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# GLOBAL VALUE CHAINS, JOB CREATION, AND JOB DESTRUCTION AMONG FIRMS IN SOUTH AFRICA

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# Global Value Chains, Job Creation, and Job Destruction among Firms in South Africa

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**Abstract**

Extant studies suggest that firms' engagement in global value chain (GVC) trade is associated with productivity gains that result from the continual reallocation of resources to their most productive use. This reallocation generates benefits for transitioning workers but also incurs costs for workers undergoing turnover. A comprehensive understanding of the overall welfare effect of firms' engagement in GVC trade requires a consideration of the productivity gains and the net job reallocation gains and losses. This paper provides the first empirical evidence in this regard using firm-level data that covers the universe of formal firms in South Africa. We document that firms' integration into GVC is associated with significantly positive job reallocation that creates a net job gain at the firm level. However, this is largely driven by firm entry into GVC as continuous GVC firms have an overall net job loss. Additional analysis provides suggestive evidence of a role of firm characteristics including firm age and size in affecting these outcomes.

**Keywords**: Job Reallocation; Job Creation; Job Destruction; Global Value Chains
**JEL Classification**: F12; F14; F16; J21

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# 1 Introduction

Recent evidence suggests that more than 50 percent of global trade is organized through global value chains (GVCs), thanks to falling trade costs that have engendered a shift in the way that goods and services are produced. Production is now increasingly organized within a vertically integrated system, whereby a lead firm relies upon a complex network of suppliers from across different continents. Baldwin (2012) refers to this as the second "unbundling" of globalization wherein stages of production that were previously performed in close proximity are now dispersed across international borders. This delocalization of production stages has altered the patterns of international trade—international trade now takes place mostly at a more granular level wherein individual firms across the globe are responsible for specific stages belonging to a supply chain (Antràs 2020; Ndubuisi & Owusu, 2023). Consequently, intermediate goods constitute a substantial share of trade as parts and components are increasingly crossing national borders multiple times.

Trade economists share the view that although international trade induces productivity gains and long-term growth, it involves the continual reallocation of resources to their most productive use that results in winners and losers at the country, sector, firm levels, and among groups of workers (Farole et al., 2018). While this led to an expansive erstwhile literature on the distributional and welfare consequences of cross-border trade, the emergence of GVC as a new way of organizing global production and trade has reinvigorated the interest on this issue albeit with a specific focus on GVC (Ndubuisi & Owusu, 2022). A significant portion of this incipient literature examines the relationship between GVC and productivity, arguing that GVC participation unambiguously stimulates productivity growth. Although this view is supported by substantial empirical evidence (Ge et al., 2018; Montalbano et al., 2018; Benkovskis et al., 2020; Mazzi et al., 2020; Owusu et al., 2021), studies are yet to compare this productivity gain with the overall welfare effect resulting from potential job destruction and transitions that GVC may also cause during the process of resource reallocation. As noted by Klein et al (2003), a comprehensive understanding of the overall welfare impact of trade requires consideration of both efficiency benefits and adjustment costs, as reallocations are not without costs.

This paper fills this knowledge gap by examining how firms' participation in GVC affects job reallocation, specifically focusing on the effects on job creation and job destruction. In principle, GVC participation has the potential to both create and destroy jobs. For example, a firm's integration in GVC is associated with ex-post productivity gain. It is also associated with exposure to bigger international markets and ultimately, leads to an expansion of production scale. Such an expansion in the market scale increases the demand for firms' products and, consequently, labor demand. However, this process also means that firms unable to participate in the trade may either contract or exit the market, resulting in job destruction. Even for those firms that are engaged in trade, competition in GVC could lead to the closure and downsizing of less competitive firms that are unable to adapt to and compete effectively. Furthermore, the productivity effect of GVC, among other factors, arises from a higher degree of specialization of economies that may be associated with a consequent reduction in the demand for labor per unit of output (Farole et al., 2018). Through GVC, firms gain access to lower-priced intermediate inputs, which can have conflicting effects on labor. On the one hand, if these inputs complement domestically available skills and production, they can increase the demand for labor through the scale effect. On the other hand, if they substitute for domestic production, they may reduce domestic labor demand (Farole, 2016). In close connection to this, Rodrik (2018) argues that GVC firms may excel in adopting advanced technologies but will be less successful in employing labor due to the adoption of labor-saving technologies in GVC production. Consequently, the effect of GVC on job creation and destruction is an empirical question.

To this end, to examine how GVC participation affects job creation and destruction we use customs and balance sheet data provided by the South African Revenue Service and National Treasury (SARS-NT) for the period 2009-2017 (National Treasury & UNU-WIDER, 2019). Both datasets provide firm-level information for the universe of formal firms in South Africa. The customs data provide transaction-level information about the export and import activities at the 6-digit harmonized system classification (HS), which enables us to identify and track firms in South Africa that engaged in GVC trade. We use an adapted Hummels et al. (2001) vertical specialization index to identify GVC firms, where GVC firms

are considered as those firms that simultaneously import intermediate inputs and export final and/or customized industrial intermediate goods (more on this in section 2). The balance sheet data contains comprehensive information about the characteristics, behavior, and performance of firms in South Africa. We use employment information from this data to compute firm-specific indicators of job creation and destruction. Inspired by the broader job reallocation literature (Davis et al., 1998; Davis & Haltiwanger, 1999; Klein et al., 2003; Haltiwanger et al., 2004; Mensah et al., 2022), we defined job creation (destruction) as the sum of positive (negative) employment changes.

Our results show a positive association between GVC participation and job reallocation, indicating that integration into GVC creates winners and losers at the firm level. When we examine the two subcomponents of job reallocation, we find significant positive job creation and destruction effects of GVC participation. However, the job creation effect dominates that of job destruction, indicating a net job gain across GVC firms in our sample. To gain further insights into the nexus between GVC and job reallocation, we extend our analysis in two important ways. The broader trade literature highlights heterogeneous outcomes among international trading firms that emanate from the dynamics of firms' entry into and exit from foreign markets (Girma et al., 2003; Buch et al., 2009). More recently, Reddy and Saidharan (2021) argued that GVC firms are heterogeneous and that their characteristics would differ based on their GVC status-including the firm's entry into, persistence in, and exit from GVC-affect our results. To this end, our first extension considers how the dynamics of firm GVC status affect our result. In principle, new firms entering GVC creates new jobs by hiring employees to fill new roles. Their interaction with other firms in the value chain can also stimulate job creation through increased demand for products. On the other hand, when a firm exits GVC, it disrupts supply chains, affecting other firms involved in the value chain and potentially leading to job losses, particularly, for firms that relied on the exiting firm for business. Results from the empirical analysis confirm our expectation that firm entry into GVC is associated with job creation, while firm exit out of GVC is associated with job destruction. For continuous GVC firms, the job destruction effect dominates the job creation effect, resulting in overall net job loss for this category of firms.

Further, how firm size and age contribute to net job creation has gained traction in the literature (Shaffer, 2006; Haltiwanger et al., 2013; Lawless, 2014; Haltiwanger et al., 2014; Abreha et al., 2021). More recently, Grazzi and Moschella (2018) showed that firm internationalization in terms of exporting influences the patterns of job growth at different age classes. Do such differences emerge in the job reallocation vis-à-vis job creation and destruction effects of GVC? The second extension of our analysis considers this possible source of heterogeneity. Older and larger firms are most often well established. They have survived tougher competition, accumulated requisite experience, and other things equal, exhausted their internal economy of scale. Accordingly, while they are more likely to integrate in GVC, there may be little, or no job reallocation associated with their integration into GVC. This is different for younger and smaller firms that are yet to exhaust their internal economy of scale. These firms suffer from the liability of smallness and newness that, among others, materializes in the forms of resource and knowledge constraints, and small-scale production and sales. They are also far from reaching the top of the productivity distribution. In this case, their integration into GVC may induce a more pronounced job reallocation through the forces of competition GVC initiates, on the one hand, and as the firms exploit the tangible and intangible resources that being integrated into GVC avails them to become both allocative and productively efficient. Consistent with our expectation, we find that the patterns of job reallocation we document in our sample are largely driven by younger and small firms. At best, larger firms' integration into GVC only significantly reduces job destruction, while the GVC integration of older firms has no significant effect on job reallocation.

This paper is related to the broader literature on the welfare effects of GVC. Among others, this literature has examined the effects of GVC on wage levels (Lu et al. 2019), wage inequality (Shen & Silva, 2018), and skill premium (Lee & Yi, 2018). We extend this literature by providing the first novel evidence on the job reallocation effect of GVC, bearing in mind that job reallocation vis-à-vis job creation and destruction has strong welfare implications: they bear ultimately on individual and household consumption patterns and poverty incidence through expenditure and earning channels. The paper is also related to thin literature that uses country-industry level data to examine the net employment change effect of

GVC (see Banga, 2016; Farole et al., 2018; Pahl & Timmer, 2020)[1]. We deviate from this literature in two important ways. First, whereas these past studies use country-industry level data, we provide novel evidence on the GVC-job nexus at the firm level. Second and most importantly, whereas the focus of these past studies is on net employment changes, our paper focuses on job reallocation vis-à-vis job creation and job destruction. In this way, we provide evidence of the possible welfare benefit (i.e., job creation) and cost (i.e., job destruction) associated with the productivity gains of GVC.

Knitted closely to the latter argument, this paper is also related to the broader literature on the job flow and job reallocation effect of international trade (Konings et al., 2003; Klein et al., 2003; Haltiwanger et al., 2004; Moser et al., 2010; Groizard et al., 2015)[2]. To date, this literature has predominantly focused on conventional trade which deviates markedly from GVC-related trade. For instance, unlike conventional trade that takes place as an arm's length contract, GVC trade prominently involves international transactions with some level of explicit coordination of firms from different countries tied together in a vertically integrated production system. Integration into the GVC has also aided firms in developing resilience by establishing multiple buyer-supplier relations while investing in building their production capacity, as required by lead firms in the value chain. This has resulted in stable export earnings and a higher ability to capture value within the value chains. These changes may have distinct effects on job creation compared to traditional aggregate trade. We extend this literature by providing the first empirical literature on the job reallocation effect of GVC. As noted earlier, global production and trade are now predominantly organized through GVC. Hence, the need for such an extension cannot be overemphasized.

The remainder of the paper is organized as follows. Section 2 describes the research design. Particularly, it presents the research methods, discusses the data, construction of data, sources, and the computation of variables used in the analysis. We present and discuss the results in section 3, while section 4 concludes the paper.

# 2 Research Design

## 2.1 Job reallocation and GVC firms

Two main variables are important for our analysis: firm-level indicators of GVC participation and job reallocation. We extract these variables, along with a host of other control variables, from two firm-level datasets that are provided by the South African Revenue Service and National Treasury (SARS-NT) for the period 2009-2017 (National Treasury & UNU-WIDER, 2019). The first dataset is the custom transactional-level data that contains detailed import and export activities of all formal firms in South Africa. The export and import values are reported at the 6-digit harmonized system classification (HS)-thus enabling us to identify firms that are engaged in GVC-related trade. The second dataset is the CIT-IRP5 firm-level panel. It contains information about the characteristics and performance of formal firms in South Africa such as employment, sales, and R&D expenditure.[3] We deflated all variables in monetary units with an economy-wide deflator provided in the dataset and merged the two datasets using the tax year and unique anonymized identifiers. Table 1 provide a description of the variables used in our analysis, while the data appendix section describes the data structuring and cleaning procedure.

### 2.1.1 Measuring Job reallocation

Our job reallocation indicators build on the existing literature (Davis et al., 1998; Davis & Haltiwanger, 1999; Klein et al., 2003; Haltiwanger et al., 2014; Mensah et al., 2022). Inspired by this literature, we define the rate of job flows (JF)as follows:

[1]While the studies mentioned use an econometrics approach, few studies have also used a decomposition approach showing significant employment generation by foreign and domestic final demand (see Foster-McGregor, 2019)

[2]On how different types of international market exposure affect job reallocation see Helpman et al. (2004) and Kasahara and Laphan (2013)

[3]Note that the SARS-NT Data only covers firms that are registered and pay tax, implying that our analysis do not capture the informal firms. Nevertheless, the share of the informal firms in South Africa is low (c.a 28%) compared to other countries in Africa, implying this is unlikely to have any major implication on our study findings.

$$JF_{it} = \frac{\Delta n_{it}}{l_{it}} \tag{1}$$

where $n_{ft}$ is the number of employees of firm i, $l_{ft}$ is the firm's average employment over two consecutive periods, and is given by $l_{it} = 0.5(n_{it} + n_{(it-1)})$. $\Delta n_{it}$ is the first difference operator of the firm's number of employees. It captures the number of new jobs in the case of positive employment change (i.e., $\Delta n_{it} > 0$), the number of job losses in the case of negative employment change (i.e., $\Delta n_{it} < 0$) and is zero if a firm does not experience employment change (i.e., $\Delta n_{it} = 0$). We average the first difference operator over two periods to smoothen potential outliers in the data (Davis & Haltiwanger, 1999). Based on equation 1 and drawing insights particularly from Haltiwanger et al. (2014) and Mensah et al. (2022), we define job creation and job destruction as in equations 2 and 3.

$$JC_{it} = \sum_{i} \frac{\Delta n_{it}^{+}}{l_{it}} \tag{2}$$

where all variables and subscripts are as previously defined, $\Delta n_{it}^{+}$ captures positive employment changes. Job creation (JC) is then the sum of positive employment changes (employment gains) in an expanding firm over time t divided by the firm's average employment over two consecutive periods.

$$JD_{it} = \sum_{i} \frac{|\Delta n_{it}^{-}|}{l_{it}} \tag{3}$$

where all variables and subscripts are as previously defined, $|\Delta n_{it}^{-}|$ captures negative employment changes (employment losses in absolute value). Job destruction (JD) is then the sum of the absolute values of negative employment changes in a contracting firm over time t divided by the firm's average employment over two consecutive periods. The difference between job creation and job destruction is the firm's net employment growth over time t, while the gross job reallocation (GJR) is the sum of the firm's job creation and job destruction.

### 2.1.2 Identifying GVC firms

Existing studies have identified GVC firms in different ways. Among others, studies have identified GVC firms as two-way traders—defined either as importing-only, exporting-only, or both (Rigo, 2021), with international quality certification (Reddy et al., 2020) or firms that simultaneously import intermediate inputs and export intermediate or final goods (Balwin & Yan, 2014). Studies have also identified GVC firms as those exporting customized industrial intermediate inputs or have used the recently published fifth version of the UN COMTRADE Broad Economic Categories (BEC5) and defined GVC firms as those exporting "specific" GVC-related intermediates (Mazzi et al., 2020). Further, some studies use the foreign value-added share of a firm's gross exports as a GVC indicator (Lu et al., 2019), while others use Hummels et al. (2001) vertical specialization index adapted at the firm-level (Reddy & Sasidharan, 2021). The latter accounts for both export and import intensities of the firm by incorporating the amount of imported intermediate inputs embodied in firms' exports. Either of the above methods may over— or underestimate the extent of GVC participation. Bearing these in mind, the first step we take towards identifying GVC firms is computing the adapted Hummels et al. (2001) vertical specialization index given as follows:

$$V_{it} = \frac{Importedintermediates_{it}}{ExpenditureonMaterialInputs_{it}} \times \frac{Finalgoods\&CustomizedIntermediateexports_{it}}{Sales_{it}} \tag{4}$$

Where all the subscripts are as previously defined, the resulting index from Equation 4 ranges from 0 to 1 and is considered a measure of GVC participation.[4] We further follow Hummels et al. (2001), Lu et

[4]CIT-IRP5 data does not provide information expenditures on material inputs. Hence, in the operationalization of equation 4, we use "cost of sales" as provided in the dataset as a proxy.

al. (2019), and Reddy and Sasidharan (2021) in differentiating between GVC integrated ($GVC_{it}$) and non-integrated GVC ($NonGVC_{it}$) firms as follows:

$$GVC_{it} = \begin{cases} 1 & V_{it} > 0 \\ 0 & Otherwise \end{cases} \tag{5}$$

Our empirical analysis relies on equation 5 to identify GVC firms. To operationalize equation 4, we restrict it to only two-way trading firms although GVC firms can also either export or import. As highlighted by Balwin and Yan (2014), such restriction allows us to capture the sequential and back-and-forth aspect of global linkage. It also captures the hallmark of GVC where firms use imported intermediate to produce goods that are re-exported. The latter explains why the import component in equation 4 includes all imported intermediates, while the export component is restricted to only final and customized intermediates goods. This is, particularly, to capture the prevalent view that GVC firms import intermediates to export final goods or processed intermediates. To identify these respective traded goods, we recur to the United Nations Broad Economic Categories Revision 4 (UN BEC4), which divides traded goods according to their end-use.[5] Based on this classification, the imported intermediate corresponds to the 6-digit HS products in the intermediate good category, while we restrict the final goods to the processed goods in the final goods category.

As per intermediate export, further steps are needed to ensure we are not merely capturing firms exporting standardized and generic products traded through arms-length relationships. Extant studies suggest that intermediate goods exported in GVC involve a higher degree of customization and are either part of an intra-firm exchange or exchanged in networks with higher degrees of coordination (Gereffi et al., 2005; Sturgeon & Memedovic, 2010). To this end, we recur to Rauch (1999) which classified traded products into three categories: (i) traded in organized exchanges; (ii) reference priced in trade publications; and (iii) differentiated products. The first two categories include products that are more traded in dense markets, while the last category includes products that are more likely to be traded within networks and therefore entail both a higher degree of relationship-specific investment and coordination.[6] We combine the Rauch and UN BEC4 to identify customized industrial intermediates. We proceed in two steps. First, we use the UN BEC4 to isolate a category of intermediates referred to as industrial intermediates.[7] Second, we map these industrial intermediates to Rauch's classification and extract the components corresponding to differentiated products.

From the foregoing, it follows that customized industrial intermediates are defined as differentiated industrial intermediates. However, in the robustness, we take advantage of the recent UN BEC5 to identify customized intermediates. The UN BEC5 divides internationally traded products into four categories according to their end-use (intermediates versus finals) and 'specification' type ('generic' versus 'specific'): 'specific' intermediates, 'generic' intermediates, final goods, and a residual group containing other exporters, especially exporters of unprocessed (primary) goods.[8] Specific intermediates, according to this classification, identify those products that prominently involve international transactions with some level of explicit coordination which as noted earlier is a fundamental characteristic that distinguishes GVC from the arm's-length transactions underpinning more "traditional" trade.

## 2.2 Descriptive Statistics

Table 1 provides the basic summary statistics of the variables we used in the analysis. Our final sample comprises about 18,704 firms with a total number of 121,109 observations across 23 manufacturing sectors for the period 2009–2017. Table 2 describes the trade status of the firms in our sample. The description

[5] See: https://unstats.un.org/wiki/display/comtrade/Intermediate+Goods+in+Trade+Statistics.

[6] Rauch suggested two definitions, a conservative (which minimizes the number of products that are classified as homogeneous) and a liberal one (which maximizes the number of products that are classified as homogeneous). Our empirical analysis relies on the former. However, we show the robustness of our result when we employ the latter.

[7] First, it requires dividing traded products into three categories according to their end-use using the United Nations Broad Economic Categories classification (BEC), namely: (i) industrial intermediates; (ii) primary intermediates (foods and beverages, fuels, and primary industrial supplies); and (iii) final products (capital and consumption goods).

[8] For more on this see https://unstats.un.org/unsd/trade/classifications/bec.asp

in Panel A is based on our main GVC indicator as formulated in Equation 5. On average, about 47 percent of firms in our sample are involved in international trade. Among this group, 9.1 percent exclusively engage in international trade as importers, 9.3 percent exclusively as exporters and 27.9 percent participate in international trade both as importers and exporters simultaneously. Our analysis focuses on the third group. Of this group, about 88.7 percent of that share (which is about 24.7 percent of the full sample) are GVC firms. Interestingly, an identical pattern in the share of GVC firms in the sample emerges when we consider other GVC indicators in Panels B and C. This suggests that the choice of how we operationalize customized intermediates (which is the source of the difference across the GVC indicators) does not significantly alter the variable.

Table 1: Basic Summary Statistics

| Variable | Description | Obs. | Mean | Std. dev. | Min | Max |
|---|---|---|---|---|---|---|
| Job Destruction | Ratio of the sum of negative employment changes to the firm's average employment over two consecutive periods | 102,405 | 0.1679 | 0.0227 | 0.1370 | 0.2318 |
| Job Creation | Ratio of the sum of positive employment changes to the firm's average employment over two consecutive periods | 102,405 | 0.2164 | 0.0309 | 0.1732 | 0.3308 |
| GVC (Conservative) | =1 if Hummels vertical specialization index $>$ 1; & 0 if otherwise | 121,109 | 0.2477 | 0.4317 | 0 | 1 |
| GVC (Liberal) | =1 if Hummels vertical specialization index $>$ 1; & 0 if otherwise | 121,109 | 0.2465 | 0.4309 | 0 | 1 |
| GVC (BEC5) | =1 if Hummels vertical specialization index $>$ 1; & 0 if otherwise | 121,109 | 0.2394 | 0.4267 | 0 | 1 |
| Wage per capita | Log ratio of labor cost to total employee | 121,109 | 6.5205 | 1.7177 | -7.8751 | 14.0298 |
| R&D Intensity | Log (1+ratio of R&D expenses to sales) | 121,109 | 0.0004 | 0.0250 | 0 | 6.9516 |
| Labor Productivity | Log ratio of sales to labor | 121,109 | 13.006 | 2.0922 | -7.8751 | 23.6859 |
| Age | Log Age, computed using incorporation year | 121,109 | 2.6134 | 0.6883 | 0 | 4.7875 |
| Foreign Firm | =1 if firm's ultimate holding company is resident outside South Africa; & 0 if otherwise | 121,109 | 0.0256 | 0.1580 | 0 | 1 |
| Capital Intensity | Log ratio of capital to labor | 121,109 | 9.0572 | 4.0764 | -8.1077 | 22.6576 |
| Size | =1 if employment level $\leq$ 50; 2 if 50 $>$ employment level $\leq$ 100; and 3 if employment level $>$ 100 | 121,109 | 1.3746 | 0.7064 | 1 | 3 |
| Industry Competition | Log Herfindahl Hirschman index at the two-digit industry level | 121,109 | -3.3605 | 0.8275 | -4.7785 | -0.0875 |
| Industry Demand | Annual growth in sales at the two-digit industry level | 102,405 | 0.0857 | 0.3796 | -3.0742 | 3.9724 |
| Trade Openness | Log ratio of total sector trade to total industry sales | 121,109 | -5.9001 | 0.6415 | -9.2783 | -3.4971 |

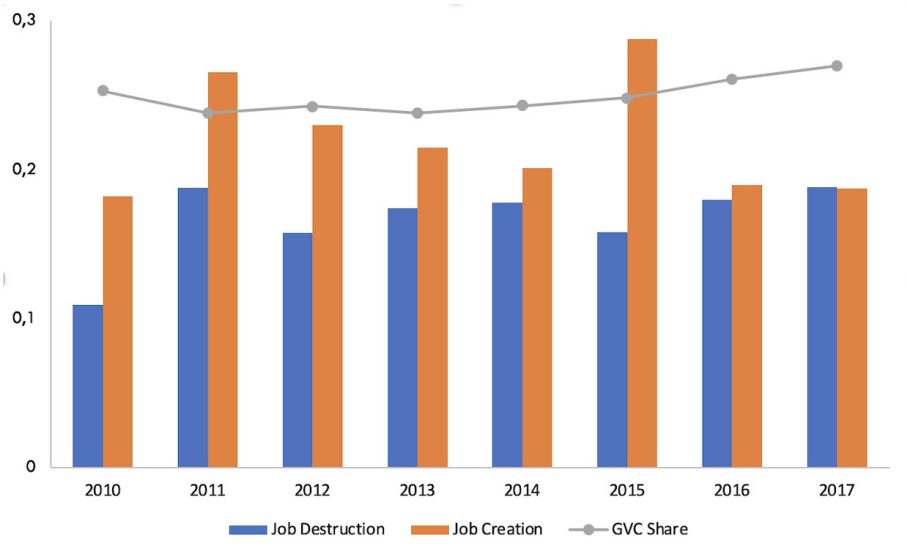
Put together, the descriptive statistics presented in Table 2 suggest that South African firms are highly engaged in international trade, but only a handful of firms are engaged in trade via GVC on average. The patterns we document are consistent with the broader trade literature and the firm-level GVC literature focused on Africa. For instance, our finding of fewer exporting or importing firms highlights the humongous sunk costs associated with these activities as existing evidence already shows (Bernard & Jensen, 1995; Konte & Ndubuisi, 2021). That we find the share of firms jointly engaged in exporting and importing to be higher than those that either only export or import is also in line with the existing evidence that firms that imports are more likely to export and vice versa (Muûls & Pisu, 2009; Kasahara & Lapham, 2013). Finally, the pattern we document for GVC (where only fewer firms meet the criteria of being classified as GVC firms) is consistent with those of Van Biesebroeck and Mensah (2019), Ab-

Table 2: Trade classification by global value chain status

| | Panel A | | Panel B | | Panel C | |
|---|---|---|---|---|---|---|
| | GVC(1)=0 | GVC(1)=1 | GVC(2)=0 | GVC(2)=1 | GVC(3)=0 | GVC(3)=1 |
| *None Traders* | 64,867 | 0 | 64,867 | 0 | 64,867 | 0 |
| *Exporters Only* | 11,075 | 0 | 11,075 | 0 | 11,075 | 0 |
| *Importers Only* | 11,353 | 0 | 11,353 | 0 | 11,353 | 0 |
| *Two-way Traders* | 3,814 | 30,000 | 3,966 | 29,848 | 4,821 | 28,993 |
| Total | 91,109 | 30,000 | 91,261 | 29,848 | 91,109 | 28,993 |

*Note*: The GVC is based on the adapted Hummels vertical specialization index. A firm takes the value of 1 and is considered a GVC firm if the Hummels vertical specialization index > 0. GVC status in Panel A results from a Hummels vertical specialization index that is computed using Rauch's conservative classification, while Panel B uses Rauch's liberal classification. GVC status in Panel C results from a Hummels vertical specialization index that is computed using UN BEC 5.

Figure 1: Evolution of share of GVC firms, and Job Creation and destruction




reha et al. (2020) and Avenyo et al. (2022). Particularly, these studies document lower levels of firm GVC engagement across most countries in sub-Saharan Africa, especially for their manufacturing sectors.

Although the full sample suggests that only a handful of firms in South Africa engage in GVC, there is a great deal of heterogeneity across the sectors. For instance, Table 3 shows that about 47.7 percent of firms in the Tobacco sector are integrated into GVC. The medium and high-tech sectors (such as Pharmaceuticals, Chemicals and chemical products, Computer and electronics and Machinery and equipment) in South Africa are more integrated in GVC as they all have a GVC share that is above 30 percent. This conclusion is irrespective of the GVC indicator we employ as the alternative GVC measures shown in the same table. Figure 1 shows the evolution of the average GVC firm shares, and job creation and destruction rate. On average, manufacturing firms in our sample in South Africa have recorded higher job creation (0.22) rate than the job destruction rate (0.16) for the period considered. Further to this, it appears that from 2011 onwards, the job creation rate among the firms in our sample has been decreasing while the job destruction rate has not changed that much. Table 3 also shows the sector dimension of the average job creation and destruction rate.

Table 3: GVC, Job creation and Job Destruction

| 2-digit Sectors | GVC(1) | GVC(2) | GVC(3) | Job Destruction | Job Creation |
|---|---|---|---|---|---|
| Food products | 0.1976 | 0.1976 | 0.1978 | 0.1645 | 0.3308 |
| Beverages | 0.2905 | 0.2905 | 0.2936 | 0.1577 | 0.2525 |
| Tobacco products | 0.4774 | 0.4645 | 0.4581 | 0.1485 | 0.1732 |
| Textiles | 0.3088 | 0.3082 | 0.3016 | 0.1796 | 0.2161 |
| Wearing apparel | 0.2296 | 0.2296 | 0.2293 | 0.1852 | 0.2444 |
| Leather and related products | 0.4079 | 0.4072 | 0.3720 | 0.2318 | 0.1907 |
| Wood and related products | 0.0979 | 0.0973 | 0.0812 | 0.1947 | 0.2369 |
| Paper and paper products | 0.2751 | 0.2751 | 0.2819 | 0.1485 | 0.2038 |
| Printing and reproduction of recorded media | 0.1250 | 0.1243 | 0.1184 | 0.1431 | 0.2032 |
| Coke and refined petroleum products | 0.2582 | 0.2582 | 0.2567 | 0.1831 | 0.2134 |
| Chemicals and chemical products | 0.3195 | 0.3177 | 0.3260 | 0.1370 | 0.2230 |
| Pharmaceuticals, etc. | 0.3675 | 0.3670 | 0.3508 | 0.1431 | 0.2067 |
| Rubber and plastic products | 0.2599 | 0.2586 | 0.2397 | 0.1594 | 0.2240 |
| Other non-metallic mineral products | 0.1760 | 0.1749 | 0.1746 | 0.1905 | 0.2221 |
| Basic metals | 0.1833 | 0.1799 | 0.1796 | 0.1593 | 0.1985 |
| Fabricated metal products except machinery and equipment | 0.1853 | 0.1825 | 0.1749 | 0.1662 | 0.2053 |
| Computer, electronic and optical products | 0.3597 | 0.3592 | 0.3532 | 0.1500 | 0.1948 |
| Electrical equipment | 0.3645 | 0.3627 | 0.3482 | 0.1568 | 0.1940 |
| Machinery and equipment | 0.3663 | 0.3655 | 0.3548 | 0.1412 | 0.2069 |
| Motor vehicles, trailers and semi-trailers | 0.3529 | 0.3529 | 0.3507 | 0.1643 | 0.1888 |
| Other transport equipment | 0.4294 | 0.4288 | 0.4152 | 0.1819 | 0.2078 |
| Furniture | 0.1484 | 0.1484 | 0.1436 | 0.1912 | 0.2247 |
| Other manufacturing | 0.2506 | 0.2492 | 0.2415 | 0.1861 | 0.2166 |

*Note*: GVC(1) results from a Hummels vertical specialization index that is computed using Rauch's conservative classification, while GVC(2) uses Rauch's liberal classification. GVC(3) results from a Hummels vertical specialization index that is computed using UN BEC 5. See Table 2

## 2.3 Model Specification and Estimation

To examine the job reallocation effects of GVC, the baseline empirical model that guides our analysis takes the following form:

$$J_{it} = GVC_{i,t-1}\beta + X^{'}_{i,t-1}\Gamma + I^{'}_{s,t-1}\theta + \delta_s + \delta_t + v_{it} \tag{6}$$

From equation 6, $J_{it} \in \{JC_{it}, JD_{it}, GJ_{it}\}$. GVC is an indicator variable as defined in Equation 5, while $\beta$ is the coefficient of interest. $X^{'}_{it}$ is a vector of time-varying firm characteristics, while $I^{'}_{st}$ is a vector of time-varying industry characteristics. $\gamma$ and $\theta$, are the respective vector of the coefficients for the firm and industry characteristics. The firm characteristics contained in $X^{'}_{it}$ include variables such as age, size, foreign status, and R&D intensity. As per $I^{'}_{it}$, it includes three variables: industry demand, competition, and the level of trade openness. Next, $\delta_s$ is sector-specific dummies included to account for unobserved differences across industries, while $\delta_t$ is year-specific dummies included to account for time-specific technological shocks that are common across firms. Finally, $v_{it}$ is a random error term.

Estimation of the GVC effect in Equation 6 using OLS or panel fixed-effect model is marred with endogeneity issues such as those arising from simultaneous (unobservable) shocks affecting both job reallocation and GVC participation or from selection and omitted variable bias. For instance, while the inclusion of time and industry-specific dummies minimize potential biases resulting from confounding factors, these are only limited to time-invariant factors. Engagement in GVC is also subject to additional fixed and variable costs that often result in more productive firms being the most likely to join GVC which is a case of self-selection bias. Drawing insights from Gebreeyesus and Mohnen (2013) and Fu et al. (2018), we apply a structural model that addresses these potential endogeneity issues. Our empirical approach recognizes the endogeneity of GVC—i.e., a firm GVC participation based on certain characteristics, and the role of GVC in predicting job reallocation. The approach is thus a two-step

procedure where the first stage predicts the GVC participation, and the second stage uses the predicted GVC values to predict job reallocations. More formally, the first-stage equation is given as follows:

$$GVC_{it}^{*} = \mathbb{Z}_{it}'\tau + z_{it}\psi + \delta_s + \delta_t + v_{it} \tag{7}$$

where all variables and subscripts are as previously defined, $GVC_{it}^{*}$ is the unobserved latent variable. $Z_{it}'$ is a vector of firm characteristics that predict GVC participation, while $\tau$ is a vector of the corresponding parameters of interest. We consider eight firm characteristics including capital intensity, labor cost per capita, R&D intensity, foreign ownership, labor productivity, foreign connection, age, and age squared. $V_{it}$ is an error term. Appropriate identification of the parameters of the GVC participation equation from those of the job reallocation equation requires an exclusion restriction in equation 7. We use the share of other GVC-integrated firms in a sector for this purpose which is given by the variable $z_{it}$ with $\psi$ being its coefficient. We expect this variable to only affect job reallocation via GVC participation as the intensity of other firms within the same sector that are actively engaged in GVC reflects a multitude of factors that affect the decision of a firm to engage in GVC (Avenyo et al., 2022). Hence, it should strongly correlate with the individual firm's decision to engage in GVC. We use a Probit model to estimate Equation 7. Next, the formalization of the second stage is as given in equation 8:

$$J_{it} = GVC_{i,t-1}^{*}\alpha + X'_{i,t-1}\gamma + I'_{s,t-1}\theta + \delta_s + \delta_t + \epsilon_{it} \tag{8}$$

where all variables and subscripts are as defined before, Equation 8 takes care of the endogeneity of GVC participation by using the predicted values of GVC as instruments in a two-stage least squares (2SLS) regression. Our identification assumption relies on the fact that predicted GVC participation is uncontaminated by endogeneity concerns such that when used in 2SLS allows us to make causal inferences about the job reallocation effect of GVC.

# 3 Empirical Results

This section proceeds in two steps. First, we present our main results on the job reallocation effect of GVC participation. Second, we show the results of an extended analysis along two dimensions including the dynamics of firm entry and exit, and firm characteristics viz-a-viz firm size and age.

## 3.1 GVC and job reallocation: Main results

Although our focus is on the job reallocation effect of GVC, we begin our analysis by gauging the productivity effect of GVC since the efficiency gains associated with factor reallocation due to trade often materializes in the form of productivity gains. The result of this exercise is reported in Table A1 in the appendix. As our empirical measure of productivity, we employ labour productivity defined as real value added per employee. Column 1 shows the result when we only account for firm characteristics, while column 2 shows the result when we introduce three industry variables: industry demand, competition, and the level of trade openness. We find a significant positive effect of GVC participation on productivity indicating that GVC firms experience higher levels of labour productivity relative to non-GVC participating firms. The result is, therefore, consistent with the broader firm-level GVC–productivity-related literature (see Del Prete et al., 2017; Benkovskis et al., 2019; Pietrobelli et al., 2018).

Table 4 presents our main results on the relationship between GVC participation and job reallocation. Columns 1 and 2 show the results for the gross job reallocation. Column 1 controls for only firm characteristics, while column 2 controls for industry characteristics (including industry demand, competition, and the level of trade openness) in addition to the firm characteristics. The estimated coefficient of GVC in column 1 is positive and statistically significant at all conventional significance levels, implying that GVC integration increases job reallocation. In column 2, the estimated coefficient of GVC remains unchanged in terms of statistical significance and sign. We also only observe a slight change in the size of the estimated coefficient, implying that the result is neither driven by confounding factors at the firm nor sector level.

Table 4: GVC Integration and Job Reallocation

| | **Job Reallocation** | | **Job Destruction** | | **Job Creation** | |
|---|---|---|---|---|---|---|
| | [1] | [2] | [3] | [4] | [5] | [6] |
| GVC Integration | 0.6717*** | 0.6776*** | 0.7255*** | 0.7244*** | 0.9061** | 0.9115** |
| | (0.109) | (0.110) | (0.191) | (0.193) | (0.437) | (0.440) |
| Capital Intensity | -0.0015*** | -0.0015*** | -0.0024*** | -0.0024*** | 0.0007 | 0.0007 |
| | (0.000) | (0.000) | (0.001) | (0.001) | (0.002) | (0.002) |
| Wage per capita | 0.0106*** | 0.0106*** | 0.0042** | 0.0042** | 0.0145*** | 0.0145*** |
| | (0.001) | (0.001) | (0.002) | (0.002) | (0.004) | (0.004) |
| R&D Intensity | -0.0356 | -0.0368 | -0.0706 | -0.0709 | -0.0467 | -0.0479 |
| | (0.042) | (0.042) | (0.073) | (0.073) | (0.168) | (0.168) |
| Royal Payment | 0.0997 | 0.0976 | -0.0212 | -0.0183 | 1.3635** | 1.3613** |
| | (0.143) | (0.144) | (0.252) | (0.252) | (0.577) | (0.577) |
| Labor productivity | -0.0033* | -0.0034* | -0.0124*** | -0.0123*** | 0.0058 | 0.0058 |
| | (0.002) | (0.002) | (0.003) | (0.003) | (0.008) | (0.008) |
| Foreign firms | 0.0165 | 0.0173* | -0.0058 | -0.0070 | -0.0044 | -0.0038 |
| | (0.010) | (0.010) | (0.018) | (0.018) | (0.041) | (0.041) |
| Age | -0.1402*** | -0.1407*** | 0.0792*** | 0.0791*** | -0.1520*** | -0.1524*** |
| | (0.010) | (0.010) | (0.018) | (0.018) | (0.041) | (0.041) |
| Size | -0.0610*** | -0.0610*** | -0.3292*** | -0.3291*** | 0.0213 | 0.0213 |
| | (0.006) | (0.006) | (0.010) | (0.010) | (0.023) | (0.023) |
| Industry Demand | | -0.0065** | | -0.0150*** | | -0.0075 |
| | | (0.003) | | (0.005) | | (0.012) |
| Industry Competition | | 0.0058 | | -0.0106 | | 0.0063 |
| | | (0.004) | | (0.007) | | (0.015) |
| Trade Openness | | 0.0230** | | 0.0250 | | 0.0210 |
| | | (0.009) | | (0.016) | | (0.037) |
| Year Dummies | Yes | Yes | Yes | Yes | Yes | Yes |
| Sector Dummies | Yes | Yes | Yes | Yes | Yes | Yes |
| Cragg-Donald Wald-F stat | 171.77 | 169.79 | 171.77 | 169.79 | 171.77 | 169.79 |
| No. of Firms | 18,704 | 18,704 | 18,704 | 18,704 | 18,704 | 18,704 |
| No. of Observations | 102,405 | 102,405 | 102,405 | 102,405 | 102,405 | 102,405 |

*Note*: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. All variables except size is expressed in a period lag. All variables are in logs except size, foreign firm and GVC. Log transformation of R&D and Royal Payment are obtained by adding a constant-i.e., ln(1+R&D) and ln(1+Royal Payment).

Our result that GVC participation is associated positively with job reallocation confirms our earlier conjecture of potential welfare gains and losses of factor reallocation induced by GVC participation. While such gains materialize in the form of productivity gains as our previous results and those of other extant studies may suggest, it could come at the cost of little or no jobs being created or even the destruction of existing jobs since resources are allocated to sectors where they are more efficiently used or the adoption of advanced labor-saving technologies in GVC that shed-off workers. To quantitatively assess this conjecture, columns 3 and 4 show the regression results for job destruction, while columns 5 and 6 show the regression results for job creation. The estimated coefficient of GVC is positive and statistically significant at all conventional significance levels for both job destruction and job creation. This implies that GVC is both positively associated with the destruction of existing jobs and the creation of new jobs. However, when we compare the respective sizes of the estimated coefficients of GVC participation for job creation to those of job destruction, those of job creation are higher.

The results presented in Table 4 are based on the GVC indicator computed using Rauch's conservative classification. Table A2 in the appendix presents results when we use the alternative GVC indicators as discussed in section 2.3. Panel A shows the results based on the GVC indicator computed using Rauch's liberal classification, while Panel B shows the results based on the GVC indicator computed using the UN BEC5. In both cases and across the six columns in the table, the estimated coefficient of GVC remains positive and statistically significant at all conventional significance levels. This implies that our findings as reported in Table 4 are not driven by our preferred choice of GVC indicator. More so, we find that when we compare the respective sizes of the estimated coefficients of GVC participation for job creation to those of job destruction, those of job creation are higher. Put together, our findings suggest that the productivity gains effect associated with GVC integration is underpinned by significant positive reallocation that sheds existing workers in return for efficiency gains accompanied by new jobs

that outweigh the job loss resulting from it. This first piece of evidence is at odds with Pahl and Timmer (2020) who document a significant jobless productivity growth associated with GVC participation at the country-industry level.

## 3.2 GVC and job reallocation: The role of firm dynamics and characteristics

Our analysis so far has focused on the full sample. In this section, we extend our analysis in two important ways. First, we examine how our results are driven by the dynamics of the firm GVC status–including firm's entry into, persistence in, and exit from GVC. The result of this exercise is reported in Table 5. We introduce three dummies. The first is a dummy that takes the value of 1 if a firm is a GVC firm throughout the sample period–we call this a continuous GVC firm. The second is a dummy that takes the value of 1 if a firm is a GVC firm in period $t$ but not a GVC firm in period $t$-1–we call this GVC starter. The third is a dummy that takes the value of 1 if a firm is a GVC firm in period $t$-1 but not a GVC firm in period $t$–we call this GVC stoppers.

Table 5: GVC Status and Job Reallocation

| | [1] | [2] | [3] | [4] |
|---|---|---|---|---|
| **Panel A: Job Destruction** | | | | |
| GVC Stater | -0.0211*** | | | -0.0227*** |
| | (0.006) | | | (0.006) |
| GVC Stopper | | 0.0339*** | | 0.0300*** |
| | | (0.008) | | (0.008) |
| GVC Continuous | | | -0.0249*** | -0.0246*** |
| | | | (0.004) | (0.004) |
| Constant | 0.4021*** | 0.4001*** | 0.3914*** | 0.3929*** |
| | (0.070) | (0.070) | (0.070) | (0.070) |
| Controls: Firm Characteristics | Yes | Yes | Yes | Yes |
| Controls: Sector Characteristics | Yes | Yes | Yes | Yes |
| Year Dummies | Yes | Yes | Yes | Yes |
| Sector Dummies | Yes | Yes | Yes | Yes |
| No. of Firms | 18,704 | 18,704 | 18,704 | 18,704 |
| No. of Observations | 102,405 | 102,405 | 102,405 | 102,405 |
| R-squared | 0.008 | 0.008 | 0.008 | 0.009 |
| **Panel B: Job Creation** | | | | |
| GVC Stater | 0.0210*** | | | 0.0138** |
| | (0.006) | | | (0.006) |
| GVC Stopper | | -0.0207*** | | -0.0267*** |
| | | (0.007) | | (0.008) |
| GVC Continuous | | | -0.0559*** | -0.0566*** |
| | | | (0.005) | (0.005) |
| Constant | -0.0348 | -0.0329 | -0.0537 | -0.0547 |
| | (0.134) | (0.134) | (0.136) | (0.135) |
| Controls: Firm Characteristics | Yes | Yes | Yes | Yes |
| Controls: Sector Characteristics | Yes | Yes | Yes | Yes |
| Year Dummies | Yes | Yes | Yes | Yes |
| Sector Dummies | Yes | Yes | Yes | Yes |
| No. of Firms | 18,704 | 18,704 | 18,704 | 18,704 |
| No. of Observations | 102,405 | 102,405 | 102,405 | 102,405 |
| R-squared | 0.004 | 0.004 | 0.004 | 0.004 |

*Note*: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.
GVC Continuous is a dummy that takes the value of 1 if a firm is a GVC firm throughout the sample period. GVC starter is a dummy that takes the value of 1 if a firm is a GVC firm in period *t* but not a GVC firm in period *t-1*. GVC stopper is a dummy that takes the value of 1 if a firm is a GVC firm in period *t-1* but not a GVC firm in period *t*.

Beginning with the GVC starters, the estimated coefficient is negative for job destruction and positive

for job creation. This implies that entry into GVC reduces the destruction of existing jobs while increasing the creation of new jobs. Conversely, the estimated coefficient for GVC stoppers is positive for job destruction and negative for job creation. This implies that firm exit from GVC increases the destruction of existing jobs while destroying the creation of new jobs. In addition to those explanations alluded in the introduction section of the paper, a plausible explanation for this result may also be the short–and long–term productivity and profitability loss associated with exiting from GVC.

Moving on to the continuous GVC firms, we observe that the job destruction effect dominates the job creation effect, resulting in an overall net job loss for this category of firms. Putting this result and that of GVC starter together suggest that the job creation effect of GVC occurs mostly during the earlier stages of entry into GVC, while the associated reduction in job destruction materializes both in the short and long term. On the one hand, that we find continuous GVC is associated with both a reduction in job creation and job destruction can be explained by the ex-post productivity gains: as a GVC firm becomes more (labor) productively efficient into the future years, it reduces the demand for labor for each unit of output. At the same time, the firm experiences a reduction in the shedding of existing workers as unproductive firms and workers must have exited in the short and medium term.

On the other hand, that we find a net job loss for this category of GVC firms can be explained by the technology absorption argument. Particularly, as firms enter GVC, they create new jobs by hiring employees to fill new roles. Over time, as they absorb technology either from lead firms or due to forces of competition, their job creation drops significantly. This argument is in line with Rodrik (2018) who shed doubts about the job creation effect of GVC, arguing that GVC firms might be successful at increasing productivity because of the gains from trade but that the adoption of advanced labor-saving technology in GVC means more jobs will be destroyed and less will be created. Our result confirms this thesis for only a sub-category of GVC firms.

Second, we extend our analysis to consider the role of firm age and size in driving our results. Table 6 shows the result for the firm age. Results for older firms are presented in columns 1-3, while the results for the younger firms are presented in columns 4-6. We use the median year–i.e., 20 years as the cutoff. The estimated coefficient of GVC in columns 1-3 (older firms) turns out statistically insignificant, implying that integration in GVC exerts no statistically significant effect on job reallocation. In columns 4-6 (younger firms), however, the estimated coefficient of GVC turns out positive and statistically significant at all conventional significance levels. On the one hand, this implies that GVC integration exerts a significant effect on job reallocation among new and younger firms. On the other hand, the results suggest that the job reallocation effects we document in the preceding section are driven by new and younger firms. Along this line, the results show that younger firms' integration GVC is both positively associated with job reallocation that creates a net job gain as the size of the estimated coefficients of GVC participation for job creation is higher than that of job destruction.

Table 7 presents the regression results for the job reallocation effects of GVC among larger and smaller firms. Results for larger firms are presented in columns 1-3, while the results for the smaller firms are presented in columns 4-6. Based on the size variable, we define larger firms as any firm with a total number of employees that is greater than 100–i.e., firms in the third category. The rest is then considered as smaller firms. For Larger firms, the estimated coefficient of GVC is statistically insignificant for job creation but is statistically significant for job destruction, with the result suggesting that larger firms' integration into GVC reduces job destruction. Results for smaller firms, on the other hand, are identical to those of the full sample and younger firms as the coefficient of GVC turns out significantly positive for both job creation and destruction. Moreover, like these preceding results, the GVC job creation effect dominates the GVC job destruction effect.

Put together, the limited evidence we document for any meaningful job reallocation associated with larger and older GVC firms may be explained by the fact that these firm types are well established, and other things equal, they have exhausted their internal and external economy of scale. Accordingly, there might be minimal or even no job redistribution linked to the integration of established firms into GVC. This contrasts with younger and smaller firms that have not fully utilized their internal economies of scale and have yet to reach the highest levels of size and productivity. For these firms, GVC integration

Table 6: GVC Integration, Firm Age and Job Reallocation

| | Older Firms | | | Younger Firms | | |
|---|---|---|---|---|---|---|
| | Gross Job Reallocation | Job Destruction | Job Creation | Gross Job Reallocation | Job Destruction | Job Creation |
| | [1] | [2] | [3] | [4] | [5] | [6] |
| GVC Integration | -0.2695 | -0.2836 | -0.2521 | 0.8913*** | 0.9213*** | 1.3190** |
| | (0.286) | (0.539) | (0.772) | (0.136) | (0.228) | (0.559) |
| Capital Intensity | -0.0016** | -0.0025* | 0.0027 | -0.0018*** | -0.0023** | -0.0006 |
| | (0.001) | (0.001) | (0.002) | (0.001) | (0.001) | (0.002) |
| Wage per capita | 0.0067*** | 0.0043 | 0.0105* | 0.0131*** | 0.0042* | 0.0169*** |
| | (0.002) | (0.004) | (0.006) | (0.001) | (0.002) | (0.006) |
| R&D Intensity | -0.1157 | 0.3453 | -0.0430 | -0.0456 | -0.1242 | -0.0690 |
| | (0.114) | (0.215) | (0.308) | (0.049) | (0.082) | (0.201) |
| Royalty Payment | 0.8091*** | -0.1397 | 5.5628*** | -0.0999 | 0.0658 | 0.0649 |
| | (0.221) | (0.416) | (0.596) | (0.186) | (0.312) | (0.766) |
| Labor productivity | 0.0114* | 0.0017 | 0.0169 | -0.0059*** | -0.0118*** | 0.0031 |
| | (0.007) | (0.013) | (0.018) | (0.002) | (0.004) | (0.009) |
| Foreign Firms | 0.0149 | -0.0008 | -0.0031 | 0.0124 | -0.0327 | -0.0194 |
| | (0.013) | (0.024) | (0.034) | (0.015) | (0.025) | (0.061) |
| Size | -0.0442*** | -0.2934*** | 0.1160*** | -0.0643*** | -0.3330*** | -0.0151 |
| | (0.011) | (0.020) | (0.029) | (0.007) | (0.012) | (0.030) |
| Industry Demand | -0.0111* | -0.0099 | -0.0109 | 0.0007 | -0.0137** | -0.0003 |
| | (0.006) | (0.011) | (0.016) | (0.004) | (0.007) | (0.016) |
| Industry competition | 0.0042 | -0.0096 | -0.0111 | 0.0077 | -0.0115 | 0.0144 |
| | (0.006) | (0.012) | (0.017) | (0.005) | (0.008) | (0.021) |
| Trade Openness | -0.0145 | -0.0171 | -0.0492 | 0.0455*** | 0.0464** | 0.0640 |
| | (0.013) | (0.025) | (0.035) | (0.013) | (0.022) | (0.053) |
| Year Dummies | Yes | Yes | Yes | Yes | Yes | Yes |
| Sector Dummies | Yes | Yes | Yes | Yes | Yes | Yes |
| Cragg-Donald Wald-F stat | 13.06 | 13.06 | 13.07 | 142.7 | 142.96 | 142.96 |
| No. of Firms | 4,844 | 4,844 | 4,844 | 15,053 | 15,053 | 15,053 |
| No. of Observations | 25,551 | 25,551 | 25,551 | 75,903 | 75,903 | 75,903 |

*Note*: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. All variables except size is expressed in a period lag. All variables are in logs except size, foreign firm and GVC. Log transformation of R&D and Royal Payment are obtained by adding a constant-i.e., ln(1+R&D) and ln(1+Royal Payment).

leads to more noticeable job reallocation. This is due to the competitive pressures initiated by GVC and the firms' utilization of the tangible and intangible resources that being integrated into GVC integration provides them to become both allocative and productively efficient.

# 4 Conclusion

One of the prevailing views in the GVC literature is that firms' integration into GVC is associated with resource reallocation. Although reallocation is generally not costless as it creates both winners and losers, extant studies have predominantly focused on the productivity gain associated with this reallocation and ignored the possible rise in job destruction and job transitions that such reallocation also entails. In light of the incipient interest in the welfare gains of GVC, we argued a comprehensive understanding of the overall welfare effect of firm's engagement in GVC trade requires a consideration of the productivity gains and the net job reallocation gains and losses. Using firm-level data that covers the universe of formal firms in South Africa for the period 2009-2017, this paper examined the effect of GVC integration on job reallocation vis-à-vis job creation and job destruction effects.

We found that firms' integration into GVC is underpinned by a significant job reallocation that creates both winners and losers in return for efficiency gains at the firm level. More specifically, we document at the full sample level that GVC integration generates moderate welfare loss (i.e., job destruction) and huge welfare gain (i.e., job creation), indicating a net welfare gain. However, further analysis suggests that this net welfare gains is largely attributed to younger and smaller firms and to firms that are new to GVC. At best, we found that larger firms' GVC integration only reduces job destruction but has no significant effect on job creation, while older firm's integration into GVC has no significant effect on job creation and destruction. Moreover, unlike the new entrant into GVC, continuous GVC firms have

Table 7: GVC Integration, Firm Size and Job Reallocation

| | **Larger Firms** | | | **Smaller Firms** | | |
|---|---|---|---|---|---|---|
| | Gross Job Reallocation | Job Destruction | Job Creation | Gross Job Reallocation | Job Destruction | Job Creation |
| | [1] | [2] | [3] | [4] | [5] | [6] |
| GVC Integration | -0.5270 | -1.5533** | 0.3742 | 3.0026*** | 0.6414** | 4.5338*** |
| | (0.343) | (0.650) | (0.311) | (0.362) | (0.279) | (0.823) |
| Capital Intensity | -0.0093*** | -0.0105*** | 0.0025** | -0.0033*** | -0.0008 | -0.0032 |
| | (0.001) | (0.002) | (0.001) | (0.001) | (0.001) | (0.003) |
| Wage per capita | 0.0034 | 0.0058 | -0.0001 | 0.0085*** | 0.0047** | 0.0083 |
| | (0.002) | (0.004) | (0.002) | (0.003) | (0.002) | (0.007) |
| R&D Intensity | 1.0280* | 1.3760 | -0.2453 | -0.2762*** | -0.0732 | -0.4045* |
| | (0.548) | (1.038) | (0.496) | (0.099) | (0.076) | (0.225) |
| Royalty Payment | 0.6788*** | -0.5230 | 6.4572*** | -0.2207 | -0.1744 | -0.1806 |
| | (0.237) | (0.449) | (0.214) | (0.367) | (0.283) | (0.835) |
| Labor productivity | 0.0177* | 0.0465*** | -0.0136 | -0.0203*** | -0.0083** | -0.0234** |
| | (0.010) | (0.018) | (0.009) | (0.004) | (0.003) | (0.010) |
| Foreign Firms | -0.0036 | -0.0169 | 0.0094 | -0.0817** | -0.0227 | -0.1471* |
| | (0.014) | (0.026) | (0.013) | (0.037) | (0.029) | (0.085) |
| Age | 0.0368 | 0.2004*** | -0.1347*** | -0.2487*** | 0.0674*** | -0.3086*** |
| | (0.029) | (0.055) | (0.026) | (0.028) | (0.022) | (0.064) |
| Industry Demand | 0.0032 | -0.0100 | 0.0008 | -0.0138* | -0.0119** | -0.0183 |
| | (0.007) | (0.014) | (0.007) | (0.007) | (0.006) | (0.016) |
| Industry Competition | 0.0064 | 0.0093 | 0.0002 | 0.0166* | -0.0088 | 0.0194 |
| | (0.009) | (0.018) | (0.008) | (0.009) | (0.007) | (0.021) |
| Trade Openness | -0.0126 | 0.0433 | -0.0634*** | 0.1226*** | 0.0440** | 0.1659*** |
| | (0.018) | (0.034) | (0.016) | (0.025) | (0.020) | (0.058) |
| Year Dummies | Yes | Yes | Yes | Yes | Yes | Yes |
| Sector Dummies | Yes | Yes | Yes | Yes | Yes | Yes |
| Cragg-Donald Wald- F stat | 8.3 | 8.3 | 8.3 | 81.8 | 81.8 | 81.8 |
| No. of Firms | 2,533 | 2,533 | 2,533 | 16,898 | 16,898 | 16,898 |
| No. of Observations | 13,282 | 13,282 | 13,282 | 88,470 | 88,470 | 88,470 |

*Note*: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. All variables are expressed in a period lag. All variables are in logs except size, foreign firm and GVC. Log transformation of R&D and Royal Payment are obtained by adding a constant-i.e., ln(1+R&D) and ln(1+Royal Payment).

overall net job loss. In this case, the net job gain effect of GVC integration occurs mostly during the earlier stages of firm's entry into GVC, while the net job loss dominates in the long term.

Our results indicate that leveraging firms' engagement in GVC for efficiency gains will require proactive measures that minimize the reallocation costs that materialize in the forms of either destruction of existing jobs or a reduction in the creation of new ones. In this case, policymakers must be cautious of policies that aim at promoting greater GVC integration without complementary labour market and trade policies or incentive packages that cushion the unintended negative consequences.

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# Appendix

Table A1: GVC integration and labor productivity

| | [1] | [2] |
|---|---|---|
| GVC Integration | 3.2977*** | 3.3099*** |
| | (0.503) | (0.507) |
| Controls: Firm Characteristics | Yes | Yes |
| Controls: Sector Characteristics | No | Yes |
| Year Dummies | Yes | Yes |
| Sector Dummies | Yes | Yes |
| Cragg-Donald Wald F statistic | 171.7 | 169.79 |
| No. of Firm | 18,704 | 18,704 |
| No. of Observations | 102,405 | 102,405 |

*Note*: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. All variables except size is expressed in a period lag. All variables are in logs except size, foreign firm and GVC. Log transformation of R&D and Royal Payment are obtained by adding a constant-i.e., ln(1+R&D) and ln(1+Royal Payment).

Table A2: GVC and Job Reallocation: Alternative Measures

| | **Panel A: Rauch Liberalized** | | | **Panel B: UN BEC5** | | |
|---|---|---|---|---|---|---|
| | Gross Job Reallocation | Job Destruction | Job Creation | Gross Job Reallocation | Job Destruction | Job Creation |
| | [1] | [2] | [3] | [4] | [5] | [6] |
| GVC Integration | 0.5353*** | 0.5556*** | 0.7549** | 0.5591*** | 0.6102*** | 0.7918** |
| | (0.091) | (0.165) | (0.383) | (0.097) | (0.175) | (0.403) |
| Controls: Firm Characteristics | Yes | Yes | Yes | Yes | Yes | Yes |
| Controls: Sector Characteristics | Yes | Yes | Yes | Yes | Yes | Yes |
| Year Dummies | Yes | Yes | Yes | Yes | Yes | Yes |
| Sector Dummies | Yes | Yes | Yes | Yes | Yes | Yes |
| Cragg-Donald Wald-F statistic | 221.9 | 221.9 | 222.43 | 197.37 | 197.37 | 197.37 |
| No. of Firms | 18,704 | 18,704 | 18,704 | 18,704 | 18,704 | 18,704 |
| No. of Observations | 102,405 | 102,405 | 102,405 | 102,405 | 102,405 | 102,405 |

*Note*: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. GVC integration in Panel A results from a Hummels vertical specialization index that is computed using Rauch's liberal classification, while GVC integration in Panel B results from a Hummels vertical specialization index that is computed using UN BEC 5. All variables except size is expressed in a period lag. All variables are in logs except size, foreign firm and GVC. Log transformation of R&D and Royal Payment are obtained by adding a constant-i.e., ln(1+R&D) and ln(1+Royal Payment).

Data Appendix
This data appendix is created in accordance with the requirements for users of the National Treasury Secure Data Facility (NT-SDF).

Data access
The data used for this research was accessed from the NT-SDF. Access was provided under a non- disclosure agreement, and our output was checked so that the anonymity of no firm or individual would be compromised. Our results do not represent any official statistics (NT or SARS). Similarly, the views expressed in our research are not the views of the NT or SARS.

Data structuring and cleaning
Our analysis relies on two datasets: custom transaction level dataset (cust_Exports_trans_v5 and cust_Imports_trans_v5). Variables on import and export are from the custom transaction level datasets, while variables on other firm characteristics used in our analysis are either directly sourced from the CIT-IRP5_V4.0 or the variables used to arrive at the final variable are sourced from the CIT-IRP5_v4. The latter also include three industry variables (trade openness, competition, and demand) we computed. Table 1 provides a description of the main variables used in our analysis. We merged the datasets using the tax year and unique anonymized identifiers.

The data cleaning procedure we undertook are as follows. We deflated all variables in monetary units with an economy-wide deflator provided in the dataset and merged the two datasets using the tax year and unique anonymized identifiers. We drop observations in the custom transaction datasets with zero or missing import or export values. We also drop observations in the CIT-IRP5 firm-level panel with missing, zero, or negative values of sales, capital, employment, or cost of sales. For the R&D and royalty expenditure variables we treat missing values as zeros. For the incorporation year, after computing the age variable, we drop values that are less than 0 and greater than 119. Finally, we restrict our analysis to only firms in the manufacturing sector with a minimum of three periods of observation periods and without a break in the time series.