

Working paper

Constraints and Opportunities in Rwanda's Industrial Sector

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CONSTRAINTS AND OPPORTUNITIES IN RWANDA'S INDUSTRIAL SECTOR*

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* This chapter forms part of the Learning to Compete collaborative research programme of the African Development Bank, the Brookings Institution, the Global Development Network and the United Nations University – World Institute of Development Economics Research. The programme is currently active in 12 African and East Asian countries and each country team will produce papers on the evolution of industry, the evidence on learning by exporting, how skills constraints affect industrialization, the role of FDI in industrialization and the role of industrial clusters in improving firm productivity. An enterprise mapping exercise will also be carried out to provide an in-depth qualitative picture of the existing capabilities of large enterprises in a country. The research programme in Rwanda feeds into the country programme of the International Growth Centre and has benefited greatly from collaboration with the Government of Rwanda.

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Abstract

The purpose of this paper is to explore the constraints and opportunities facing the industrial sector in Rwanda by analysing patterns of productivity, exports and investment using data from the first comprehensive industrial survey in Rwanda (2011). The findings are then compared with the performance of manufacturing firms in Ethiopia and Kenya.

The industrial sector in Rwanda has remained fairly stagnant in the past decade and accounted for 14% of GDP in 2010. The main production activities are focussed on agro-processing and construction, and exports rely on volatile commodities like tea, coffee and minerals. Our findings show significant differences in performance across manufacturing firms in Rwanda – firms with any foreign ownership, those located in Kigali and exporters tend to outperform their counterparts. Our findings also show that large firms in Rwanda have higher levels of labour productivity which could be explained by the fact that they have on average higher capital stock per worker, more foreign ownership and tend to export.

1. Introduction

Since 1995 many African economies, particularly commodity rich countries, have witnessed high rates of economic growth. This has been possible mainly through the expansion of primary commodity exports and by avoiding past policy mistakes like import substitution and structural adjustment policies of the 1970s and the 1980s. Page (2011) argues that the sustainability of such growth is questionable and will to a large extent depend on structural transformation in African economies - the transformation from low productivity sectors like agriculture (on which many African economies predominantly depend) to high productivity sectors like industry (including agro-processing and tradable services). Such a transformation, particularly the speed at which this transformation takes place, will determine how quickly a country can pull out of poverty and get richer (McMillan and Rodrik 2011).

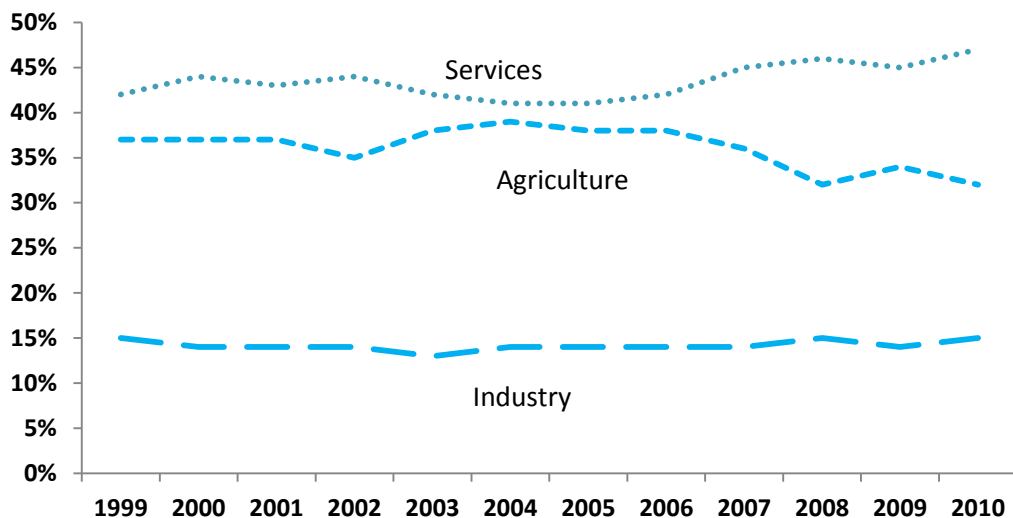
McMillan and Rodrik (2011) argue that in many Latin American and Sub-Saharan African countries, globalization has not fostered the kind of structural change needed to improve labour productivity. In fact, labour has moved in the wrong direction to more informal sectors rather than to high productive sectors like manufacturing. How a transformation to high productivity sectors can take place is the key question and the purpose of the *Learning to Compete* research programme is to search for answers.

In this chapter we take a closer look at the industrial sector in Rwanda today. The next two sections will take a closer look at sectoral composition, analyzing patterns of productivity, exports and investment and finally, comparing the performance of Rwandese manufacturing firms to those in Kenya and Ethiopia. The final section will provide concluding remarks.

2. The industrial sector in Rwanda today

In 2010, the industrial sector in Rwanda accounted for 14% of GDP of which 36% of output was contributed by the formal sector, implying the existence of a large informal sector (NISR 2010). From 1999 to 2010, while the share of agriculture decreased and the share of services increased, the share of industry in GDP (mining and quarrying, manufacturing, electricity and water, and construction) has been oscillating around 14% of GDP (NISR 2010).

Figure 2.1 Sectoral shares of GDP between 1999 and 2010

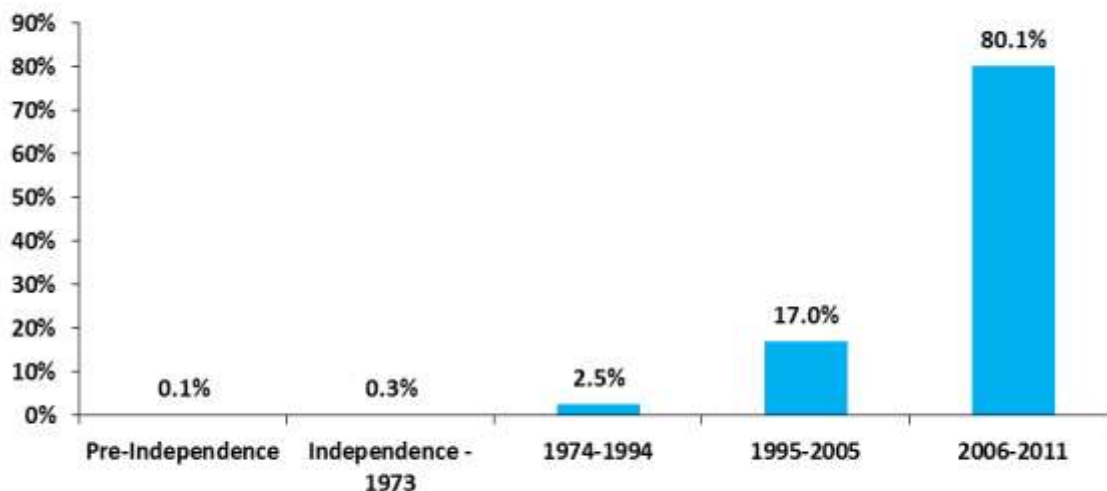


Source: NISR 2010

2.1 Firm Characteristics

Compared to many other African countries, firms in Rwanda are relatively young. Figure 2.2 shows that around 80% of the existing firms today entered the market between 2006-2011.

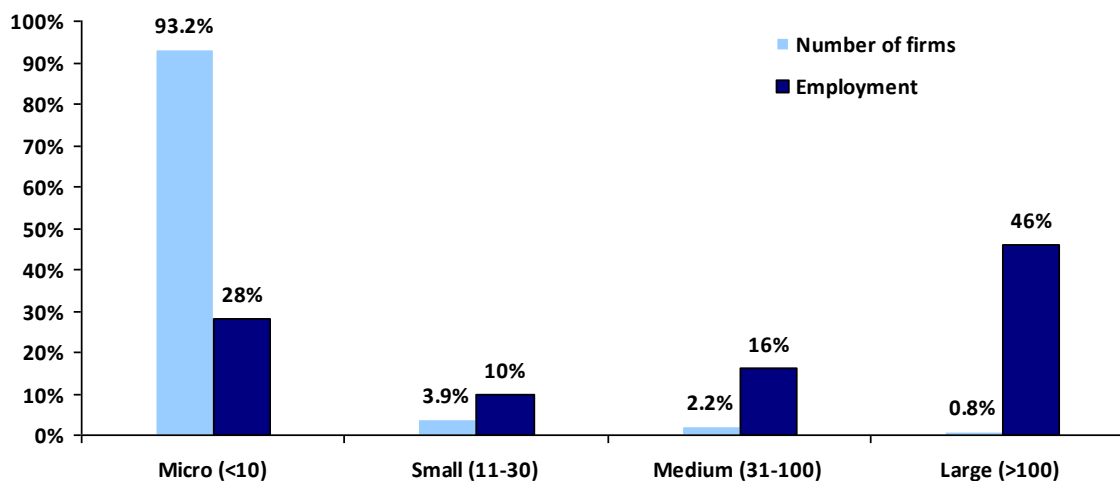
Figure 2.2: Year of establishment for firms in Rwanda today



Source: Establishment Census 2011

The formal industrial sector today consists of 4752 firms of which 97% are manufacturing, 2% construction and 1% mining and quarrying firms (Establishment Census 2011). The majority of these firms are micro (employing less than 10 persons) while SMEs (employing between 11 and 100 persons) account for 6.1% and large firms (employing more than 100 persons) only 0.8% of all firms in the sector. Though large firms accounted for less than 1% of all firms, they employ 46% of the total workforce in the sector which corresponds to 15,566 workers (see figure 2.3).

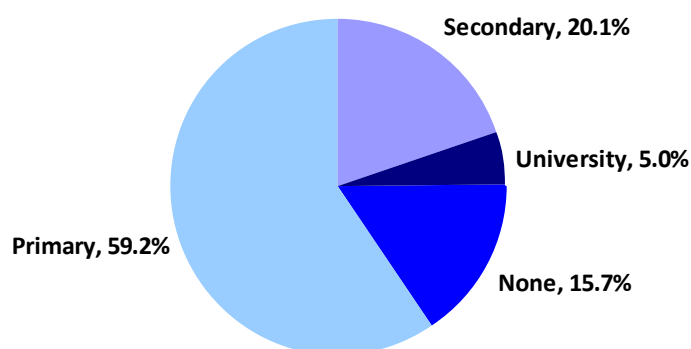
Figure 2.3 Firm size and employment in 2010



Source: Establishment Census 2011

Most employees in the sector have primary level education as shown in figure 2.4. The skills challenge in Rwanda has been identified in both the medium and long term strategic plans and is often cited as one of the many challenges facing the manufacturing sector in Rwanda today (Vision 2010, EDPRS, Business Investment Climate Survey 2008).

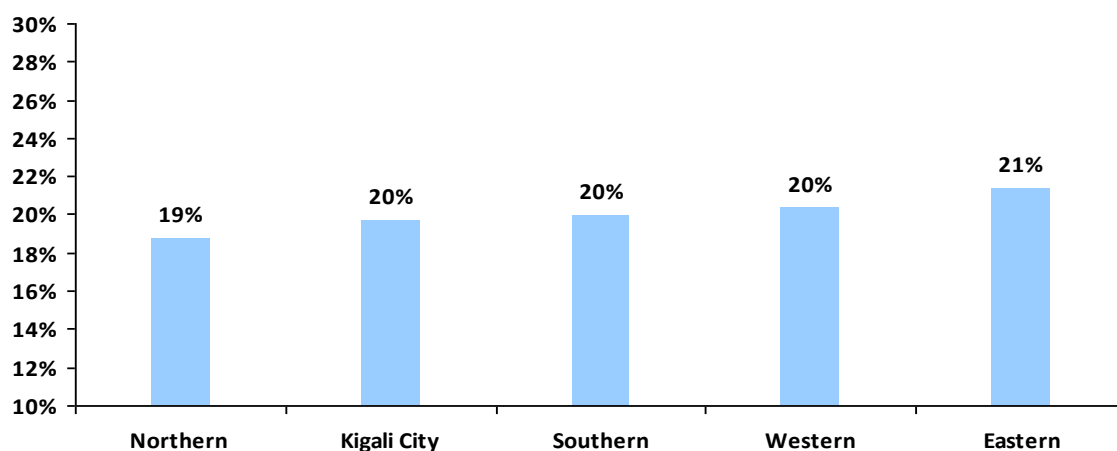
Figure 2.4 Employee qualifications in 2010



Source: Establishment Census 2011

Rwanda is split into five provinces which includes a separate province for Kigali city. Firms are fairly evenly spread out in the country as shown in figure 2.5. However, these also include micro firms which constitute the majority of firms in the country. Taking SMEs alone, around 40% of them are located in Kigali city while for large firms, approximately 51% are located in the capital city (Establishment Census 2011).

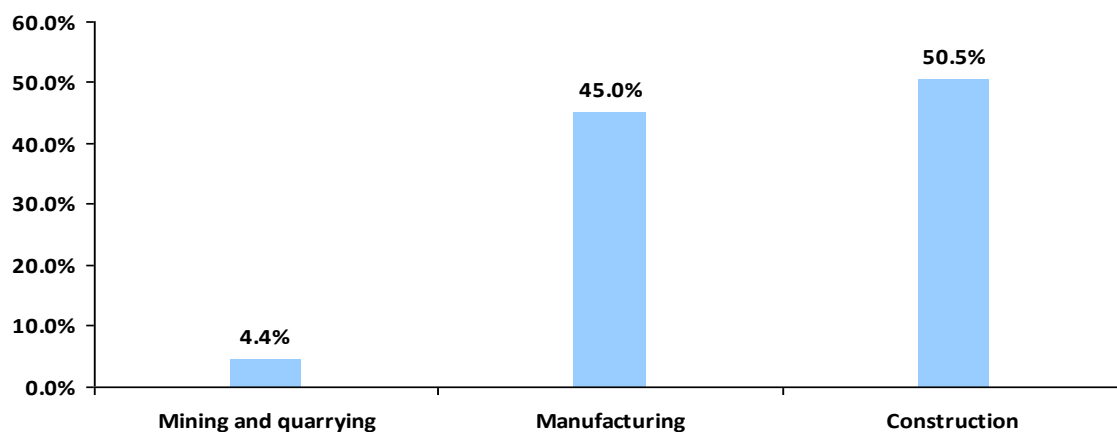
Figure 2.5 Location of firms in 2010 (split by province)



Source: Establishment Census 2011

As far as total output (value added) is concerned, the Rwandan industrial sector in 2010 was dominated by the construction sector¹, closely followed by manufacturing of which agro-processing contributed the most to manufacturing output (see figures 2.6 and 2.7). Between 2001 and 2010, one can see noticeable changes in the composition of the manufacturing sector, with the share of food processing growing to 42% in 2010 compared to 25.5% in 2001.

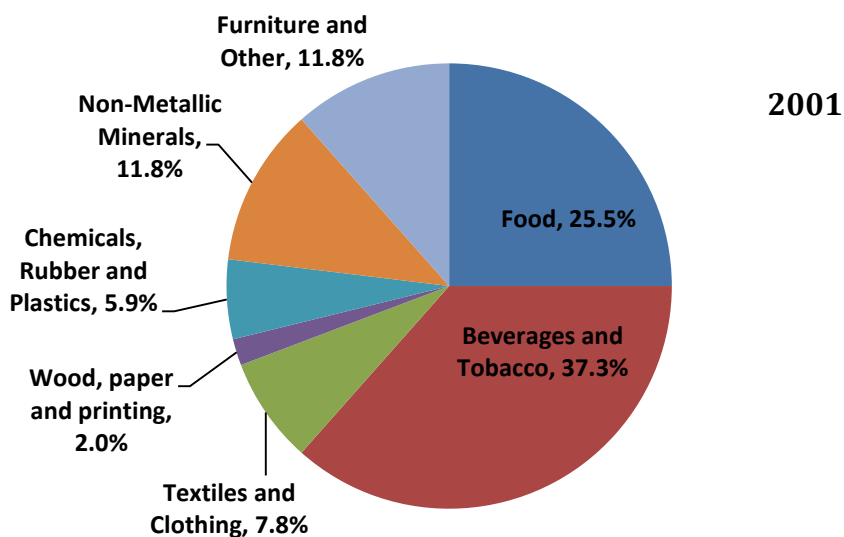
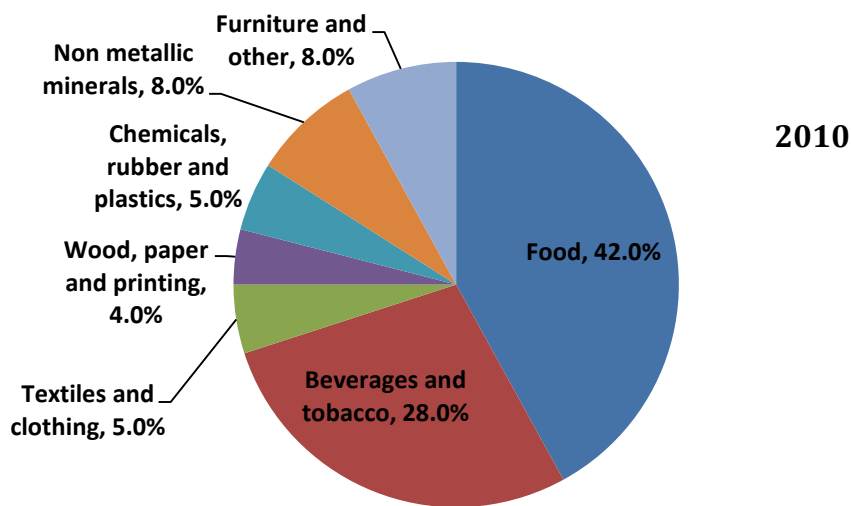
Figure 2.6 Shares of sub-sectors in industrial output in 2010



Source: NISR 2010

¹ In national accounts, construction also includes informal construction activities by individuals (to build houses for instance).

Figure 2.7 Composition of manufacturing output in 2010 and 2001



Source: NISR 2010

Rwanda's main exports are coffee, tea and minerals which are often subject to highly volatile international prices. In 2010, tin exports accounted for 7.7% of industrial output while coffee and tea exports combined accounted for 10.7% of industrial output. Rwanda's main export partners in 2010 were Switzerland, Kenya, Belgium,

Hong Kong and China. Despite joining the East African Community (EAC) in 2007, Rwanda trades more with the rest of the world than its EAC partner countries.

Table 2.1 Top five exports of Rwanda in 2010

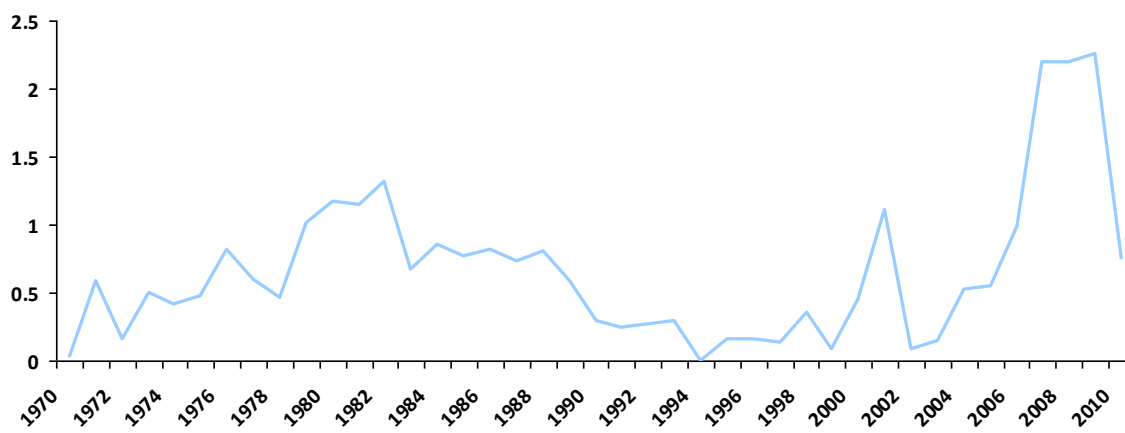
Product	USD(in millions)	Percent of Industrial Output	Percent of GDP
Tin	65.8	7.7%	1.2%
Coffee	57.1	6.7%	1.0%
Tea	33.9	4.0%	0.6%
Niobium, tantalum, vanadium or zirconium	20	2.3%	0.4%
Tungsten	7.3	0.9%	0.1%

Source: Authors' calculations based on NISR 2010

Rwanda is a net importer of industrial products and in 2010 its top five imports were special purpose motor vehicles, motor cars, petroleum oils, cement, and furnishing articles. Important import partners in 2010 included China, Uganda, Kenya, Japan and India.

Figure 2.8 shows FDI inflows to the economy as a percentage of GDP between 1970 and 2010. The past decade has witnessed a considerable increase in FDI, particularly since Rwanda joined the East African Community in 2007 but the levels have not been sustained post the recent recession.

Figure 2.8 FDI inflow as a percentage of GDP (1970-2010)



Source: UNCTAD

In 2009 for instance, of the 108 new companies registered with the Rwanda Development Board, around 45% had at least one foreign owner. In addition, 41% of these foreign firms were registered in the industrial sector. The top five investor countries were Kenya, China, Tanzania, Belgium and USA (RDB 2011). The role of foreign firms in productivity, exports and investment will be explored further in this section.

2.2 Patterns of Productivity, Exports and Investment

In 2011, Rwanda for the first time carried out an industrial survey covering all firm employing 10 or more persons (317 firms). The Rwanda Industrial Survey (RIS) collected information on firm characteristics, turnover, production costs, exports, investment, employment and access to finance, thereby enabling analyses of the determinants of productivity, exports and investment.

2.2.1 Summary Statistics

Table 2.2 provides summary statistics for the main variables of interest in the analyses². Some key points of interest are:

- Manufacturing accounts for the highest share of employment (56%) in the sector.
- The sector employs 23% female workers and 13% female managers.
- Though 69% of managers have at least secondary level education, only 14% of employees possess the same.
- Foreign ownership is highest in the Mining and Quarrying sector (35%) with the industrial sector average at 17%.
- Only 14% of firms exported in the year 2010.
- Firms in Rwanda are relatively young with a median age of 4 years.
- 72% of firms made an investment in 2010.

² Even though the survey was intended to cover those firms employing 10 or more workers, due to seasonality of employment some firms have reported less than 10 workers. For this paper, we restrict our analysis to those firms employing 5 or more workers.

Table 2.2 Summary statistics based on the Rwanda Industrial Survey 2011

	Manufacturing	Construction	Mining and Quarrying	All firms
Share of employment	56%	24%	20%	100%
Median employees	21	30	44	25
Female managers	16%	0%	3%	13%
Female employees	35%	14%	4%	23%
Manager (secondary education)	66%	100%	61%	69%
Employee (secondary education)	17%	12%	8%	14%
Foreign ownership	14%	24%	35%	17%
Firm age (median)	4	11	2.5	4
Exporters	14%	-	25%	14%
Any Investment	71%	70%	81%	72%
Kigali City	32%	87%	16%	35%
Sole Proprietors	30%	52%	28%	32%
ISO certified products	14%	-	12%	12%
Received any credit	39%	61%	19%	38%
Number of firms	231	23	32	286

Source: Rwanda Industrial Survey (2011)

Using data from the RIS, this sub-section will attempt to answer the following questions on manufacturing firms in Rwanda:

- What are the distinguishing features of SMEs and large firms?
- What are the determinants of productivity, exports and investment in Rwanda?
- What factors distinguish the top performing firms from other firms?

Table 2.3 describes the variables of interest in the analyses

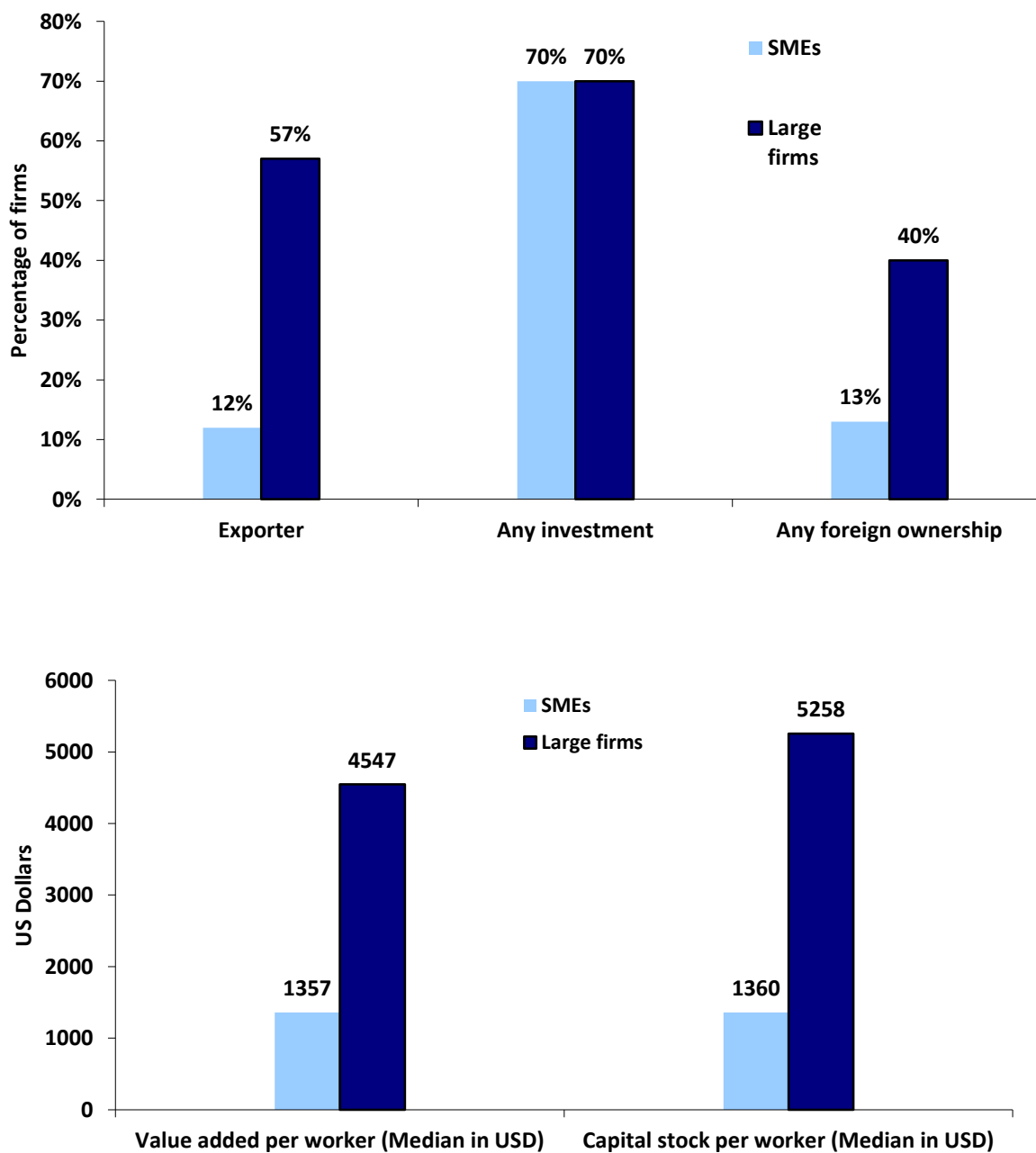
Table 2.3 Description of variables

Variable	Description
firmage	Age of the firm in years
iso	Dummy variable: 1 if firm has an ISO certified product
export	Dummy variable: 1 if firm has exported in 2010
investment	Dummy variable: 1 if firm has made an investment in 2010
credit	Dummy variable: 1 if firm has received credit
mgmale	Dummy variable: 1 if manager is male
anyfor	Dummy variable: 1 if the firm has any foreign ownership
sole	Dummy variable: 1 if the firm is a sole proprietor
mgeduc	Dummy variable: 1 if the manager has atleast secondary education
avgeduc	Average number of years of education of workers
kigali	Dummy variable: 1 if firm is situated in Kigali province
large	Dummy variable: 1 if firm employs more than 100 persons
lkl	Log capital stock per worker; defined using replacement cost of capital
lemp	Log employment
lsales	Log sales
lvadl	Log value added per worker

2.2.2 Does firm size matter?

Here we explore the differences in productivity, exports and investment between SMEs and large firms in the manufacturing sector. We define SMEs as those employing between 10-100 persons (170 firms) and large firms as those employing more than 100 persons (23 firms).

Figure 2.9 Differences between SMEs and large firms in the manufacturing sector



More than half of all large manufacturing firms are exporters while only 12% of SMEs export. Large firms are more than three times more productive than SMEs and they have close to four times as much capital stock per worker. Foreign ownership is also higher among large manufacturing firms. The only variable for which firm size does not seem to matter is for investment since 70% of both SMEs and large firms made an

investment in 2010. This could be explained by the fact that most firms in Rwanda are relatively young (median age of 4 years) and therefore more likely to make an investment. The magnitude of the total investment made in 2010 varies with a median investment of 8,500 USD for SMEs and 213,350 USD for large firms.

We now regress productivity, exports and investment on various firm characteristics in order to test for the significance and magnitude of different determining factors. We use a simple linear regression model (with robust standard errors)³ and restrict our sample to manufacturing firms.

2.2.3 Productivity Estimation

We look at two measures of productivity in this chapter. The first is labour productivity which is simply value added per worker and the second is total factor productivity which is often referred to as ‘technological progress’ in the economics literature. Total factor productivity is the growth in output which is not accounted for by traditional inputs like labour and capital. We have defined value added per worker as:

$$\text{Value Added Per Worker} = \text{Total Sales} - (\text{Cost of Raw Materials} + \text{Cost of Energy})$$

We ignore all firms with negative value added, with raw material cost reported as zero and those employing less than 5 persons. The median value for labour productivity in the manufacturing sector in Rwanda is 1527 US dollars per year. The profile of the top 10 best performing firms using labour productivity is shown in table 2.4.

³ We use a linear regression model with robust standard errors instead of a probit or a logit model to estimate the effects of various explanatory variables on the probability of exporting and making an investment. This does not affect the sign or the magnitude of the co-efficients, which is what we are primarily interested in for this paper.

Table 2.4 Profile of the top 10 best performing firms in Rwanda’s manufacturing sector

Position	Size	Main activity	Ownership	Kigali
1	Medium	Furniture	Rwandan	Yes
2	Small	Tea	Rwandan & Foreign	No
3	Large	Beer	Rwandan & Foreign	Yes
4	Small	Tea	Rwandan	No
5	Large	Rice	Foreign	Yes
6	Small	Juice	Rwandan	No
7	Medium	Coffee	Foreign	Yes
8	Small	Light Manufacturing	Rwandan	No
9	Medium	Wheat Flour	EAC	No
10	Small	Plastic	Foreign	Yes

As evident from the table above, we find a mix of firm sizes, ownership and location among the top performers. Even though large firms on average have much higher value added per worker when compared to SMEs, this does not imply that all top performers are large firms.

We now test for the determinants of productivity among manufacturing firms in Rwanda. Here we use the standard Cobb-Douglas production function which assumes constant returns to scale and diminishing returns to capital and labour (where α and β lie between 0 and 1) and can be specified as:

$$Y = K^\alpha L^\beta$$

Where Y is output (value added), K is capital (replacement cost of capital) and L is labour (number of employees). Taking logarithms on both sides, we get:

$$\log Y = \alpha \log K + \beta \log L$$

If we subtract $\log L$ from both sides, we get:

$$\log Y - \log L = \alpha \log K + \beta \log L - \log L$$

Let us assume that $\alpha + \beta = 1 + \theta$. If $\theta = 0$, then we have constant returns to scale, if $\theta > 0$, we have increasing returns to scale and if $\theta < 0$, then diminishing returns to scale.

Using this assumption, we can rewrite the equation above as:

$$\log (Y/L) = \alpha \log K + (\beta-1) \log L$$

substituting $(\beta-1)$ as $(\theta-\alpha)$, this equation can be further rewritten as:

$$\log (Y/L) = \alpha \log (K/L) + \theta \log L$$

which states that log output per worker is a function of log capital per worker and log employment. The co-efficient for the employment variable will give us estimates on returns to scale.

Regressing this equation will give us:

$$\log (Y/L) = \alpha_1 + \alpha_2 \log (K/L)_i + \alpha_3 \log L_i + u_i$$

where the error term u_i captures total factor productivity. We now assume that TFP is dependent on various firm characteristics like location, firm age, worker's and manager's education levels etc. and plug these variables into the production function and estimate using a linear regression method with robust standard errors. The equation can be specified as:

$$l_{vdl} = \alpha_1 + \alpha_2 l_{kl} + \alpha_3 l_{emp} + \alpha_4 anyfor_i + \alpha_5 firmage_i + \alpha_6 kigali_i + \alpha_7 mgmale_i + \alpha_8 mgeduc_i + \alpha_9 avgeduc_i + \alpha_{10} credit_i + \alpha_{11} sole_i + \alpha_{12} export_i + \varepsilon_i$$

The coefficients on the various dummies can be interpreted as effects on total factor productivity (see table 2.5), provided the residual ε_i is uncorrelated with the independent variables.

Table 2.5 Results of the productivity estimation (Manufacturing firms)

lvadl	Coef.	Std. Err.	t	P>t
lkl	0.3425	0.0758	4.52	0.00
lemp	-0.0639	0.1709	-0.37	0.71
mgeduc	0.0050	0.3465	0.01	0.99
avgeduc	0.0198	0.0406	0.49	0.63
firmage	-0.0142	0.0153	-0.93	0.36
mgmale	0.4490	0.4842	0.93	0.36
kigali	0.9527	0.4119	2.31	0.02
export	0.7309	0.5496	1.33	0.19
anyfor	1.2600	0.4803	2.62	0.01
sole	0.1421	0.4041	0.35	0.73
credit	0.2818	0.3456	0.82	0.42
cons	4.1161	1.0206	4.03	0.00

n=108

Four important findings come out of this estimation. Firstly, firms with any foreign ownership are 3.5 times more productive than Rwandan owned firms. Foreign firms may bring with them a higher skill set as well as knowledge about the market which gives them an advantage over their counterparts. This finding suggests that encouraging FDI in the manufacturing sector in Rwanda can be quite beneficial.

Secondly, firms located in Kigali City are 2.6 times more productive than those located anywhere else in the country. Being located in the capital city gives firms more access to skilled employees, better infrastructure, and access to information. As per the Business and Investment Climate Survey (2008) businesses in Kigali report an easier time recruiting and training personnel than do businesses in other parts of the country.

Thirdly, firms who export are twice more productive than non-exporters, however this result is only significant at the 20% level. This obviously begs the question - do firms raise their productivity by exporting or do more productive firms export? The answer is often difficult to empirically determine and the *Learning to Compete* project in Rwanda has a separate paper dedicated to this question. For now, we know that there might be productivity differences between exporters and non-exporters in Rwanda.

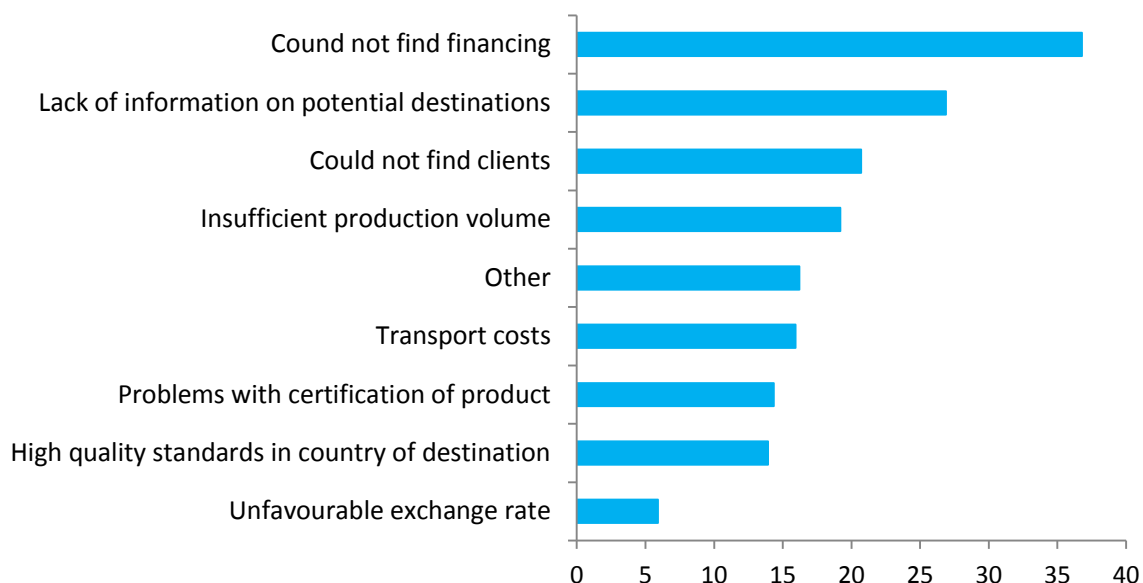
Lastly, we find no evidence of increasing returns to scale among manufacturing firms in Rwanda. At present, the data does not allow us to test for increasing returns to scale in different sub-sectors in the manufacturing sector (e.g. agro-processing, light manufacturing etc.). What probably explains the better performance of large firms in Rwanda is their high stock of capital per worker and their propensity to be foreign owned and exporters.

2.2.4 Exports Estimation

As per the Rwanda Industrial Survey, only 14% of firms exported in the year 2010. Exports play a central role in achieving the medium and long term economic goals of Rwanda (\$900 per capita income by 2020). As mentioned in the previous section, Rwanda is at present a net importer and depends on volatile commodity products like tea, coffee, and minerals for the majority of its product-based export revenues⁴. The following are the reasons cited by firms for not being able to export in 2010.

⁴ National Export Strategy

Figure 2.10 Reasons for not being able to export in 2010 (percentage of firms)



Lack of financing could probably be attributed to firms not having adequate finances to meet their installed production capacity, let alone be prepared for the exports market. Firm also lack information and face high transport costs.

We now regress the export dummy on various firm characteristics using a linear regression model with robust standard errors. The coefficients can be interpreted as measuring the partial effects on the probability of exporting. The equation is specified as follows.

$$export = \alpha_1 + \alpha_2 anyfor_i + \alpha_3 firmage_i + \alpha_4 lemp_i + \alpha_5 kigali_i + \alpha_6 mgmale_i + \alpha_7 mgeduc_i + \alpha_8 credit_i + \alpha_9 iso_i + \alpha_{10} lsales_i + \varepsilon_i$$

Table 2.6 Results of the Exports Estimation (Manufacturing firms)

export	Coef.	Std. Err.	t	P>t
anyfor	0.2863	0.1198	2.39	0.02
firmage	-0.0075	0.0041	-1.80	0.07
large	0.3420	0.1256	2.72	0.01
kigali	-0.0694	0.0757	-0.92	0.36
mgmale	0.0432	0.0572	0.75	0.45
mgeduc	-0.0431	0.0529	-0.81	0.42
credit	0.0025	0.0533	0.05	0.96
iso	0.1161	0.1106	1.05	0.30
lsales	0.0489	0.0153	3.20	0.00
cons	-0.3791	0.1506	-2.52	0.01

n=151

As shown in Table 2.6 above, firm size matters for exporting in Rwanda; large firms have a 34 percentage points higher probability of being an exporter when compared to SMEs. After controlling for firm size, firms with any foreign ownership have a 29 percentage points higher probability of being exporters when compared to Rwandan owned firms. Foreign ownership seems to have a positive impact on both productivity and exports. Younger firms also have a higher probability of being exporters though the magnitude is weak. Credit does not seem to play a significant role in determining exports.

2.2.2 Investment Estimation

The role of the private investment has been recognised in Rwanda's long term Vision 2020 strategy. In order to transform Rwanda's economy into a middle income country, a transformation from a subsistence agriculture economy to a knowledge - based economy, with high levels of savings and private investment is required (Vision 2020).

71% of firms in the industrial sector made an investment in 2010. We tease out the determinants of investment among manufacturing firms in Rwanda using the equation below:

$$investment = \alpha_1 + \alpha_2 anyfor_i + \alpha_3 firmage_i + \alpha_4 lemp_i + \alpha_5 kigali_i + \alpha_6 mgmale_i + \alpha_7 mgeduc_i + \alpha_8 credit_i + \alpha_9 lsales_i + \varepsilon_i.$$

Table 2.7 Results of the Investment Estimation (Manufacturing firms)

investment	Coef.	Std. Err.	t	P>t
anyfor	-0.0830	0.1347	-0.62	0.54
firmage	-0.0085	0.0045	-1.88	0.06
large	-0.1122	0.1230	-0.91	0.36
kigali	-0.0499	0.0835	-0.60	0.55
mgmale	0.0364	0.0984	0.37	0.71
mgeduc	-0.0878	0.0723	-1.21	0.23
credit	-0.0380	0.0676	-0.56	0.58
lsales	0.0356	0.0169	2.10	0.04
cons	0.5000	0.1950	2.56	0.01

n=165

The only significant finding for investment is that younger firms have a higher probability of investing when compared to older firms (though the magnitude is weak). This is not a surprising finding as young firms often need to invest in their early years. Credit does not play a significant role in investment decisions in Rwanda. This could be explained by the fact that most firms finance their investment and working capital using enterprise funds. As per the RIS, 43% of firms financed their investment in 2010 using enterprise funds.

To summarise:

- Large firms are more than three times more productive, tend to be exporters and have more foreign ownership when compared to SMEs in Rwanda.

- There are three main determinants of total factor productivity in Rwanda all of which have a positive impact on TFP – having any foreign ownership, being an exporter (though not a robust finding) and being located in the capital city. Large firms in Rwanda tend to be exporters and have more foreign ownership which may partly explain their better performance. In addition, large firms also have much higher capital stock per worker when compared to SMEs which has a positive effect on firm productivity.
- We find no evidence of increasing returns to scale among manufacturing firms in Rwanda.
- For exports, larger foreign owned firms have an advantage over their counterparts in the manufacturing sector. Firms cited lack of information and transport costs as some of the barriers to export.
- For investment, the only significant determinant after controlling for firm size is firm age, with younger firms having a higher probability of being investors. Credit does not play a significant role in investment decisions in Rwanda.

3. Cross-country benchmarking: Kenya and Ethiopia

In this section, we compare the performance of manufacturing firms in Rwanda to those in Kenya and Ethiopia. Ethiopia is quite similar to Rwanda in that it's a high growth economy with a small industrial sector (14% of GDP) and a small exports market dominated by primary commodities (11% of GDP). Kenya on the other hand is a much bigger economy with a GDP per capita of 790 USD and driven by the services sector which accounted for 67% of GDP in 2010. Kenya is also a big exporter in the region, with exports at 26% of GDP (World Development Indicators). We expect to see vast differences between Rwandan and Kenyan manufacturing firms and similarities between Ethiopian and Rwandan manufacturing firms.

A summary of the data used for cross-country benchmarking is outlined in Table 3.1 below. We use a similar approach to the previous sections and analyse patterns of exports, investment and productivity.

Table 3.1 Sources of data for cross-country benchmarking

	Rwanda	Ethiopia	Kenya
Year	2010	2007/08	2006
Sector	Manufacturing	Manufacturing	Manufacturing
Firm size	Employing more than 10 workers	Employing more than 10 workers	Small, Medium and Large firms
Sample Size	231	1734	453
Source	Rwanda Industrial Survey	Survey of Large and Medium Manufacturing Industries	Productivity and Investment Survey

A simple comparison between firm characteristics in Rwanda, Ethiopia and Kenya reveal quite a few interesting findings as shown in table 3.2⁵.

Table 3.2 Firm Characteristics – A comparison between Rwanda, Ethiopia and Kenya

	Rwanda	Ethiopia	Kenya
Median employees	21	21	45
Female managers/owners	16%	-	36%
Manager (secondary education)	66%	-	19%
Any foreign ownership	14%	6%	15%
Firm age (median)	4	6	17
Exporters	14%	4%	41%
Investment	71%	46%	54%
Located in capital city	32%	46%	-
Value added per worker (median USD)	1527	1690	9119
Capital stock per worker (median USD)	1623	644	15125
Number of firms	231	1734	453

Rwandan and Ethiopian firms have a lot in common – similar firm size, are relatively young and have similar levels of labour productivity. Rwanda and Kenya have similar levels of foreign ownership, however Kenyan firms are close to six times more productive than Rwandan firms and have nine times more capital per worker. Kenyan firms are a lot older, bigger in size and close to half of them are exporters. Only 4% of Ethiopian firms exports, however Ethiopia has access to a bigger domestic market which Rwanda lacks, therefore underscoring the importance of exports for Rwanda in the industrialization process.

An analysis of determinants of total factor productivity for all three countries reveal that there exists significant differences in performance across firms in Rwanda, which is not observed in Kenya. In Ethiopia, there is some learning as firms grow older but

⁵ Please note that for both Rwanda and Kenya, we have used replacement cost of capital as the variable for capital stock while for Ethiopia we have used net book value as information on replacement cost was unavailable. This may not allow for a strict comparison between countries on capital stock per worker.

apart from that there are no significant differences across firms. In Kenya and Rwanda, we find no evidence of increasing returns to scale among manufacturing firms.

Table 3.3 Comparison of productivity differences across firms

	Rwanda	Ethiopia	Kenya
Do exporters have higher TFP?	Yes: 2.1 times higher*	No	No
Do foreign owned firms have higher TFP?	Yes: 3.6 times higher	No	No
Are older firms more productive?	No	Yes: 0.6% per year	No
Are firms in the capital city more productive?	Yes: 2.6 times higher	No	-
Evidence of increasing returns to scale	No	Yes	No
Effect of capital stock per worker	Positive	Positive	Positive

*significance level is 20%

Similar observations can be made with regards to differences due to firm size (see table 3.4). In Rwanda and Ethiopia, firm size seems to matter for exports, foreign ownership and labour productivity while in Kenya the magnitude of the difference is much smaller.

Table 3.4 Comparison between SMEs and large firms in Rwanda, Ethiopia and Kenya

	Rwanda		Ethiopia		Kenya	
	SMEs	Large Firms	SMEs	Large Firms	SMEs	Large Firms
Exporter	12%	57%	1%	19%	34%	77%
Any Investment	70%	70%	40%	79%	53%	63%
Any foreign ownership	13%	40%	2%	30%	17%	23%
Value added per worker (Median in USD)	1357	4547	1416	4907	8823	10375
Capital stock per worker (Median in USD)	1360	5258	462	2111	16476	14958
Number of firms	170	23	1329	261	234	109

What is also worth noting is that small Kenyan firms are six times more productive than small Rwandan firms and large Kenyan firms are twice more productive than large Rwandan firms. Small Rwandan firms are lagging behind their counterparts in

Kenya for two possible reasons. The first is that they have lesser capital stock per worker which has a positive effect on productivity. Secondly, one of the main determining factors of productivity in Rwanda, namely foreign ownership is also lesser among small firms in Rwanda. Foreign ownership does not play a determining role in explaining productivity among Kenyan manufacturing firms. Kenya has been exposed to foreign investment and influences for a much longer period than Rwanda which may serve as a partial explanation. Rwanda is just beginning to bear the fruits of external influences and over time the differences in productivity may lessen.

To summarise:

- Rwandan and Ethiopian firms are similar in firm size, firm age and labour productivity. Only a small fraction of Ethiopian firm export compared to Rwandan firms. However, Rwanda lacks a large domestic market like Ethiopia.
- Kenyan firms outperform Rwandan firms by a large margin. For instance, small Kenyan firms are six times more productive than small Rwandan firms and large Kenyan firms are twice more productive than large Rwandan firms.
- Capital stock per worker combined with the role of foreign ownership and exports may partly explain the differing performance among Rwandan firms.
- We find no evidence of increasing returns to scale in either Kenya or Rwanda.

4. Conclusions

The main aim of the chapter is to highlight some of the constraints and opportunities facing the industrial sector in Rwanda today. Compared to the agriculture and services sectors, the industrial sector in Rwanda is small, accounting for 14% of GDP and is dominated by agro-processing and construction activities. There is a large informal sector accounting for 64% of output in industry. Exports are primarily dependent on price-volatile commodities like coffee, tea and minerals and Rwanda trades more with the rest of the world than with its EAC partners. Since independence, the share of agriculture in GDP has dropped significantly but the industrial sector is yet to play a leading role in Rwanda's economic growth.

Our findings show that labour productivity differences between SMEs and large firms in Rwanda and Ethiopia are significant. This can be partly explained by the differences in capital stock per worker between SMEs and large firms in both countries. In Kenya, SMEs and large firms have similar levels of capital stock per worker and similar levels of labour productivity.

We also find that in Rwanda there are significant differences in performance across firms which is not the case in Kenya. For instance, having any foreign ownership, being an exporter and being located in the capital city all have positive effects on total factor productivity in Rwanda. Since large firms have more foreign ownership and tend to be exporters, this could also partly explain the poor performance of small firms.

We do not however find evidence of increasing returns to scale in Rwanda or Kenya suggesting that small firms that have similar levels of capital stock per worker and similar characteristic features as large firms (ownership, exports, location etc.) should perform as well as their large counterparts.

We also find that exporting firms are more productive than non-exporting firms in Rwanda, though this finding is significant only at the 20% level. Whether firms learn by exporting or more productive firms export will be the focus of a separate *Learning to Compete* chapter. For now we know that the probability of being an exporter is higher, the larger the firm and if the firm has any foreign ownership.

These findings suggest that any degree of foreign ownership can be beneficial to Rwandan manufacturing firms. Kenya has been exposed to foreign influences for longer than in Rwanda and has already borne the fruits of such exposure. Rwanda on the other hand is just beginning to experience high levels of foreign investment and this serves as a starting point for a possible improvement in the performance of Rwandan manufacturing firms.

In order to encourage more exports, the barriers cited by firms, namely lack of information, transport costs etc. need to be tackled. Rwanda as a landlocked country has a natural disadvantage when it comes to trade thereby underscoring the importance of developing good transport linkages.

From a policy perspective, measures should be taken to tackle the differing features of SMEs and large firms with regards to capital stock, ownership, location and exporting. In addition, encouraging SMEs to grow into large firms may also have beneficial outcomes. While SMEs play an important role for reducing gender inequalities and offering a safety net for unskilled workers, the main drivers of industrial growth in Rwanda for the time being will be large firms.

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