

## IMF Working Paper

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### South Africa's Exports Performance: Any Role for Structural Factors\*

Prepared by **Rahul Anand**<sup>1</sup>, **Roberto Perrelli**<sup>2</sup>, **Boyang Zhang**<sup>3</sup>

Authorized for distribution by Laura Papi and Petya Koeva Brooks

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#### Abstract

Despite a substantial and prolonged exchange rate depreciation, South Africa's export performance has disappointed since the global financial crisis. In this paper we focus on the role of structural factors in reducing the responsiveness of South African exports to the real exchange rate depreciation. To this end, we construct a unique database of export performance at the firm level. Our analysis suggests that electricity bottlenecks, limited product market competition, and labor market constraints have reduced the responsiveness of firms' exports to the rand depreciation. On the other hand, a firm's ability to diversify its exports has helped it benefit more from currency movements.

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Author's E-Mail Address: [RAnand@imf.org](mailto:RAnand@imf.org); [RPerrelli@imf.org](mailto:RPerrelli@imf.org); [bz95@cornell.edu](mailto:bz95@cornell.edu)

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<sup>1</sup> Institute for Capacity Development, International Monetary Fund, Washington, DC 20431, USA

<sup>2</sup> Strategy, Policy, and Review Department, International Monetary Fund, Washington, DC 20431, USA

<sup>3</sup> Department of Economics, Cornell University, Ithaca, NY, 14853, USA

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## I. INTRODUCTION

Despite substantive depreciation of the rand after the global financial crisis, South Africa's export performance has been very weak. In a group of 20 emerging market peers, South Africa's real effective exchange rate (REER) witnessed one of the longest and largest exchange rate depreciation spells in recent years, with its real effective exchange rate (REER) weakening by around 25 percent during January 2011–July 2014 (Figure 1). Notwithstanding the fall in relative prices, South African exports have grown at a very slow pace (about 4 percent) over this period. In relative terms, South Africa's exports growth has averaged about 82 percent of its trading partners' imports growth during 2011–14—one of the lowest proportions among peers (Figure 2), with its share of global exports falling by nearly 15 percent. Sluggish exports combined with relatively inelastic imports—partly related to large infrastructure projects—have resulted in the widening of the current account deficit to levels close to 6 percent of GDP (from about 2 percent of GDP in the beginning of the aforementioned period).

Several explanations have been put forward to explain the insensitivity of South African exports to real exchange rate depreciation. Edwards and Garlick (2008) find that South African exports are constrained by infrastructure deficiencies. The South African Reserve Bank (SARB) argues that weaker external demand, softer commodity prices, prolonged industrial action, and logistical and energy constraints have played a major role on this issue.<sup>4</sup> Other plausible explanations include the “survival of the cheapest”—large capital inflows and the concomitant real exchange rate appreciation in until 2010 may have eroded the competitiveness of South African exporting firms, forcing some of them out of business. High margins in product markets and wages in labor markets have resulted in uncompetitive domestic costs of production, eroding external competitiveness (Saint-Paul, 1997; Cuñat and Melitz, 2012).<sup>5</sup>

In this paper we explore an alternative route—the supply-side story. Over the past few years, constraints to the production function of South African exporting companies, such as lower energy availability and strikes, have seriously hurt output. These binding structural constraints may be one of the reasons behind South Africa's poor exports performance.

The innovation of the paper resides on the use of firm-level data to gauge the impact of structural factors on external sector performance. Traditional attempts to estimate the sensitivity of exports to exchange rate movements do not control for characteristics of individual firms or specific industries (Bahmani-Oskooee and Ratha, 2004). We examine the responsiveness of export transactions to REER movements and external demand growth across companies operating in key sub-sectors of the South African economy. We assess how

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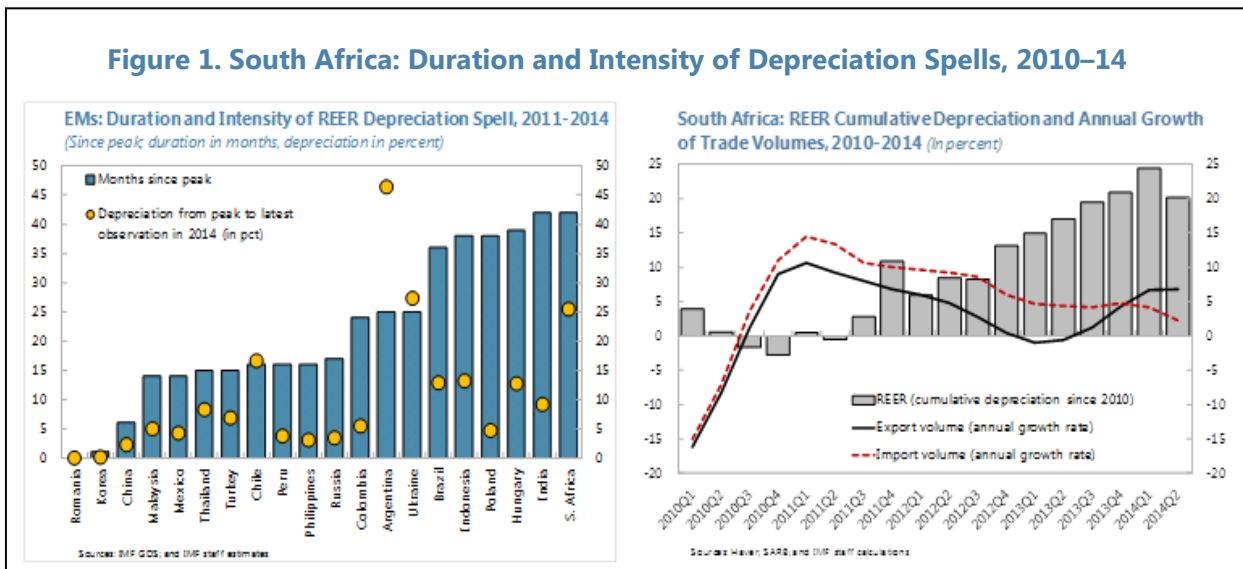
<sup>4</sup> See SARB's *Quarterly Bulletin*, September 2014. The role of commodities prices is a bit controversial. Our estimates indicate that, if terms of trade remained at 2010 levels, South Africa's deficit in the balance of goods in 2014 would be as large as the deficit recorded before the depreciation spell observed in recent years.

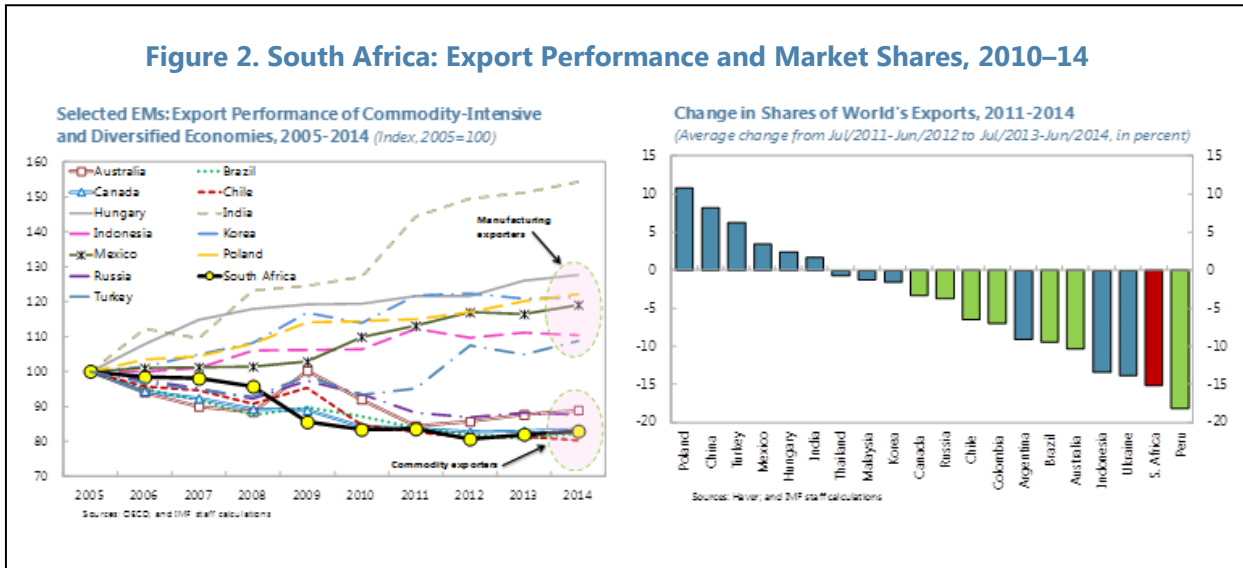
<sup>5</sup> In addition to structural factors, Sub-Saharan African exports performance has remained vulnerable to difficulties in partner countries and credit constraints (Berman and Martin, 2012; Chor and Manova, 2012).

a set of proxies for structural constraints—more specifically, electricity gaps, labor-market regulation, and product-market rigidities—has affected firms’ export performance since 2010. Using a panel regression framework with firm-level data permits us to isolate the impact of structural constraints at the most “micro” level, while controlling for macroeconomic conditions common to all firms at each point in time.

Our results suggest that electricity bottlenecks, limited competition in product markets, and binding rigidities in labor markets have reduced the responsiveness of South African exporting firms to exchange rate depreciation during the post-global financial crisis years. We also find that small and medium enterprises (SMEs), which export mostly manufacturing goods to Sub-Saharan Africa (SSA), are more responsive to exchange rate changes. Our findings suggest that structural reforms are macro-critical and have hindered external adjustment in South Africa.

The paper is organized as follows. In section II we present a brief review of the literature. In section III we describe the firm-level data used in the panel regressions. In section IV, we explain the econometric strategies that serve as the backbone of our research, while in section V we present the empirical findings. Our concluding remarks are featured in section VI.





## II. A BRIEF REVIEW OF THE LITERATURE

Previous studies estimating the elasticity of exports in South Africa were based on pre-global financial crisis years, and did not control for firm- and sector-specific characteristics in a panel framework. Behar and Edwards (2004) use vector error correction models (VECM) to estimate long-run elasticities of South Africa's manufactured goods during 1975–2000. After controlling for competitors' export prices, the authors find the elasticity of manufacturing exports to lie between -3 to -6, which means, *ceteris paribus*, one percent currency depreciation should lead to 3 to 6 percent increase in manufacturing exports. Edwards and Lawrence (2006) find the elasticity of manufacturing exports to be much smaller (between -1.3 and -1.6) after controlling for tariff rates during 1970–2004. Using alternative indicators of relative prices during 1970-1998, Golub and Ceglowski (2002) find even smaller price elasticities (ranging from -0.8 to -1.4). Studying a longer sample span (1960–2005), Narayan and Narayan (2010) find that the long-run elasticity of South African exports to the exchange rate is not statistically significant, and that the Marshall-Lerner condition does not hold for the country. Our paper contributes to the literature as our focus is on a more recent period—arguably free of the Apartheid-related structural breaks pertaining to samples used in early studies—and we construct a unique database that enables us to examine the impact of relative prices and structural constraints at the firm level.

## III. UNIQUE DATABASE

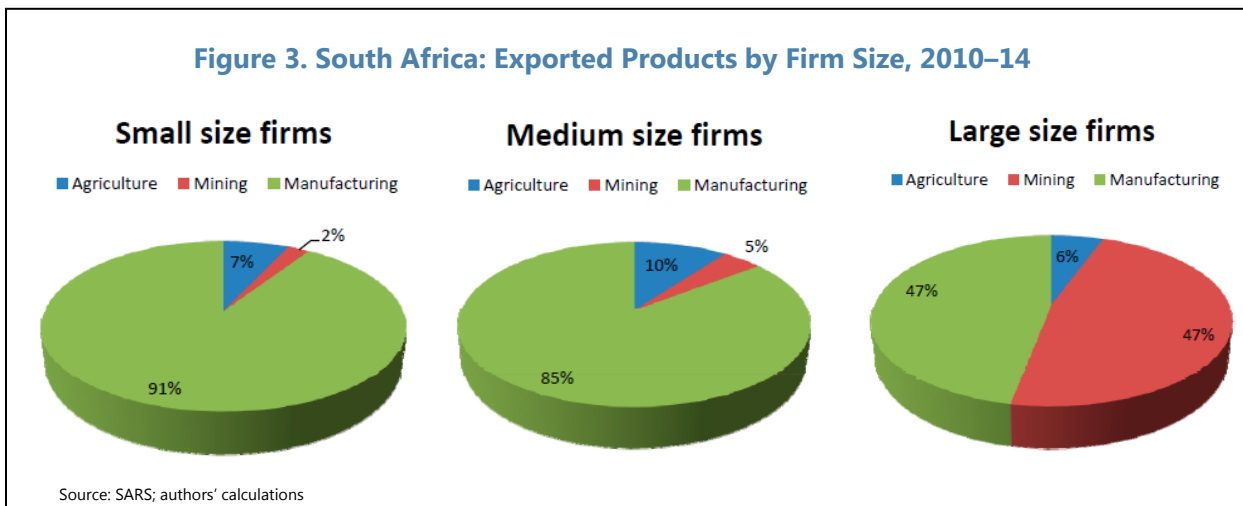
Data on monthly exports were provided by the South African Revenues Service, covering the period from January 2010 to December 2014, and including a total of sixty thousand reporting firms in 2013. The database includes information on the type of product exported, the destination of each export transaction, the currency of the transaction, and whether each reporting firm was active at each point in time. We supplement this information with trade

flows for 99 sub-sectors of the economy, as provided by the UN Comtrade database via the World Integrated Trade Solution (WITS) platform.

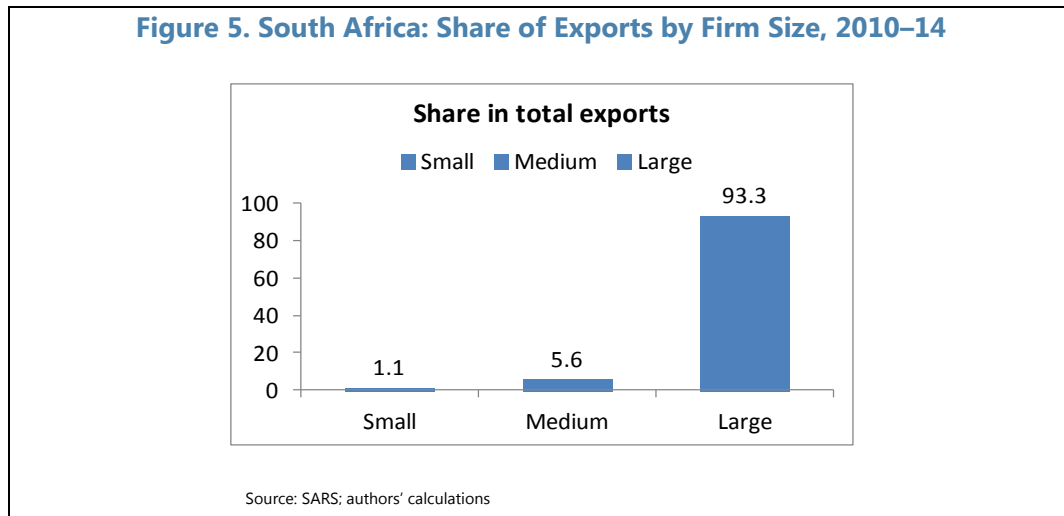
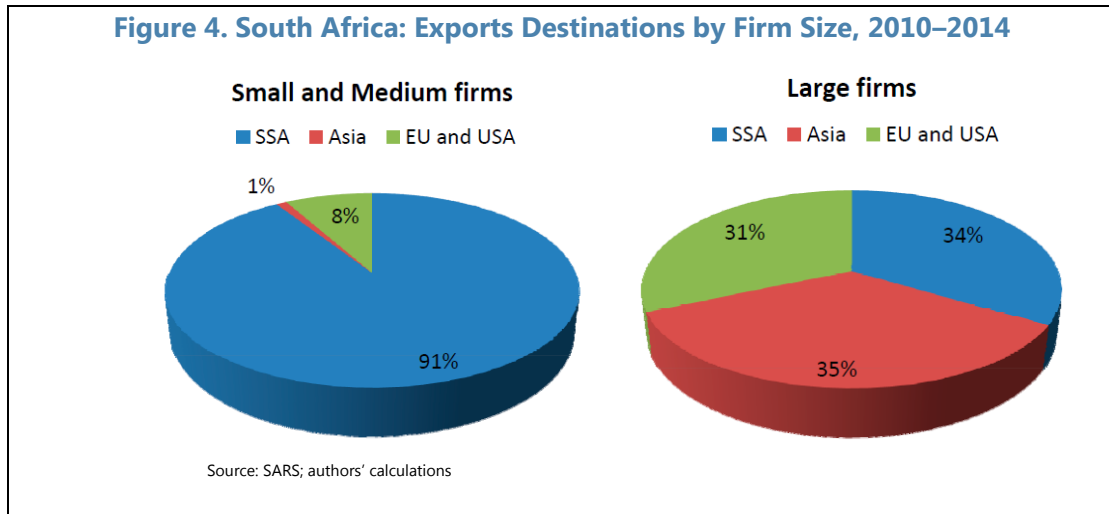
The information on relative prices (real effective exchange rate, unit labor costs, and terms of trade) was obtained from the South African Reserve Bank (SARB), while the sector-specific external demand was computed by the authors using data from the IMF's World Economic Outlook (WEO). Data on electricity consumption is taken from Statistics South Africa. The concentration and diversification indices were computed by the authors from the firm level data, while the information on days lost due to strikes was based on various industrial action annual reports (South Africa Department of Labour, 2015).

### A. Micro-Level Data

The micro-level data reveals that small and medium sized enterprises (SMEs) are manufacturing-intensive, and export primarily to regional partners. More than 85 percent of the goods exported by SMEs are manufactured products, while almost half of large companies' exports are mining products (Figure 3). Over 90 percent of SMEs' exports are shipped to Sub-Saharan Africa (SSA), while export destinations are more evenly distributed in the case of large firms (Figure 4).



However, the share of SME in the total external trade remains tiny, while large firms account for more than 90 percent of export sales in the sample period (Figure 5). This is in line with Purfield and Farole (2014), which found that super-exporters dominating South Africa's trade have underutilized the country's large pool of unskilled workers, and failed to turn the export activity into a major contributor to employment growth and poverty reduction.



## B. Transition Probabilities

The micro-level database allows us to estimate a transition probability matrix of export flows by firm size. The results show stark differences between small and large firms. Large firms have much higher probability of continuing in business than SMEs, and they account for the bulk of South Africa's exports. Nearly one quarter of active small firms in a given period are likely to become inactive (temporarily or otherwise) in the following period. Moreover, the probability that a small firm will grow to become large in the following period is minuscule. Conversely, very few active large firms are likely to become inactive or small in the next period (Table 1). Similar results are found in other developing countries (Reis and Farole, 2012). This may reflect product market rigidities that negatively affect the operation of SMEs.



**Table 1. Firm Size and Transition Probability Matrix**  
Transition Matrix

	Inactive	Small	Medium	Large	Total
Inactive	57.5	40.2	2.1	0.2	100
Small	26	68.3	5.5	0.1	100
Medium	4.6	19	70.6	5.8	100
Large	1.5	1.6	11.5	85.4	100

Source: SARS; authors' calculations

### C. Structural Rigidities

To capture the impact of structural impediments to export growth, we construct indicators of structural constraints pertaining to the supply of electricity, the concentration of product markets, and the rigidity of labor markets. We design variables that vary across sectors and over time. To capture electricity constraints, we construct a measure of electricity gap defined as the ratio of electricity consumption to production multiplied by the electricity intensity of each sector. For instance, the electricity intensities of the agricultural sector and the mining sector are 0.316 and 0.634, respectively. The demand-to-supply ratio in 2010Q1 is 96.7 whereas in 2010Q2 it is 100.8. The underlying idea is that higher demand of electricity relative to supply represents a binding constraint for the production function of firms in that sector, and a sector with higher electricity intensity is more affected by such constraints (in South Africa, this involves “load shedding” to prevent the electricity power system from a total blackout). Product market concentration is gauged by the traditional Herfindahl index (Table 2). It defined as the sum of the squares of the market shares of the firms within the industry and thus a positive number ranging from 0 to 1. For example, the organic chemicals sector has an Herfindahl index of 0.64, indicating extremely high market concentration. To capture labor market issues, we use the number of strike days per thousand of workers multiplied by the unionization rate.

**Table 2. Export Market Concentration by Sub-Sector of Production**

Sector	Export share	Export market concentration (measured by Herfindahl index)
Organic Chemicals	1.4	0.64
Aluminium And Articles	2.0	0.38
Precious Metals	20.8	0.24
Ores	13.0	0.23
Plastics	1.5	0.14
Vehicles	8.6	0.11
Cereals	0.9	0.11
Iron and Steel	7.5	0.08
Inorganic Chemicals	1.2	0.08
Mineral fuels	10.7	0.08
Beverages	1.4	0.06
Miscellaneous Chemicals	0.9	0.05
Machinery	6.9	0.02
Fruits and Nuts	2.4	0.02
Articles of Iron and Steel	1.7	0.01
Electrical Machinery	2.3	0.01

Note: Herfindahl index (HI) above 0.2 is considered highly concentrated. HI here is the average for 2010-2013.

Source: SARS; authors' calculations

↓  
decreasing  
concentration

#### IV. ECONOMETRIC STRATEGY

In the first part of our study, we estimate the short- and long-run responses of export sales to REER changes in a panel of heterogeneous sub-groups of exporting firms. We employ a dynamic heterogeneous panel estimator based on seminal work of Pesaran and Smith (1995), Pesaran and Shin (1998), and Pesaran, Shin, and Smith (1999).<sup>6</sup> The model, also known in the econometric literature as panel autoregressive distributed lag (panel ARDL) model, uses an “error correction” term to identify the short- and long-run responses of export growth to changes in relative prices and other macro fundamentals (equation 1). The error correction term characterizes the long-run relationship between export and macroeconomic variables and indicates how temporary deviation from the long-run relationship is imbedded into the short-run dynamics:

$$\Delta y_{i,t} = \beta_0 (y_{i,t-1} - \Phi_i' x_{i,t}) + \sum_{j=1}^p \beta_j \Delta y_{i,t-1} + \sum_{k=0}^q \gamma_k' \Delta x_{i,t-k} + \varepsilon_{i,t} \quad (1)$$

where  $y$  denotes exports sales of each sector (at constant prices),  $x$  refers to a matrix of macroeconomic variables, namely real effective exchange rate and sector-specific external

<sup>6</sup> Recent theoretical advances include Pesaran (2006) and Chudik, Mohaddes, Pesaran and Raissi (2013).

demand. The subscripts  $i$  and  $t$  refer to, respectively, the cross-section (firms and sectors) and time series (months and quarters) indicators.

Unlike standard panel data estimators (e.g. fixed and random effects), which assume uniformly fixed coefficients in the cross-section dimension, the panel-ARDL model allows coefficients to differ across sections of observations. In the present study, we compute the coefficients for 3 sub-groups of exported goods, constructed by aggregating exports up to two-digit sectors using SARS' export database.<sup>7</sup>

In the second part of our analysis, we try to quantify the impact of structural rigidities on export performance at the firm level. We use fixed effects panel data regression of firms' export sales (at constant prices) on macro variables, controlling for time, firm, and sector-specific characteristics.<sup>8</sup> To capture the impact of structural constraints on firms' export performance, we interact relative prices (REER) with structural indicators, as summarized in equation 2:

$$\begin{aligned}
 y_{i,j,t} = & \beta_0 + \sum_{k=1}^I \gamma_k Firm_k + \sum_{s=1}^T \eta_s T_s + \beta_1 ED_{j,t} + \beta_2 HI_{j,t} + \beta_3 PD_{i,t} + \beta_4 EG_{j,t} \\
 & + \beta_5 LC_{j,t} + \delta_1 REER_t * HI_{j,t} + \delta_2 REER_t * PD_{i,t} + \delta_3 REER_t * EG_{j,t} \\
 & + \delta_4 REER_t * LC_{j,t} + \varepsilon_{i,j,t}
 \end{aligned} \tag{2}$$

where  $y$  denotes exports sales (at constant prices); ED stands for sector-specific external demand growth (i.e. annual growth of trading partners' imports of South Africa's exports); HI represents the Herfindhal index, while PD indicates the degree of product diversification—both try to capture product market rigidities; EG stands for electricity gaps; and LC is a proxy for labor market rigidities. The subscripts  $i$ ,  $j$ , and  $t$  refer to, respectively, firms, sectors, and time periods. For EG and LC, we use the indicators described above. This panel data regression framework is useful to test whether the interaction terms can offset (or possibly amplify) the impact of relative prices on firms' export performance. The structural indicators are normalized to zero mean and unitary standard deviation, so their coefficients can be interpreted as the impact of one standard deviation changes in structural conditions on the export responsiveness to real exchange rate depreciation.

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<sup>7</sup> To be concrete, it first implements an ARDL regression for each time series in the dependent variable. Then by computing the mean of the group estimates, it generates the long run effect for the panel.

<sup>8</sup> Due to the non-continuity of firms' exports activity throughout the sample period, the panel ARDL model could not be used in this part of the study.

## V. EMPIRICAL FINDINGS

The dynamic heterogeneous panel data regression estimates suggest that manufacturing exports are more responsive to relative prices (REER) than commodity-intensive exports (Sekkat and Varoudakis, 2000). Table 3 summarizes the main results, which indicate that a one-percent depreciation of the REER could boost export sales by around 0.6 percentage point in the case of manufacturing exporters, while not having a statistically significant impact on commodity exporters. The impact of REER movement is relatively minor on mining. Even though mining companies are global price takers (U.S. dollar denominated), it is expected that the rand depreciation should increase their profitability as some of the costs are local. However, the difficulty in increasing mining output to benefit opportunistically from the depreciation due to several reasons (technology, easiness of hiring and firing employees, etc.) may explain the result. External demand is statistically significant for both sectors, with a higher impact on the performance of companies belonging to the mining sector. This finding is particularly important for South Africa given the high share of commodities in its total goods exports in the post-global financial crisis years.

**Table 3. Long-Run Impact of Relative Prices on Export Performance, by Sector**

		(1)	(2)	(3)	(4)
Variables	Expected Sign	Top 50 Sectors	Agriculture	Mining & Metals	Manufacturing
REER	-	-0.24 (0.17)	<b>-0.40***</b> (0.15)	-0.12 (0.69)	<b>-0.58***</b> (0.25)
Demand	+	<b>0.19***</b> (0.07)	<b>0.20*</b> (0.11)	<b>0.41***</b> (0.19)	<b>0.38***</b> (0.12)

Standard errors in parentheses: \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$

Source: Authors' calculations

Table 4 contrasts the results of a “baseline” regression with an “augmented” regression that contains interaction terms involving the product of relative prices (REER) and the proxies for structural rigidities. All interactive terms are statistically significant and have the expected sign. Firms in the electricity intensive sectors have seen lower exports growth as lack of power (“load shedding”) has prevented firms to expand exports. Similarly, even if the depreciation has presented an opportunity to expand exports, labor market rigidities have held back firms capacity to benefit from it. Overall, a one-standard deviation improvement in a structural indicator would be related to an increase on export elasticity by about fifty

percent. Also, an improvement in all four structural variables by half of a standard deviation would be associated with a doubling of exports' responsiveness.

**Table 4. The Impact of Structural Rigidities on Export Performance, by Firm**

Export Revenues	Expected Sign	(1)	(2)
		Baseline	Augmented
External Demand	+	0.02***	0.02***
Herfindahl Index	-	-9.77*	-9.03*
Diversification	+	14.56***	14.59***
Electricity Gap	-	-0.26	-0.43
Labor Condition	-	-1.66	-1.94
REER*Herfindahl Index	+		<b>0.48*</b>
REER*Diversification	-		<b>-0.25***</b>
REER*Electricity Gap	+		<b>0.24**</b>
REER*Labor Condition	+		<b>0.22***</b>
Observations		1,726,688	1,726,688
Time Frequency		quarterly	quarterly
Robust standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1			

Source: Authors' calculations

The results may help to understand why the mining sector, which is more energy intensive and had long disruptions due to strikes, has performed sub-optimally during this period. They also suggest that exports from sectors with high concentration have been less responsive to the depreciation, perhaps due to a rigid cost structure that offsets the external competitiveness of those sectors. Finally, the estimates suggest that firms with more diversified production have benefitted more from the depreciation. The reasons are twofold. On the production side, they can adjust the output level more easily due to economies of scale; on the sales side, product diversification reduces the average cost of trade in each export category.

The firm-level panel data show that structural constraints help to explain the limited reaction of some exporters to the weaker exchange rate. Critical inputs to any firm's production function, such as electricity and labor supply, as well as market rigidities, are associated with the sluggish response of South Africa's exports to the rand depreciation. In this environment, the comparative advantage brought up by the weaker currency has failed to boost exports due to supply-side constraints faced by firms.

## VI. CONCLUSION

Our analysis suggests that structural reforms in South Africa are macro-critical. During the post-global financial crisis years, the competitiveness-boost from lower relative prices has been attenuated by binding structural impediments to firm's production function. This sub-optimal outcome may have prevented the full transmission of domestic policies (especially in the monetary front), and averted a precious opportunity for the rebalancing of the economy.

Some particular findings are noteworthy. The dynamic heterogeneous panel data regression estimates suggest that manufacturing exports are more responsive to relative prices than commodity-intensive exports. More specifically, a one-percent depreciation of the REER could boost export sales by around 0.6 percentage point in the case of manufacturing exporters, while not having a statistically significant impact on commodity exporters. Export market concentration has also prevented firms (or sectors) from responding to the exchange rate depreciation. Meanwhile, firms with more diversified production have benefitted more from the weaker rand because of economies of scale in both production and sales.

Small and medium enterprises SMEs, albeit accountable for a tiny share of external trade, have been more sensitive to the rand depreciation during the sample period due to their specialization on manufacturing goods and their trade with regional peers. On the other hand, large mining exporters—notably more energy-intensive and subject to prolonged disruptions in the production process due to labor strikes—have been deprived of enjoying higher export growth in response to the weaker rand.

Structural rigidities hindering the current account adjustment to the depreciation force macroeconomic policies to play a greater role in reducing the current account deficit by lowering domestic absorption, as external financial conditions become less benign. Hence, addressing structural constraints is essential to generate more growth and jobs, as well as to improve the external position, facilitate the economy's rebalancing, and allow macroeconomic policies to be work more effectively.

To enrich the analysis, there are several possible extensions. As highlighted in Edwards and Schoer (2002), and Edwards and Golub (2004), the performance of export firms depend on factors beyond the REER, such as unit labor costs (ULCs). The exercise could be repeated using sector-specific ULC-based REER, data permitting. The impact of the level of sector-specific REER on exports performance could be an area of further investigation. In addition, not only the magnitude of the REER changes, but also the impact of its persistence and its volatility on exports performance could be explored. Finally, data permitting, a cross-country analysis based on firm-level data would be a welcome innovation in this field.

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