** (0.003)	0.015*** (0.005)	0.017* (0.009)
log imports	0.008** (0.003)	0.012** (0.005)	0.010* (0.006)	0.001 (0.005)	-0.004 (0.007)	-0.014 (0.014)
log imports*narrow	0.001 (0.001)	-0.000 (0.001)	-0.000 (0.003)	0.001 (0.001)	0.001 (0.002)	0.005 (0.003)
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	29 631	10 417	5 491	30 460	10 775	5 577
R-squared	0.365	0.306	0.265	0.457	0.488	0.405

Source: SARS data
Robust standard errors in parentheses
****p<0.01; **p<0.05; *p<0.1*

As imports increase and firms get more involved in offshoring, more female workers are employed – this is statistically significant at 5% for manufacturing in total and labour-intensive firms, and only at 10% for capital-intensive firms. In the last three columns of Table 8, none of the offshoring variables are significant in explaining male employment levels of manufacturing firms. Table 9 summarises employment levels per gender from the firm-level panel. All manufacturing firms employ more males compared to females; however, the ratio of male-to-female employment decreases for firms that engage in broad offshoring. This observation confirms the regression results in Table 8. The ratio of male to female decreases because increased imports increase the number of female workers, but has no statistically significant effect on male employment.

Table 9: Firm-level employment per gender

	All manufacturing firms	**All offshorers**	**Narrow offshorers**
Mean # of female workers per firm	12.63	28.78	32.53
Mean # of male workers per firm	25.73	55.28	67.06

Ratio: male to female	2.04	1.92	2.06

Source: SARS data

Table 10 summarises the analysis of the determinants of individual salaries – similar to Table 7 – but now separated for the two gender categories. For both categories of male and female employees, broad offshoring generally increases remuneration (see positive and significant coefficient of import). The male estimate, however, is only significant at 5%, while the female estimate is significant at 1%.

Table 10: Regression results with individual log monthly earnings as dependent variable

	Female employment			**Male employment**		
	All manufacturing	**Labour intensive**	**Capital intensive**	**All manufacturing**	**Labour intensive**	**Capital intensive**
log sales	0.057*** (0.006)	0.128*** (0.016)	0.104*** (0.018)	0.052*** (0.006)	0.085*** (0.009)	0.025** (0.010)
log capital	0.000 (0.002)	0.001 (0.003)	-0.000 (0.006)	0.003** (0.001)	0.001 (0.002)	0.003 (0.004)
log imports	0.005*** (0.001)	0.007*** (0.003)	0.006** (0.003)	0.002** (0.001)	0.004*** (0.001)	-0.001 (0.001)
log imports*narrow	-0.000 (0.000)	-0.001 (0.000)	0.002** (0.001)	-0.000 (0.000)	-0.001** (0.000)	0.000 (0.000)
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Job fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	197 523	34 009	36 556	378 984	89 418	89 623
R-squared	0.058	0.072	0.143	0.124	0.127	0.103

Source: SARS data
Robust standard errors in parentheses
****p<0.01; **p<0.05; *p<0.1*
All regressions include control variables for age and tenure.

The last two columns of Table 10 indicate that the positive estimate for offshoring, in general, is driven by the positive impact on male remuneration in labour-intensive firms. For capital-intensive firms, there is no significant impact on male remuneration – while it is reported for female employees. In the manufacturing sector, male salaries are higher than female salaries – see Table 11. However, as offshoring gains momentum, female earnings increase across all manufacturing firms, while male earnings only show a statistically significant increase in labour-intensive firms.

Table 11: Mean monthly salary calculated from worker level panel

	All manufacturing	**Labour intensive**	**Capital intensive**
Mean monthly salary female	9 996.64	8 665.15	13 134.48
Mean monthly salary male	15 794.76	12 050.92	23 753.56
Ratio: male to female salary	1.58	1.39	1.81

Source: SARS data

7. Conclusion

South Africa's fledgling democracy is faced with the trilemma of low and stagnant economic growth, persistently high and increasing levels of long-term structural unemployment, and widening inequalities on various fronts in society. Government responded with a range of policy initiatives to combat the entrenched socio-economic challenges of South Africa. Fourie (2015) tracks a number of these initiatives.

From 2004, several relatively focused initiatives such as the Expanded Public Works Programme, industrial policy plans (IPAPs) as well as the National Development Plan (NDP) were established. A key theme of both the Industrial Policy Action Plan (IPAP) (2017/2018-2019/2020) and the NDP is to achieve shared and inclusive growth through decent jobs, especially in labour-intensive sectors. It is, however, acknowledged that there are severe skills shortages and mismatches in the labour market. The NDP (2013:115) summarises the situation: "The proposals in the plan take cognisance of the fact that South Africa is a middle-income country. On the one hand, it cannot compete in low-skilled industries because cost structures are already too high. On the other hand, the country lacks the skills to compete with advanced manufacturing countries such as Germany. South Africa therefore needs to compete in the mid-skill manufacturing and service areas, and niche markets that do not require large economies of scale".

Perceived skills shortages influence the ability of the manufacturing sector to enhance its capacity to create economic and employment multipliers across value chains. Indeed, statistics show that although manufacturing GDP has increased over the last decade, manufacturing employment has decreased (DTI, 2017). The backdrop of these findings is a continuous process of capital deepening as labour as a production factor is substituted by capital in the production process. There has furthermore been a trend of increasing imports of intermediate inputs as a result of increasing domestic production costs (e.g. electricity and labour) and production volatility (e.g. strikes and power disruptions). These production uncertainties led to South African manufacturing firms' increasing involvement in offshoring activities.

Newly available data allowed us to investigate the labour market outcomes (wages and employment) of offshoring within South African manufacturing firms. Regressions of firm characteristics such as the level of employment and salary per worker on a range of explanatory variables (including offshoring dummies) formed the methodology of the investigation. The narrow offshoring dummy did not prove to be highly significant – probably due to the relatively small number of firms engaging in narrow offshoring[5].

The above analysis was supplemented by worker-level regressions to focus on the impact of changes in firms' importing activities on workers. Offshoring increases employment of skilled workers in capital intensive firms. The opposite effect applies to unskilled workers in both categories (capital and labour intensive firms). Contrary to international experience, offshoring increases wages in labour-intensive, but not in capital-intensive firms.

[5] This may be addressed by broadening the definition of narrow offshoring to also include firms selling products in the domestic market that are classified in the same HS4 category as their main import products.

The results of this study can potentially be of value to empower South African policymakers to develop policy responses based on sound research. Practically speaking, South African manufacturing firms are increasingly involved in offshoring. Offshoring creates employment opportunities for skilled workers, but reduces the demand for unskilled labour. This further burdens policymakers to develop strategies to alleviate structural unemployment among unskilled labour, especially within the context of duality and segmented labour markets as pointed out by Fourie (2015).

The research presented in this paper also opens up a number of important complementary research agendas. The firm-level analysis here will benefit significantly from research at the industry and country level in order to, for example, investigate possible spill-over effects. This avenue of investigation will assist in examining the broader socio-economic implications of international linkages such as offshoring. These include aspects such as wage inequality, the gender dimension as well as the impact on different demographic groups. In addition to the above, the particular influence and context of the South African institutional framework in terms of labour legislation and its impact on firm level decisions must also form part of such a research endeavour.

South Africa's democracy and the well-being of its citizens depend on our ability to address the challenges the country is faced with. Policy based on sound evidence has the best chance of succeeding in achieving the quality of life for its citizens, envisaged by our Constitution. Improved levels of agency, social cohesion and the achievement of the developmental state, envisaged by the government, depend on policymakers to get it right. The opportunity cost for not achieving this may be too high for future generations, who are to live with the choices being made now for their future, to endure. This is the responsibility resting on the shoulders of the current generation and its leaders.

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Appendix

Table A1: IRP5 data cleaning

Keep individual	From the IRP5 data, only workers/employees were used in this article, therefore from the variable "nature of person" only "Individuals" were kept.
Periods worked	Some of the data on the "period employed from" and "period employed to" has "invalid periods" reported, this was corrected: 1. For instance 1910 instead of 2010 2. End date 27 February instead of 28 February 3. End date before start date 4. End date in the month before year end and then start again a few days after the start of the year.
Multiple job spells	There are individuals with "multiple job spells", therefore 1 individual working multiple jobs at the same firm. When adding the number of days of each job spell 3% adds to more than 365 days (which is impossible). For this 3% of jobs the average of the worker's multiple job spells at the firm we taken.
Duplicate certificates	Each job is assigned a certificate number; duplicate certificates were dropped to avoid double counting.
Age 15-64	There were individuals found to be 90 years of age. This study kept to the South African labour force definition and kept workers of the age 15-64.
Income	There are various ways to calculate income, we used the Gross remuneration (by adding three variables named: "grossntaxableincomeamnt grossretfundincomeamnt grossnretfundincomeamnt").

Table A2: ISIC 4 description

ISIC4	Description	Intensity
1010	"Manufacture of food products"	Capital
1011	"Manufacture of beverages"	
1012	"Manufacture of tobacco products"	
1013	"Manufacture of textiles"	Labour
1014	"Manufacture of wearing apparel"	
1015	"Manufacture of leather and related products"	
1016	"Manufacture of wood and of products of wood and cork, except furniture	
1017	"Manufacture of paper and paper products"	Capital
1018	"Printing and reproduction of recorded media"	Capital
1019	"Manufacture of coke and refined petroleum products"	Capital
1020	"Manufacture of chemicals and chemical products"	Capital
1021	"Manufacture of pharmaceuticals, medicinal chemical and botanical products	
1022	"Manufacture of rubber and plastics products"	Labour

1023	"Manufacture of other non-metallic mineral products"	Labour
1024	"Manufacture of basic metals"	Capital
1025	"Manufacture of fabricated metal products, except machinery and equip	Labour
1026	"Manufacture of computer, electronic and optical products"	
1027	"Manufacture of electrical equipment"	
1028	"Manufacture of machinery and equipment n.e.c."	Labour
1029	"Manufacture of motor vehicles, trailers and semi-trailers"	
1030	"Manufacture of other transport equipment"	
1031	"Manufacture of furniture"	
1032	"Other manufacturing"	
1033	Repair and installation of machinery and equipment	