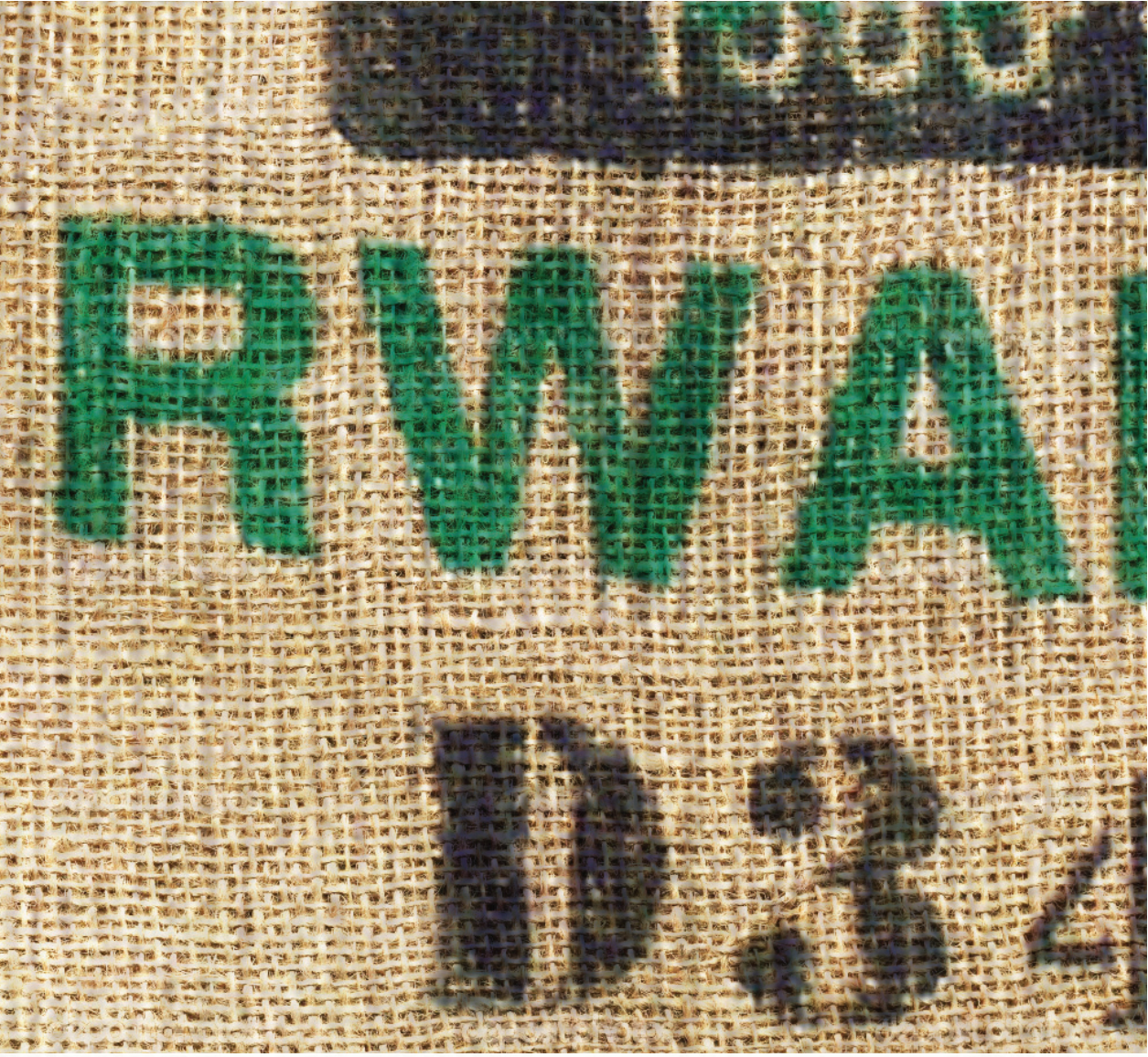

Understanding Rwanda's Export Sector

A deep-dive into Rwanda's merchandise export sector, focusing on destinations, products and firms

Sachin Gathani & Dimitri Stoelinga

IGC International Growth Centre

laterite TRANSFORMING ADVISORY SERVICES IN AFRICA

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This paper has been prepared for the **International Growth Center** and is part of the Learning-to-Compete program of the Africa Growth Initiative. The Africa Growth Initiative is a collaborative research program of the African Development Bank, the Brookings Institute, the Global Development Network, and the United Nations University. The objective of the "Learning to Compete: Accelerating Industrial Development in Africa" program, is to identify the drivers of accelerated industrial development in Africa by examining the industrialization process and the evolution of industrial policies in a number of African countries, including Ethiopia, Kenya, Ghana, Mozambique, Nigeria, Senegal, Uganda and Rwanda. The focus of this effort is both horizontal, drawing on lessons learned from cross-country comparisons on thematic focus areas such as exports, skills, agglomeration effects, FDI, industrial policy and enterprise mapping; and vertical, building on each of these thematic focus areas to gain insights on industrial development from a country perspective and advise governments on potential policy implications.

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1. Introduction & approach

The main objective of this policy paper is to explore the dynamics of Rwanda's **merchandise exports sector**, focusing on destination discovery, product discovery and firm level performance. [1] This analysis is targeted in particular at Rwandan policy-makers and academics participating in the Africa Growth Initiative. For Rwandan policy makers, this paper will present: (i) a new and structured way of understanding and analyzing Rwanda's performance as an exporter based on filtered and cleaned official exports data; and (ii) insights on current and likely future trends.

Our Approach

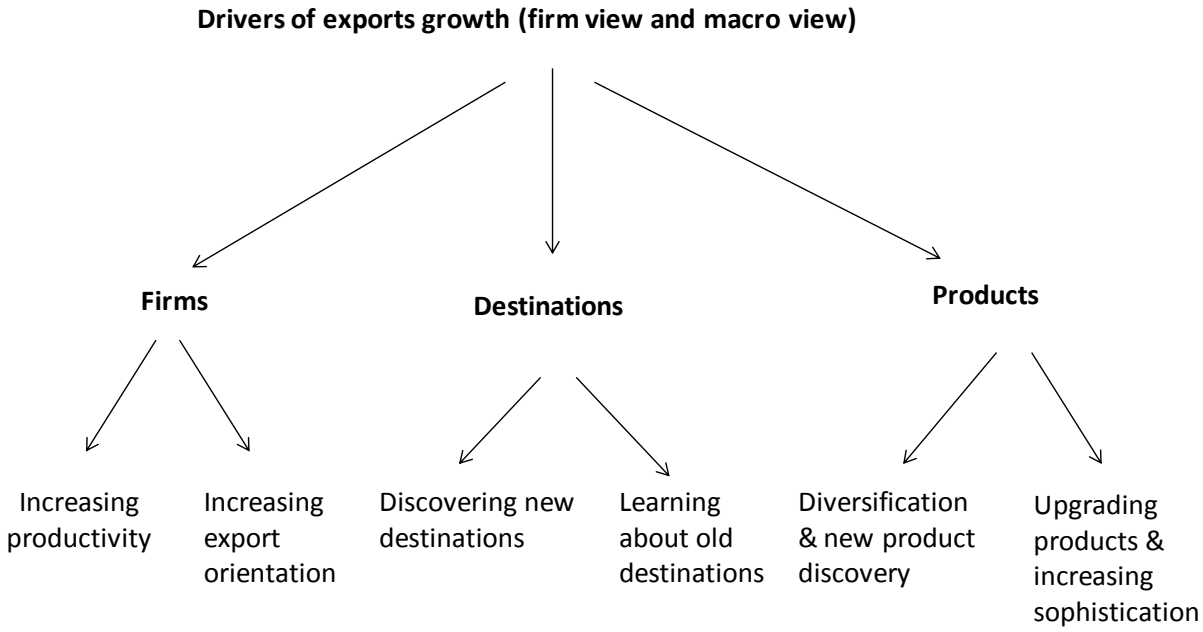
In this paper we propose a broad policy-centered approach to analyzing export dynamics, with a focus on if and how firms in Rwanda - and Rwanda's exports sector as a whole - have acquired the capabilities to export to new destinations, discover new products and improve their productivity levels to better compete on regional and international export markets. The building blocks of our approach can be narrowed down to three units of interest: firms, products and destinations. Firms export certain products to certain destinations; firms can learn about the destinations markets they export to, acquire the required capabilities to export to new destinations, innovate to produce new or better products enabling them to compete in the export markets, or improve internal systems and productivity to respond to demand and price competition. The capabilities and investments required to achieve each of these incremental steps, be it entering new markets, introducing new products, or improving internal systems are very different; likewise, the adequate policy tools to address issues of competitiveness or product diversification, or to promote new destination discovery, are contingent on the dynamics of firms, products and destinations at the firm and economy-wide levels. Understanding these dynamics is key to designing the right policy solutions. According to Zahler (2007):

"The type of innovations required for firms to increase value, is distinct from the ones required to produce new products or the ones required to enter a given geographic market. Selling coffee in a new market is different from making coffee for the first time or improving an existing brand. Moreover, the policies required to solve potential market or coordination failures in these three dimensions are also different. Compare, for example, R&D incentives with export promotion agencies and free trade agreements"

To analyze and better understand these dynamics we propose a framework, which is summarized in Figure 1. It is based on the premise that: (i) the three main vectors of exports growth are destination discovery, product discovery, and firm-level productivity; (ii) that these three growth vectors are not mutually exclusive; (iii) that incremental improvements happen both at the firm and macro-levels; and (iv) that policy makers need to develop an understanding of all three dynamics to determine how to best support future exports growth.

[1] We define merchandise exports, as the exports of goods; i.e. not services, such as tourism for example.

Figure 1: The Exports Dynamics Tree



We study each branch of this exports dynamics tree starting from the macro-perspective, before delving into details of firms, products or destinations. We combine data analysis with case studies, in order to better understand what is behind the numbers and to explain some of the insights or findings that may seem counterintuitive in the first instance. To analyze product discovery, we rely mostly on previous work by Hausmann et al on the product space (2006) as well as subsequent research on economic complexity (2009); we study destination discovery building on export decomposition techniques designed by Zahler (2007); finally, we compare the productivity levels of exporters and non-exporters, by exploring productivity data in Rwanda's manufacturing sector in detail.

The outcome of this work is a detailed and structured deep-dive into Rwanda's exports sector, focusing on firms, products and destinations, using cleaned export data (up to 2010), excluding re-exports, unofficial exports, and correcting for misclassifications (for a detailed explanation on the data sources used and the corrections made please see Annex 1). Key takeaways from this paper are: (i) to understand Rwanda's exports sector one needs to make a clear distinction between commodity exports (tea, coffee, and minerals in particular) and non-commodity exports – export dynamics for these two groups of products are very different be it in terms of destination discovery, product discovery or firm-level performance; (ii) while destination markets for Rwanda's commodity sectors are relatively well established, non-commodity exports are only nascent, driven in particular by increasing exports to Burundi and the Democratic Republic of Congo (DRC); (iii) firms in Rwanda's non-commodity export sectors are not very export oriented, which is reflective of the fact that the products of Rwanda's manufacturing and agribusiness sectors are not very competitive yet in regional markets; and (iv) new entrants, in particular firms owned by large East African groups, are behind the recent growth in the non-commodity exports sector.

It is important to note that there are some issues that are beyond the scope of this study. One major omitted issue for example is the role of the exchange rate, which appreciated compared to other EAC partners during the period of interest. Another is the role of tariffs and in particular the impact of East Africa's Common Market Protocol on regional and international exports. Lastly, for lack of detailed and comparable

data over time, we only focus on official merchandise exports - not on the exports of services or unofficial exports, which both play a major role in Rwanda's overall exports sector.[2]

We start this paper by providing some context on Rwanda's export sector. Next we study each of the three branches of the exports dynamics tree applied to the case of Rwanda, starting with destinations, followed by products and lastly firms, before concluding and providing policy recommendations.

2. Overview of Rwanda's Merchandise Export Sector

The objective of this section is to give the reader a bird's-eye view of Rwanda's exports sector in terms of products, destinations and firms, and to put the ensuing discussion into context. We remind the reader that the focus of this study is official merchandise exports; it therefore excludes informal exports, as well as the exports of services.

2a. The timeline of Rwanda's exports sector

The evolution and current composition of Rwanda's exports sector is the product of history. The origins of Rwanda's current export sector go back to the early 1930s, following a number of investments by the Belgian colonial administration. At the time of independence, in 1962, Rwanda was an exporter of coffee (55%), minerals such as cassiterite, tin, and wolfram (37%), pyrethrum (3%) and tea (2%).[3] Coffee, which until the genocide was Rwanda's main export, became widespread in the late 1930s following five waves of mandatory coffee-tree planting imposed by the Belgian colonial administration in order to increase revenue collection from its Rwanda-Urundi colonies in the context of the Great Depression; pyrethrum was introduced during the same period in areas where coffee trees could not grow, in particular at high altitudes[4]; Rwanda's minerals sector was started in 1930 and by 1955 included more than 200 quarries, controlled by Belgian settlers and companies, extracting tin, gold, silver, wolfram, and cassiterite[5]; while tea was introduced much later, in the early 1950s, by European and Asian settlers. Until very recently, these products have accounted for over 90% of Rwanda's merchandise exports.

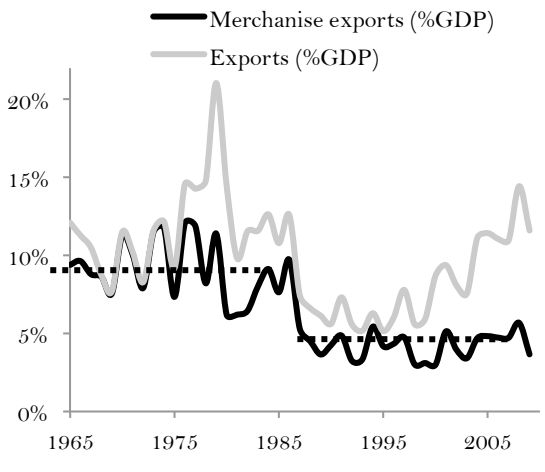
We can distinguish three periods in the development of Rwanda's exports sector since independence:

- **The 1962-1986 period**. During this period merchandise exports averaged 8% of GDP, with 60% of income coming from coffee exports, about 30% from the exports of minerals, with smaller export products including tea and pyrethrum.
- **The 1986-1995 period**. Rwanda's exports sector collapsed between 1986 and 1995. The rapid decline started in 1986, as the result of a very large drop in global coffee prices, which fell by an estimated 70% between 1986 and 1992. This decline was amplified by the unsustainability of inward oriented policies and eventual economic instability following consecutive devaluations in the early 1990s and the political instability leading to the 1994 genocide.
- **The 1995-2011 period**. While Rwanda's exports sector has fully recovered from the catastrophic impact of the 1994 genocide – increasing from about 5% of GDP in 1994 to an average of about 12% since 2004 - this recovery is largely due to the performance of the services sector. Exports of goods, or what we refer to as merchandise exports, have remained constant at about 4-5% of GDP, at about half of

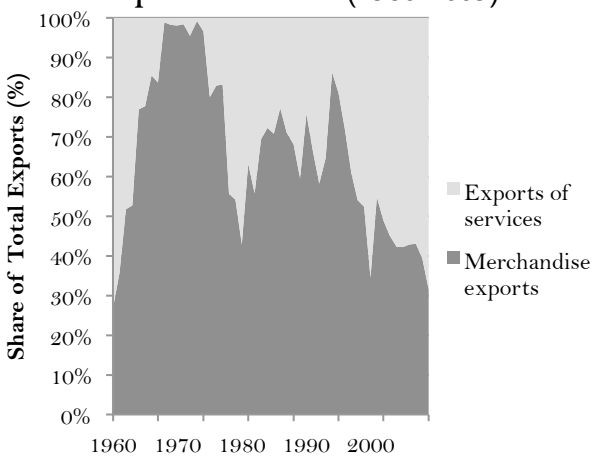
[2] The Ministry of Industry and Commerce as well as the International Growth Center in Rwanda have commissioned forthcoming studies to shed light on some of these issues that have been omitted in this paper.
[3] 1964 data from: International Development Bank for Reconstruction and Development, *The Economy of Rwanda*, Report No. AF-78a, 1968.
[4] Gathani and Stoelinga, *Understanding Rwanda's Manufacturing and Agribusiness Sectors*, The International Growth Center, Conference Version, July 2012
[5] Bezy, *Rwanda 1962-1989: Bilan Socio-économique d'un régime*, Institut d'Etudes du Développement, 1990

their pre-genocide levels (see graph 1). As a result, services have now replaced coffee as Rwanda's largest export – averaging 55% of exports since 2000. This shift could be interpreted as the result of the tepid performance of the merchandise exports sector, or on the contrary, as the result of the fact that having shifted its policy regime towards more openness, Rwanda is now developing according to its comparative advantages, of which the service sector is one area.

Graph 1. Merchandise exports over GDP (1960-2010)



Graph 2. Merchandise exports vs exports of services(1960-2009)



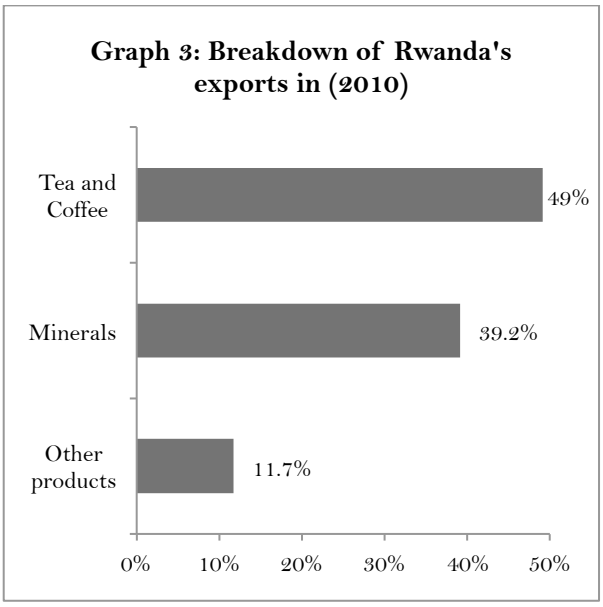
2b. Rwanda is an exporter of commodity products

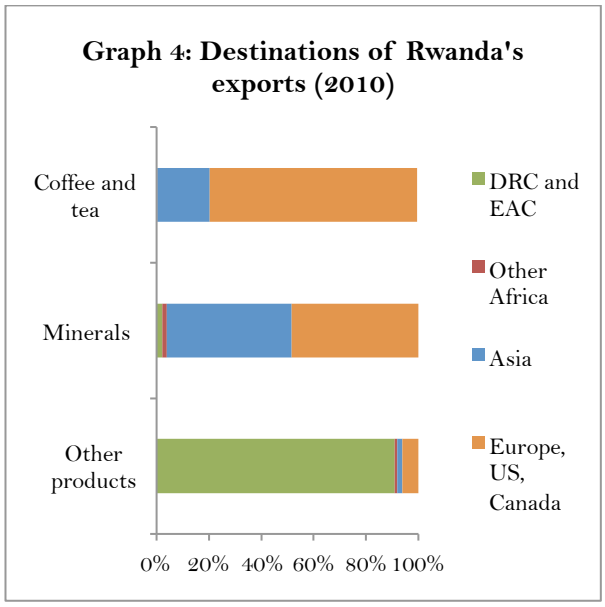
The key to understanding Rwanda's merchandise exports[6] sector is to distinguish between commodity exports, which have been present since pre-independence, and non-commodity exports, which are much more recent. We will show throughout this paper that learning dynamics, be they in terms of firms, products or destinations vary greatly depending on whether we are talking about commodity exports or non-commodity exports.

Rwanda is overwhelmingly an exporter of commodities[7]. Rwanda's commodity exports are concentrated around 3 types of products: coffee, tea, and mineral products, in particular tin ores, niobium, tungsten, and chromium. Together, minerals, coffee and tea account for about 88% of the country's exports. The remaining 12% of exports include in particular live animals, pyrethrum, non-processed agricultural products (e.g. beans), plastic shoes, construction materials, plastic tanks, and beverages. These numbers are based on cleaned trade data, where several filters have been applied in order to eliminate the most likely re-exports, misclassified as exports (see graph 3).

As a rule of thumb, Rwanda's commodity exports of tea, coffee and minerals are mostly exported to Europe, America and Asia. In official trade data the majority of tea exports are captured as an export to Kenya because coffee is traded at the Mombasa auction and exported out of the port of Mombasa; however, the tea only transits through Kenya on to other destinations, mostly in Europe, the US and Asia. In graphs 3 and 4, we re-allocate these tea exports to other destinations based on global tea imports statistics. Contrary to commodity exports, 91% of non-commodity exports (equally divided between agricultural and non-agricultural products) are exported to the Democratic Republic of Congo (DRC) and the East African Community (EAC).

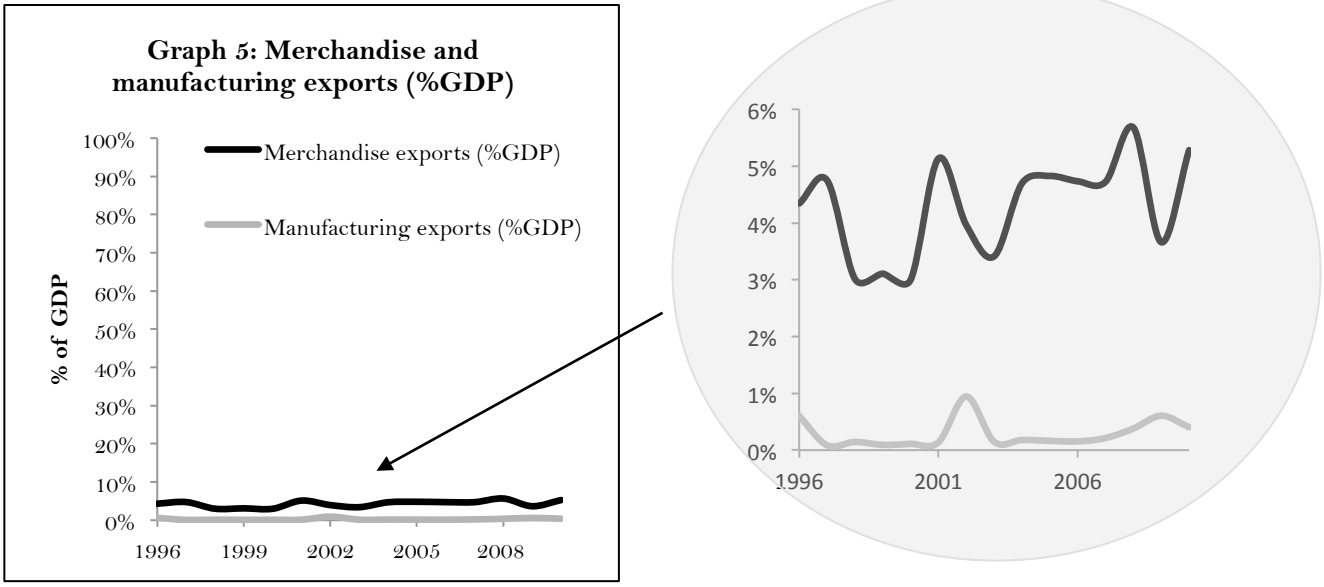
[6] We refer to merchandise exports as any exports of goods as opposed to services
[7] For the purposes of this paper, we refer to commodity exports as tea, coffee and mining sectors





2c. Rwanda exports few processed/manufactured products

Rwanda is not a large exporter of manufactured products. WDI data[8], which excludes tea, coffee and mineral exports from the list of manufactured products, reveals that Rwanda's manufactured product exports averaged only 0.5% of GDP during the 1996-2010 period (see Graph 5). This amounts to an estimated USD$1.5 per capita in real terms (constant USD, 2000) or a total of approximately USD$30m in total manufactured exports (current USD, 2010). These figures include re-exports (such as cars and machinery), which have been misclassified as actual exports, so the actual numbers could be substantially lower. On average, less than 10% of the output of Rwanda's manufacturing sector is exported, which means that manufacturing firms in Rwanda are predominantly focused on the domestic market.



We confirm these results at the individual firm-level using 2010 Rwanda Revenue Authority data, and discover that out of Rwanda's largest manufacturing firms (outside the tea and coffee sectors) only a handful export more than 10% of their output. We estimate the exports of Rwanda's top 20 manufacturing firms in

[8] WDI – World Development Indicators (World Bank)

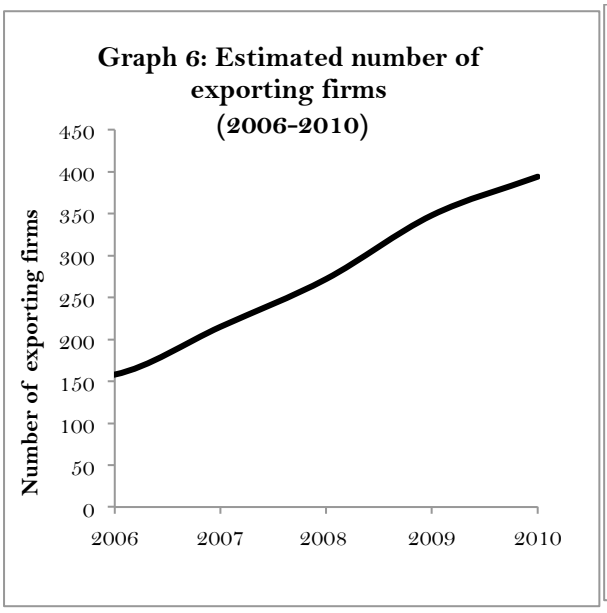
2010 (excluding tea, coffee and mining was approximately USD$12m with an average export orientation of 3.5% of total sales.

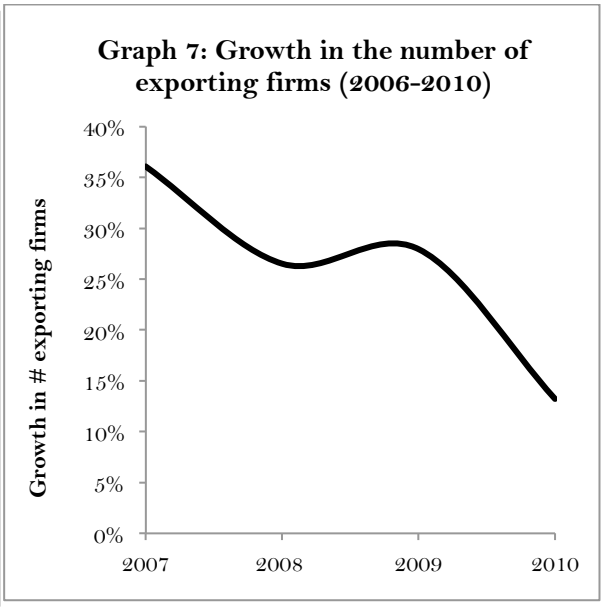
2d. A growing number of firms are joining the exports sector

Rwanda's exports sector remains dominated by commodity exporters in the tea, coffee and minerals sectors. Out of the top 20 exporters in 2010 there were 5 tea companies, 5 coffee processors/exporters, and 8 mining firms. These firms are 100% export oriented, with the local market for roasted coffee, processed tea, and minerals being relatively small. The largest non-commodity exporters were: (i) Bralirwa (beer and soft drinks) in 15th position, with exports of about USD3.5m; and (ii) Pembe Flour Mills (wheat bran), in 20th position, with exports of about USD2.3m.

Since 2011, there are two new major entrants in Rwanda's exports sector: Steelrwa and Bakhresa Grain Milling.[9] After only one year in operations, Steelrwa - one of the East African Community's two reinforced steel bars (or rebars) producers - had an estimated exports of about USD$3.2m in exports[10]; while Bakhresa, which is owned by one of East Africa's largest industrial groups, exports about USD$11m to the Democratic Republic of Congo.

Despite the dominance of commodity exporters, a growing number of firms are joining Rwanda's exports sector. After cleaning Rwanda Revenue Authority export data to exclude evident re-exports and non-commercial exporters (such as embassies, government institutions, etc.), we estimate that there were about 160 exporting firms in 2006, compared to approximately 400 in 2010 (see Graph 6), an increase of 150% in the space of 4 years (even though as can be seen in Graph 7 the pace of growth in the number of exporting firms has slowed over the past few years). This increase in exporting firms has come hand in hand with an increase in non-commodity exports: in 2006 only 6% of merchandise exports were non-commodity exports, compared to about 12% in 2010.





As can be seen in Table 1, 80% of growth in the number of exporting firms has come from three sectors: (i) the vegetables sector, including tea and coffee; (ii) the construction materials / metals sector; and (iii) the animal/animal products sector. The share of vegetable exporting firms over total exporters did not change much between 2006 and 2010; it was high to start with. However, growth in the number of construction material/metals and animals/animals products exporters was impressive. In 2006 only two Rwandan firms were exporting construction materials or metals: Simaco and Kigali Steel and Aluminum Works. In 2010,

[9] Gathani and Stoelinga, *Understanding Rwanda's Manufacturing and Agribusiness Sectors*, The International Growth Center, Conference Version, July 2012

[10] Based on interview with the MD of SteelRwa for the Rwanda Enterprise Mapping Exercise, 26th January 2012

there were 64, including major producers such as Tolirwa, Master Steel and Safintra. There was only one exporter of live animals or animal products in 2006, compared to 29 in 2010.

Based on available data, we estimate that two thirds of this growth in exporting firms came from retailers and wholesalers, and only one-third from the increase in the number of producers. [11] While an estimated 70% of exporters in 2006 were producers, only 40% were producers in 2010. This reflects the fact that exports growth is mainly driven by indirect exports (through distributors), as opposed to direct exports.

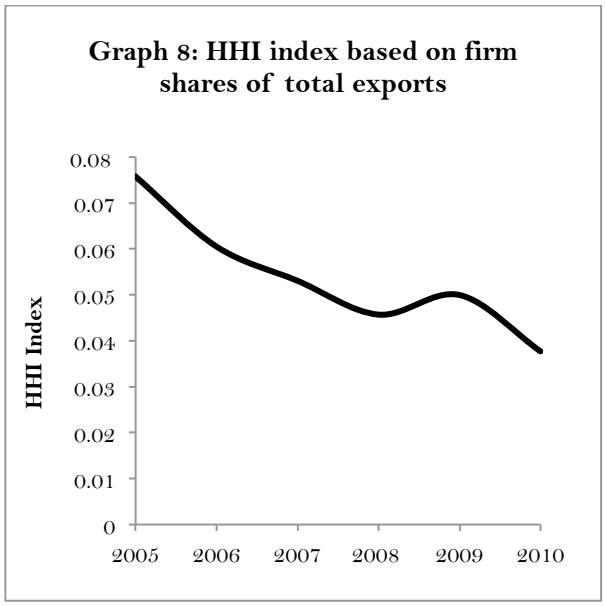
Table 1: Difference in Exporting Firm Growth: 2006 and 2010

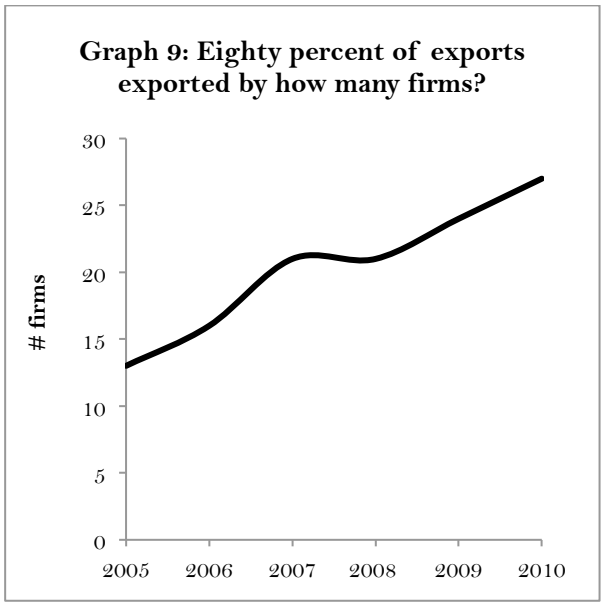
Sector	Share of firms (2006)	Share of firms (2010)	Difference in share	Number of new firms
Vegetable Products	37%	40%	3%	98
Construction Materials/Metals	2%	16%	14%	61
Animal & Animal Products	1%	7%	7%	28
Chemicals & Allied Industries	2%	4%	2%	11
Machinery / Electrical	2%	3%	1%	9
Mineral Products	16%	8%	-8%	6
Miscellaneous	11%	6%	-6%	4
Wood & Wood Products	6%	3%	-2%	4
Stone / Glass	1%	2%	0%	4
Foodstuffs	5%	3%	-2%	3
Textiles	9%	4%	-5%	2
Plastics / Rubbers	4%	2%	-2%	2
Transportation	0%	1%	1%	2
Raw Hides, Skins, Leather, & Furs	3%	2%	-2%	1
Footwear / Headgear	1%	1%	0%	1

As a result of these and other dynamics, firm-level concentration has declined. In 2005, Rwanda's 14 largest exporters accounted for 80% of exports; today the 27 largest exporters account for 80% of the country's exports (see Graph 9). This trend is confirmed by the Herfindahl-Hirschman index[12] of concentration for Rwanda's exports sector (see Graph 8). Between 2005-2010 the index dropped from 0.08 to 0.04, pointing to a decline in the concentration of exporting firms. The main reasons firm concentration levels have declined is: (i) the number of exporting firms has increased by 150% over the past 4 years alone; (ii) the tea sector is being privatized, breaking down the dominance of state-owned OCIR Thé (new entrants include Imporient since 2004; Rwanda Mountain Tea, since 2006; and the Jay Shree Tea & Industries, 2010); (iii) the number of processors in the coffee sector has increased following the privatization era of the late 90s (new entrants include Rwashoscco in 2005, the Kivu Arabic Coffee Company in 2005, etc); and (iv) there have been new large investments in the mining sector (e.g. Minerals Supply Africa Ltd, Rwanda's largest mining company, was created in 2008).

[11] This estimate is based on incomplete information on the nature of exporting firms; this is due to missing observations in the tax roster, which account for about 1/3 of observations in 2010 and more than half of observations in 2006. Given the comparative share of producers and traders, missing observations are unlikely to affect the conclusion, which is that the majority of growth has come from indirect exports, as opposed to direct exports.

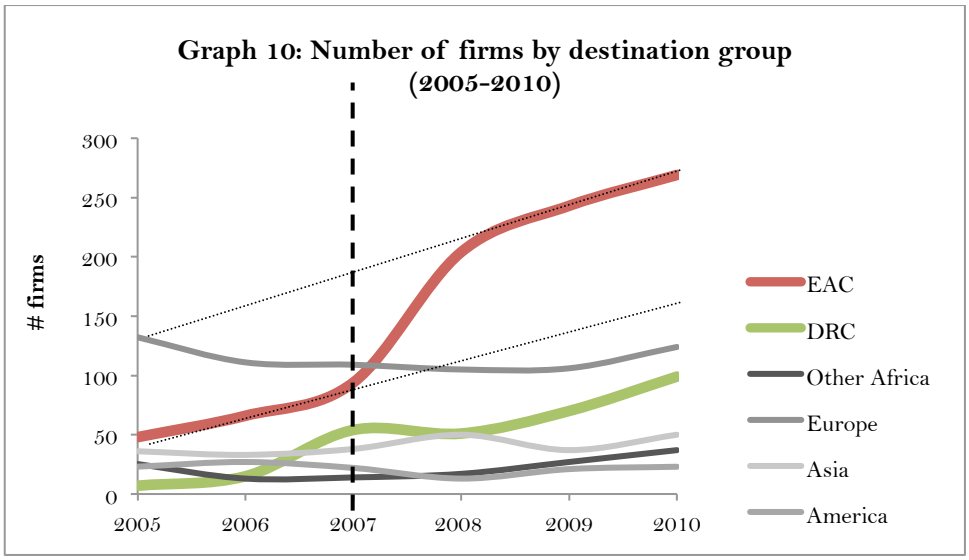
[12] The Herfindahl–Hirschman Index or HHI is a measure of the size of firms in relation to the industry and an indicator of the amount of competition among them. It is defined as the sum of the squares of the market shares of the 50 largest firms (or summed over all the firms if there are fewer than 50) within the industry, where the market shares are expressed as fractions. Increases in the HHI in the local market generally indicate a decrease in competition and an increase of domestic market power, whereas decreases indicate the opposite.





2e.New exporters are targeting the EAC and DRC markets

Another potential driver of this increase in the number of exporting firms could be the country's entry into the East African Community's Customs Union in 2007 and the EAC Common Market in July 2010. Rwanda's entry into the EAC's Customs Union – which led to a gradual removal of tariff and non-tariff barriers to trade within the region – seems to have led to an increase in the number of firms exporting to Burundi, Uganda, Tanzania and Kenya (although we do not seek to establish a causal relationship). In 2006, just before Rwanda's entry into the EAC Customs Union, there were about 66 Rwandan firms exporting to the EAC region, which was approximately half the number of firms exporting to Europe at the time; in 2008, just after Rwanda's entry into the EAC, that number had grown to 204 (an increase of about 200%). By 2010, there were two times more firms exporting to the EAC than there were firms exporting to Europe, a complete reversal compared to 2006 (see Graph 10). The only other destination region that did not stagnate or decrease in terms of the number of exporting firms during this period was the Democratic Republic of Congo (DRC). In 2005, based on cleaned RRA data, there were 7 exporters to DRC; in 2010 there were 100 (a fifteen fold increase).

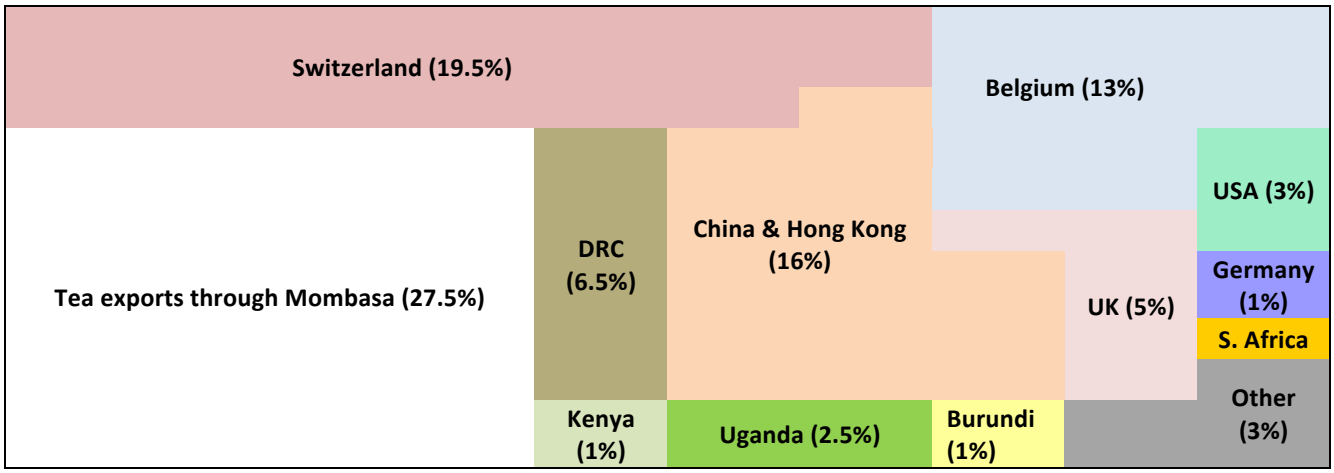


3. Destination discovery

3a. Where does Rwanda export to?

As can be seen in Figure 2, when excluding tea exports that transit through the Mombasa auction, Rwanda's three top merchandise export destinations were Switzerland, China (including Hong Kong), and Belgium. All three are destinations for commodity products: Switzerland imports coffee (72% in 2010) and minerals from Rwanda (25%), China imports mineral products (99% in 2010), while Belgium imports coffee (60%) and mineral products (40%).

Figure 2: Rwanda's merchandise export destinations (2010)



The surprising fact in this breakdown is the comparatively small share of the East African Community (EAC) in Rwanda's exports mix, despite the large number of companies exporting to the region. Based on cleaned Rwanda Revenue Authority data, merchandise exports to Kenya accounted for approximately 28.5% of total exports in 2010, but are significantly lower when excluding tea exports, which are traded at the Mombasa tea auction and then re-exported to other destinations. **When these are excluded, actual exports to Kenya amount to only 1.2% of exports. This brings the EAC total to a mere 5.5% of Rwanda's merchandise exports package**. Including DRC, we find that Rwanda only exports a total of about 11.7% of its merchandise exports to neighboring countries. These figures are reflective of the fact that 99% of Rwanda's commodity exports go to Europe, Asia and America, while the vast majority of non-commodity exports go to the EAC and DRC.

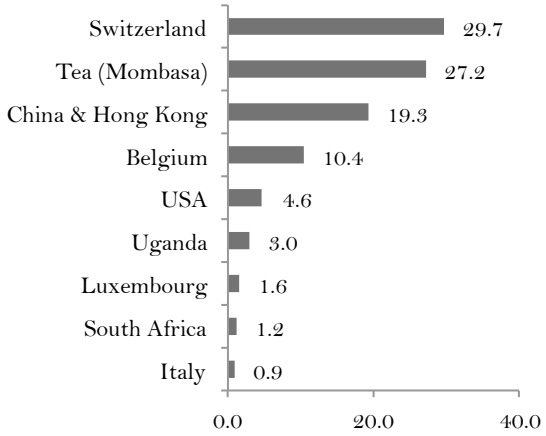
Which destinations have grown the fastest as a share of Rwanda's exports package over the past few years? The destinations that contributed most to exports growth in the commodity sector between 2005 and 2010 were Switzerland, China, and Belgium. During the 2005-2010 period, commodity exports to these three destinations grew by US$60m, at an average rate of about US$12m a year (see graph 11). Combined, these three destinations accounted for 60% of commodity exports growth during this period. Between 2002 and 2010 Rwanda had consistent commodity exports to 13 destinations, including Switzerland, China, India, Belgium, Germany, the UK, the Netherlands, the US, Tanzania, Uganda, Kenya, DRC and South Africa.[13]

The one destination that contributed the most to non-commodity exports growth between 2005 and 2010 was the DRC (60%) followed by EAC partners (29%). Combined, these regional destinations added US$18.7m to non-commodity exports during this period, at an average rate of almost US$3.7m per year, and accounted for almost 90% of non-commodity exports growth during this period (see graph 12). During the 2002-2010 period, Rwanda had consistent non-commodity exports to 20 different destinations. There

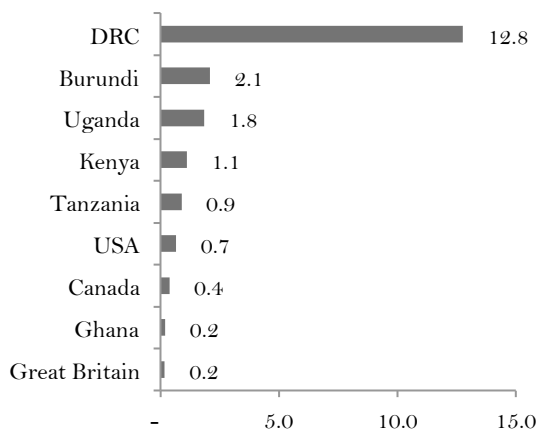
[13] We refer to "consistent export destinations" as destinations that Rwanda has exported to for at least 8 of the 9 years between 2002 and 2010.

are only seven destinations to which Rwanda exported more than US$1m in non-commodity products: DRC, Kenya, Burundi, Uganda, Tanzania as well as the USA (pyrethrum exports) and Italy.

Graph 11: Contribution to commodity exports growth 2005-2010 (US$m)



Graph 12: Contribution to non-commodity exports growth 2005-2010 (US$m)



3b. How much destination discovery is there in Rwanda's merchandise exports sector?

The two main questions we try to answer in this section are: (i) how much have Rwandan firms been learning about new destinations over the past decade?; and (ii) how much have they been learning about old destinations? A good place to start this analysis is to identify the sources of growth in Rwanda's exports sector, in terms of products, destinations and firms. To determine which destinations and products have been driving exports growth, we use a straight forward and insightful approach designed by Zahler (2007) which enables us to break down exports growth into 4 groups:

- growth from old export products to old destinations {old,old};
- growth from new export products to old destinations {new, old};
- growth from old export products to new destinations {old, new}; and,
- growth from new export products to new destinations {new, new}.

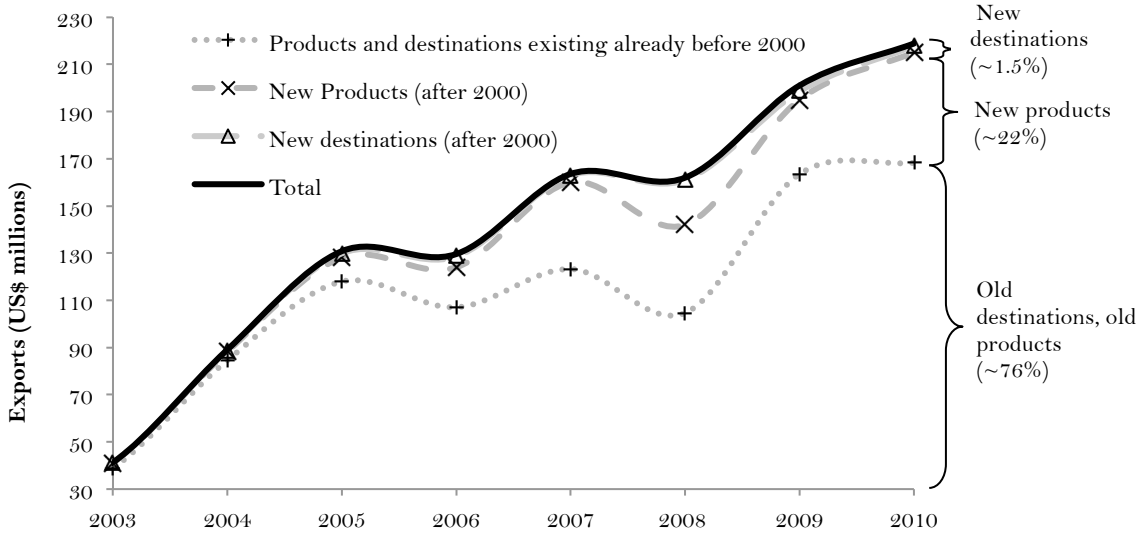
We define as "old" any export destination or product that existed before 2000, and "new" any export product or destination that emerged after 1999. To ensure we do not count as "old destinations" markets to which Rwanda had insignificant exports before the year 2000, we consider that a destination was only discovered the year when Rwanda exported at least US$50,000 worth of goods to that destination.

Using cleaned COMTRADE data, we find that over the past decade about 76% of exports growth has come from the products that Rwanda already exported before 2000 (i.e. tea, coffee and minerals), to destinations that Rwanda was already exporting to before 2000 (see Graph 13).[14] In other words, 76% of exports growth came from old export products to old destinations. New export products accounted for an estimated 22% of growth; new destinations for 1-2% of growth, while the combination of new products to new destinations was negligible. Exports growth coming from "new products" and "new destinations" is what the recent research on exports calls growth at the "extensive margin", while growth resulting from old products and old destinations is referred to as "intensive margin" growth. Our findings on the Rwandan context are very much in line with patterns observed in other countries: Brenton and Newfarmer (2007) for example find that intensive margin growth accounts for about 80% of exports growth, compared to only

[14] We adjust COMTRADE data to include specialty coffee as a new product; specialty coffee, which accounted for about 22% of coffee exports in 2010 (NAEB), was introduced after.

18% at the extensive margin; Amurga-Pachero and Pierola (2008) find that extensive growth only accounts for about 14% of growth.[15]

Graph 13: Breakdown of manufacturing export growth (2003-2010)



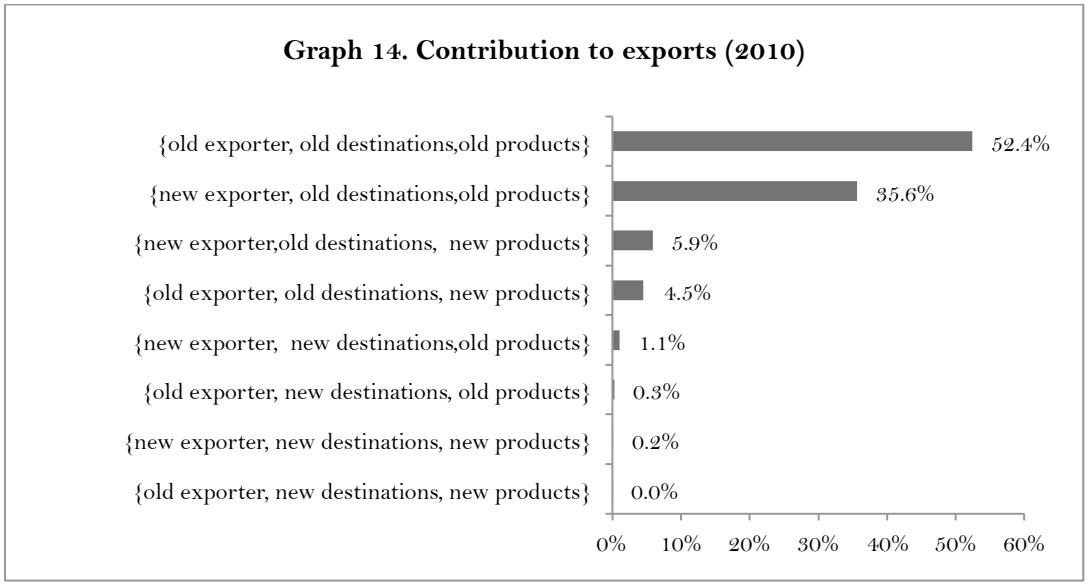
New export destinations based on this metric we define include: Luxembourg (US$1.6m in 2010), Japan (US$0.66m), Austria (US$0.24m), Ghana (US$0.2m), Ukraine (US$0.15m), Canada (US$0.15m), Zambia (US$0.13m) and Norway (US$0.11m). These are mainly destinations for commodity products, including coffee, tea and minerals.

We confirm the fact that there has been little new destination discovery using a slightly different approach based on Rwanda Revenue Authority data. This detailed firm-level dataset enables us to further breakdown growth in Rwanda's merchandise exports sector during the 2005-2010 period into 9 different categories, using new and old exporters, products, and destinations. We call a "new" exporter, product or destination, any new exporter that started exporting after 2006, or any product or destination that was introduced after 2006 (it is not possible to use the year 2000 as our benchmark as we only have reliable firm-level data during the 2005-2010 period). As can be seen in graph 14, this breakdown comes to similar conclusions: i.e. that exports growth between 2006 and 2010 can be attributed to old destinations and old products, with very little new destination discovery. Based on this definition, using the year 2006 as a benchmark, "old" destinations accounted for 98.4% of merchandise exports in 2010 and "old" products for 89.4%.

The somewhat surprising fact is that while growth in the merchandise exports sector largely came from old destinations and old products, "new" exporters (that entered the exports market in 2007 or after) were the ones driving growth and accounted for a total of 42,7% of exports in 2010. Not only were new exporters driving exports growth to established destinations but we estimate that 57% of new product discovery during this period also came from new exporters. Examples of major new entrants in the exports sector, from 2007 onwards, that have had a significant impact on the merchandise exports sector include: Pembe Flour Mills (Rwanda's largest wheat flour and bran processor) in 2007, Minerals Supply Africa Ltd (the largest minerals exporter) in 2008, the Rwanda Trading Company (coffee) in 2009, as well as Bakhresa Grain Milling (the second largest wheat flour processor) and Steelrwa (rebars for the construction sector) in 2011. This list does not include all the new tea processors that were established as a result of the privatization of government owned tea factories. Borrowing from the vocabulary of the exports literature, these findings suggest that we see growth at the "intensive margin" from a product and destination

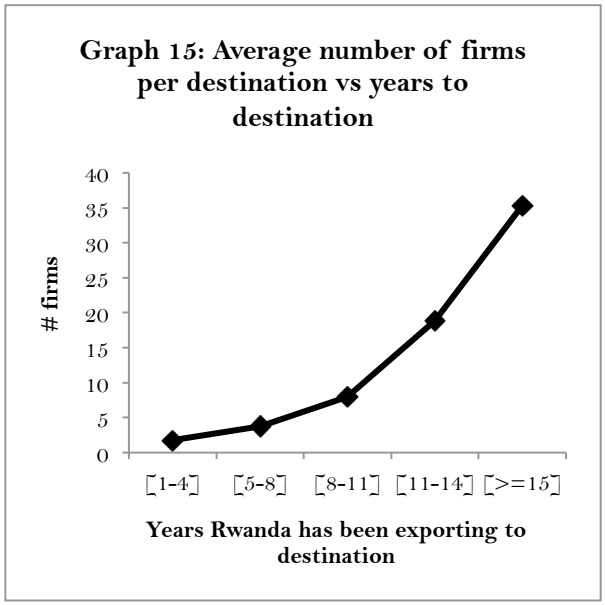
[15] For a summary of the recent literature on intensive and extensive margin exports growth, see Carrere, Strauss-Kahn and Cadot (2011).

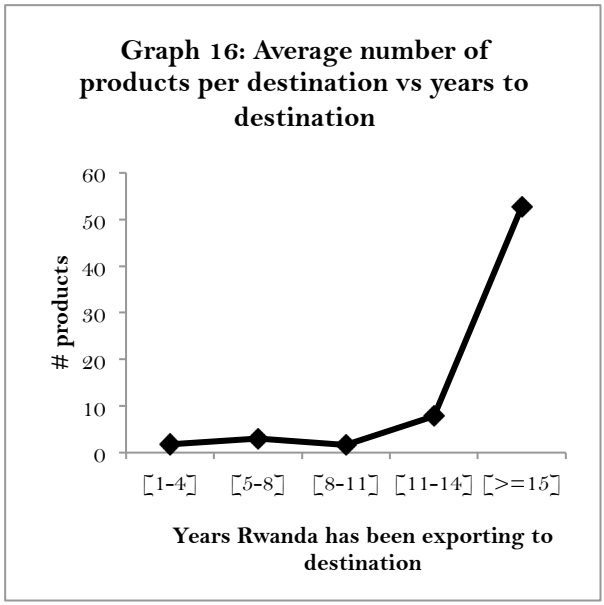
perspective, but "extensive growth" at the firm level, with new firms driving growth. An interesting question to consider for future research is whether this "extensive margins" growth at the firm level will eventually translate into "extensive margins" growth as well at the product and destination levels.



3c. Some interesting facts about the links between destination discovery, products and firms

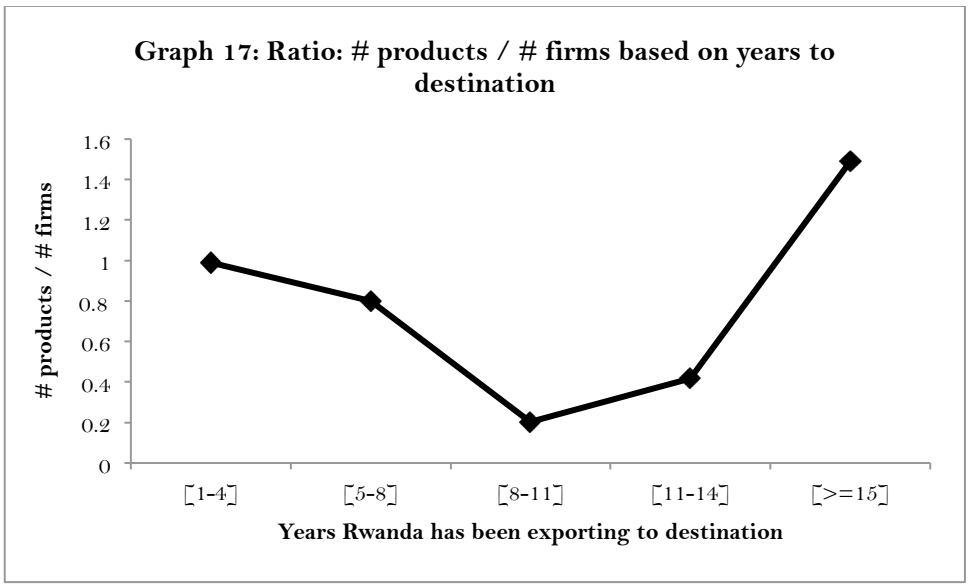
We can take a more detailed look at this relationship between firms, products and destinations by analyzing the link between the number of years Rwanda has been exporting to a certain destination and the number of exporting firms – and the number of products - exported to that same destination.





We find that the longer Rwanda has been exporting to a certain destination, the more products on average it exports to that destination and the higher the number of firms exporting to that destination (see graphs 15 and 16). What these figures suggest is that: (i) Rwanda's merchandise exports sector is concentrated on a number of markets that exporters have targeted for a long time (both neighboring markets and long-standing commodity destinations); and (ii) that new markets are not quickly broken into on a large scale. This concentration of firms and products on "old destinations" and the slow entry into new

markets is reflective of the fact that new destination discovery is happening slowly and as a result has contributed little to exports growth.



Graph 17 depicts the average product to firm ratio, based on the number of years Rwanda has been exporting to a certain destination. The V-shaped curve reveals that the product to firm ratio decreases on average during the first ten years of exports to a new destination from 1 to 0.2, before increasing again to 1.5 thereafter. A potential – albeit hypothetical - explanation as to why this might be the case is that:

- During the first 10 years, destination discovery happens within sectors. A firm discovers a destination market for a certain product, and followers/competitors quickly follow suit and start exporting the same product to that destination. The rate at which firms within a sector start exporting to a new destination is much faster than the rate at which new products are exported to that destination, which explains why the product to firm ratio decreases from 1 to 0.2.
- After a certain period of time, discovery spill-over effects seem to shift from within sectors to across sectors. When a destination market becomes established (after the 10 year mark), many more firms start exporting many more products to the latter. This time the rate at which firms start exporting new products to that destination outpaces new firm entry. This suggests that firms are gradually getting to know demand in the destination market better and are discovering and taking advantage of new opportunities to export to it.

However, it is worth noting that the graph shows the average of the trends across products and destinations, so it does not necessarily mean that if a firm starts exporting to a new country, say Sweden, then other firms will necessarily enter and new products will necessarily be developed for that market.

A closer look at established destination markets reveals that one export destination in particular is behind the increase we observe in the products to firm ratio in graph 17. This country is DRC, which is by far Rwanda's most diverse export destination, in terms of number of unique products exported to it. We estimate that in 2010 Rwanda exported 147 different products to DRC, double the second most diverse destination, Uganda, with 74 products. The firms to products ratio for DRC was almost 1.7 in 2010, compared to an average of 0.76 for EAC countries and 0.6 on average for other significant exporters such as China, USA, GB, Belgium and Switzerland. This suggests that DRC is the market with the highest demand for Rwandan products (in terms of number of products, as opposed to value) and the market where the average product diversity of firms is the highest (see Table 2 for more details).

Table 2: Product diversity of export destinations

Countries	Type of destination market	Product to firm ratio	# products	# firms
DRC	Non commodity	1.69	147	87
Burundi	Non commodity	1.00	68	68
Kenya	Non commodity	0.72	13	18
Uganda	Non commodity	0.70	74	106
Tanzania	Non commodity	0.63	24	38
USA	Commodity / Non commodity	0.92	12	13
GB	Commodity	0.72	13	18
China	Commodity	0.58	11	19
Belgium	Commodity	0.58	15	26
Switzerland	Commodity	0.19	5	27

Not surprisingly, we also find a significant difference in the products-to-firms ratio between commodity destinations and non-commodity destinations, which are respectively 0.65 and 1.26 (almost double). As we argue throughout this paper, this wedge between commodity exports and non-commodity exports is due to the very different nature of these markets and the firms that operate within them; what is relevant for our discussion on destination discovery is that these differences translate into a very different destination discovery experience for commodity exporters and non-commodity exporters. As we will show with two short case-studies below on the largest commodity-destination (Switzerland) and the two largest non-commodity destinations (Burundi and DRC):

- Commodity exporters tend to be specialized and foreign-owned: if there is any destination discovery happening, one could argue that it happens in the opposite direction, i.e. on average, foreign owned companies discover Rwanda as a supplier market, rather than Rwandan firms discovering the destination as a consumer market; and,
- Non-commodity exporters tend to be more diversified and locally owned (or owned by regional firms): given that the market for their products are regional and less structured than commodity markets, firms need to understand market demand in potential destinations and build relationships with local distributors and importers, before any exporting can take place.

Case Study 1: The case of Switzerland – a commodity destination

The case of Switzerland, currently Rwanda's largest trading partner, can shed some light on the mechanisms of destination-discovery in the Rwandan context. In 2010 Rwanda exported USD$40m to Switzerland, out of which about 70% was coffee and the remaining 30% minerals. Switzerland is the largest buyer of Rwandan coffee. Coffee exports to Switzerland in 2010 totaled USD$26.3m or 46% of aggregate coffee exports that same year.

In the coffee business, producer/exporter-buyer markets are highly structured, with large buyers dominating global markets. In the case of a small coffee producer market like Rwanda – which is characterized by a myriad of relatively small producers/processors (the largest processor exports an estimated USD$13-14m of coffee per year) – the bulk of the searching costs (identifying a trading partner) are borne by big international commodity or coffee trading houses, for which Switzerland is a major hub. The latter tend to invest heavily not only in identifying and sourcing local production of coffee, but also supporting local production. The burden of discovering the destination is therefore less on the exporting country or firm, and more on the buyer. We show this with a couple of examples of how Swiss-based trading companies started purchasing and processing ordinary and specialty Arabica Coffee in Rwanda.

Using OCIR Café data, we find that one buyer – Sucafina, a Geneva based company – is responsible for 50% of Rwanda's coffee exports to Switzerland. Sucafina made its entry into the Rwandan market between 1996-1998 when it jointly set-up (and then fully purchased) Rwacof, which today is Rwanda's largest coffee processor. Sucafina Group has established a network of coffee processors and exporters in a number of countries, with a very strong presence in East Africa. Sucafina owns Ugacof Ltd, which has been one of Uganda's largest coffee exporters since 1994, Tancof based in Tanzania (since 1998), Bucafe in Burundi since 2008 as well as other coffee processors and exporters in Serbia, Vietnam and Brazil. The company's decision to invest in Rwanda coincided with the privatization of Rwanda's coffee sector that started soon after the 1994 genocide and came amidst a major supply gap in the global coffee sector.

It is in large part the success of Sucafina's subsidiary in Rwanda – Rwacof - that has made Switzerland such an important destination for Rwanda's coffee exports. Rwacof supplies 92% of Sucafina's coffee imports from Rwanda, which is equivalent to about USD$14m. Sucafina is responsible for the exporting and marketing functions of Rwacof, which itself dry-mills and controls the quality of local Arabica coffee. Through Rwacof, Sucafina gradually got to know the Rwandan coffee production market better and today imports an additional USD$1.6m of Rwandan coffee from 10 other processors/exporters, in particular cooperatives.

There are two other major Swiss coffee trading houses that import coffee from Rwanda. These are: Schluter (which purchases 12% of Rwanda's total coffee production, or 30% of coffee exports to Switzerland) and Bernhard Rothfos Intercafé (10% of coffee exports to Switzerland). Both are highly specialized trading houses that have been involved in the exporting and processing of African coffee for decades. Schluter was founded in 1885, and since then has specialized in African coffees only. Its Rwanda operations are managed by a representative on the ground, who coordinates purchases from 18 different cooperatives/processors. Bernhard Rothfos Intercafé is owned by the Neumann Kaffee Gruppe, which owns coffee processors and exporters in Burundi, Uganda, Tanzania and Kenya and has extensive experience in eastern Africa. It deals with 4 different cooperatives/processors here in Rwanda.

Sucafina, Schluter and Bernhard Rothfos Intercafé – which together account for 90% of coffee exports to Switzerland - are good examples of coffee buyers that are specialized in African coffee and have spent significant resources identifying and investing in local producer markets, such as Rwanda. Given the structure of global coffee markets and the small size of coffee producers in Rwanda, Rwanda's exports to Switzerland seem to have grown less as a result of Rwandan firms learning about Switzerland as a destination/trading market for coffee, and more because of large Swiss buyers increasingly investing in the local market.

We find a similar pattern in the minerals exports sector. The vast majority of mineral exports from Rwanda to Switzerland are conducted by Minerals Supply Africa Ltd (MSA), which is Rwanda's largest mining company and exports 100% of its tin ores to Switzerland, and then on to Malaysia, where it is smelted. A Swiss registered corporation called Cronimet Suisse AG has a majority stake in MSA. The discovery of Switzerland/Malaysia as an export destination for tin ores and niobium is therefore more the result of Swiss investments in Rwanda's mining sector, as opposed to Rwandan firms discovering Switzerland as a destination market for mineral products.

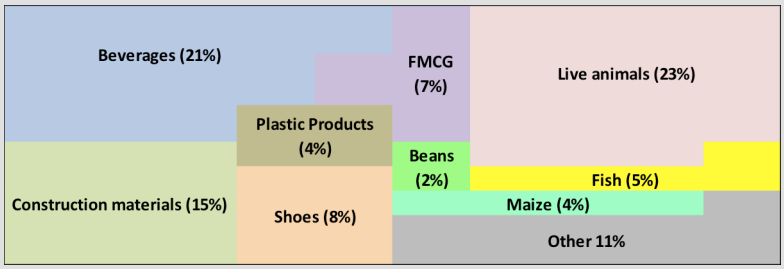
Case Study 2: The cases of Burundi and DRC – non-commodity destinations

While major foreign buyers dominate large global commodity markets, smaller local producers in the agribusiness and light manufacturing sectors are aggressively targeting regional markets, in particular Burundi and the Democratic Republic of Congo. We find that exporting to these destinations is closely linked to an in-depth knowledge of these markets and established relationships with distributors. Given the nature, diversity and small volume of exports to Burundi and DRC, exports to these destination markets are comparatively less structured than commodity markets.

In 2005 exports to Burundi and DRC accounted for a little over 1% of Rwanda' total product exports; today this number is closer to 10%. In 2005 only 11% of firms exported to Burundi and DRC; today 41%. Reported exports have grown from a little over USD$1m in 2005 to about USD$20m in 2010 and more than US$30m in 2011. This is in large part due to the increase in processed food and manufactured exports, which in 2010 accounted for about 55% of exports to Burundi and DRC (compared to 35% for raw agricultural products, while the remaining 10% comprised mostly of mineral products). In fact, between 2008-2010 an estimated 76% of Rwanda's manufactured exports (excluding the mining sector, tea and coffee) went to Burundi and DRC. We expect manufactured exports to the two countries to grow significantly in 2011-2012 with the entry of new firms into the export market, such as Steelrwa and Bakhresa, which jointly exported an estimated US$14m to Burundi and DRC in 2011.

Rwandan firms are gradually learning about the potential of the Burundi and DRC markets, where there seems to be a market for everything Rwanda manufactures. Even though it is in relatively small quantities, Rwanda exports beverages (beer, sodas, juices and milk), construction materials (roofing sheets, rebars, cement, clay products, paints), processed food (tomato paste), furniture (including mattresses), plastic products (plastic water tanks), shoes (plastic shoes), and other fast moving consumer goods (cosmetics, soaps, detergent, toilet paper, batteries) to Burundi and DRC.

Figure 3: Decomposition of exports to Burundi and DRC in 2010



Exports to Burundi and DRC are dominated by 3 types of exporters:

- Large and established domestic manufacturing firms, such as Sulfo Industries (soaps and cosmetics) and Bralirwa (beer and sodas, turnover), which were created in the 1960s. Over the space of 50 years these multi-million dollar firms have established very elaborate distribution networks both domestically and in neighboring Burundi and Eastern DRC;
- Firms owned by large regional groups, which have been active in the region's industrial sector for several decades, such as Bakhresa Grain Milling (owned by the Bakhresa Group of Companies), Steelrwa (owned by the Manji Family), Aqua-San (owned by the Aqua-San Tech Group), Roto Tanks (owned by the Flametree Group), Kigali Steel and Aluminum Works (owned by the Shumuk Group of Companies) and the Kigali Cement Company (in which the Athi River Group from Kenya has a minority stake); and lastly,
- Firms owned by individual investors with experience in the region. A good example is Mr Sano from Société Rwandaise de Chaussures (plastic shoes) - the most export oriented firm in Rwanda - which exports about 70% of its output to Burundi. Prior to starting Société Rwandaise de Chaussures in Rwanda, Mr Sano had been managing director of a large shoe manufacturer in Burundi for 32 years.

Distribution channels to these destinations vary based on the product, but are usually based on ad-hoc relationships with distributors operating across borders. There are very little direct sales/exports to Burundi and DRC, even for large exporters such as Bakhresa Grain Milling and Bralirwa, which is reflective of the fact that these markets are relatively unstructured, that exports to Burundi and DRC are still only nascent, and that firms in Rwanda's manufacturing sector are not very export oriented (an estimated 4.25% of output was exported in 2010).

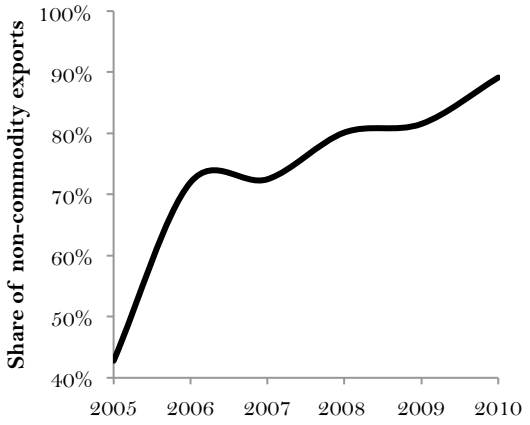
3d. Is low destination discovery a constraint to exports growth?

In this section we have established: (i) that there has been very little new destination discovery in Rwanda's merchandise exports sector over the past decade; (ii) that destination discovery is a slow process; (iii) that destination discovery in commodity markets seems to be happening in the opposite direction – foreign companies are discovering Rwanda as a supplier and potential investment destination, rather than Rwandan firms getting to know the destination market better; (iv) that exports in non-commodity markets are highly concentrated around two markets in particular - DRC and Burundi; and (v) that the majority of Rwandan exporters of manufactured and agribusiness products have yet to establish themselves as regular and significant exporters. The question then becomes: **is low destination discovery a binding constraint to the growth of Rwanda's exports sector?**

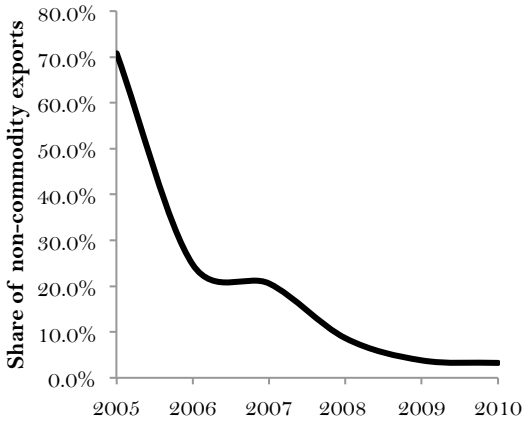
We believe the answer is no for commodity export markets, which are already relatively diversified in terms of destinations. Out of Rwanda's top 20 destinations, which account for 99.8% of exports, 80% are mainly destinations for commodity products (coffee, tea, and minerals). These include Switzerland, China, Belgium, Great Britain, the USA, Germany and South Africa. Moreover, foreign ownership in the tea, coffee and mining sectors is large, thereby ensuring that there will always be a foreign buyer for Rwanda's commodity products. As described in the case of Switzerland, given the nature of commodity markets and high demand in the sector, commodity buyers spend considerable resources identifying supplier markets, and Rwanda has now become a known supplier for coffee, tea, tin, tungsten, niobium, chromium, etc. The challenge for Rwanda in the commodity exports sector moving forward will therefore not be growth at the "extensive margin" (i.e. discovering new destinations), but growth at the "intensive margin" (i.e. increasing exports to existing destinations). The policy question for Rwanda is how to increase the aggregate value of exports of these products either through productivity gains, improved product quality, or simply increased volumes resulting from more mineral extraction or growth in the areas used for tea and coffee cultivation. For more insights on policy related questions arising from the "intensive" vs "extensive" margin distinction, see Brenton and Newfarmer (2007) and Cadot et al (2011).

However, low destination discovery for non-commodity export markets could be binding, although we argue that export policies should focus more on strengthening exports to the region - and in particular Burundi and DRC - in the short term than focus on increasing destination diversity. As can be seen in graph 18, the concentration of destination markets for Rwanda's non-commodity exports has increased rapidly since 2005. In 2005, 45% of non-commodity exports were exported to the EAC and DRC; in 2010, this number was 90%, almost double. The rapid decrease in the relative diversity of export destinations for Rwanda's non-commodity exports can be explained by a number of parallel dynamics: (i) on the positive side, the increasing share of exports to the EAC and DRC could be the result of Rwanda's increasing integration into the EAC market following its entry into the Customs Union in 2007 and the gradual stabilization of the situation in Eastern DRC; (ii) on the negative side, it reflects the failure of some manufacturing export industries that exported to alternative destinations - in particular the leather sector. In 2005 leather products accounted for over 70% of non-commodity exports compared to only 3.3% in 2010. The collapse in leather exports led to the closure of Rwanda's largest tanneries, including Rwanda Leather Industries and Saban S.a.r.l (see graph 19). The latter exported to destinations such as Pakistan, China, Italy, Holland, Switzerland, India and Belgium.

Graph 18: Share of non-commodity products exported to EAC and DRC (2005-2010)



Graph 19: Leather exports as a share of total non-commodity exports



The decrease in the destination diversity of Rwanda's non-commodity exports could also indicate that these are the only markets where Rwanda's non-commodity exports are currently competitive. This seems to be especially true for Rwanda's manufacturing exports sector, for which we estimate that 99% of exports go to DRC and the EAC[16]. While growth in non-commodity exports towards the regional DRC and EAC markets has been impressive (an estimated 42% for EAC during 2007-2010; and 123% for DRC), the decline in non-commodity exports to alternative destinations has been equally large (-42% during the same period). Despite this rapid growth in exports to the DRC and EAC markets and the significant opportunity these markets represent for Rwandan producers, exports to these destinations remain small - with only 4.3% of aggregate output exported in 2010. Increasing the competitiveness of Rwanda's non-commodity products on global markets will require significant long-term investments aimed at reducing factor costs (e.g. cost of electricity, transportation, etc.), improving labor productivity and the quality of the exported products; a more successful strategy in the short term would be to focus on regional markets – in particular Burundi and DRC - where there is proven and unmet demand for Rwanda's manufacturing and agribusiness products and where Rwanda has the competitive advantage of proximity. These markets can be a stepping stone for future growth towards other regional and global non-commodity export destinations. One example of a company that started by exporting to neighboring Burundi and DRC and then went on to export to more distant destinations is Inyange Industries, which has established a strong relation with distributors in South Sudan and Congo Brazaville.[17]

[16] This estimate is based on a sample of 72 of Rwanda's largest manufacturing firms for which we have data.
[17] Gathani and Stoelinga, *Understanding Rwanda's Manufacturing and Agribusiness Sectors*, The International Growth Center, Conference Version, July 2012

4. Product Discovery

In this section, we take a more detailed look at new product discovery in Rwanda.[18] We focus on three questions in particular: (i) the parameters of new product discovery in Rwanda (which products, what firms and to which destinations)?; (ii) what kind of products Rwanda could move-into in the near future; and (iii) whether exporting has led to product upgrading or increased levels of product sophistication? It is important to note, as Brenton and Newfarmer do in their 2007 paper entitled "*Watching more than the discovery channel: export cycles and diversification in development*", that new product discovery is not the main driver of exports growth in developing countries and that subsequently "governments should not focus solely or primarily on the discovery channel".[19] Other policies at the "intensive margin" – i.e. aimed at increasing exports of existing products to existing markets – also matter a lot, if not more. Nevertheless, it useful to analyze trends in new product discovery in Rwanda, take stock of what new products Rwanda is exporting, and understand whether new product discovery is holding exports growth back or not.

4a. The majority of Rwanda's exports are at the periphery of the product space

To understand product discovery in Rwanda we make extensive use of Hausmann et al's (2006) concept of the product space, which is a useful tool for analyzing product discovery at the aggregate level. The product space is based on the intuition that some products are more similar in the competencies and inputs they require to be produced than others, and that if a country or firm produces a certain product it is more likely to move into the production (and eventually exporting) of a new product that is similar, rather than a product that is very different. If for example a company has the required skills and inputs to make bicycle tires, that firm is much more likely to diversify into the production of car or truck tires than the production of tomato paste. Based on global exports data, Hausmann et al estimate the so called "distance" between all products in the world (as classified by various product classification systems – e.g. SITC, HS, etc.) using a metric of how likely it is for a country that exports one product with a comparative advantage, to also export another product with a comparative advantage. The logic is that if a pair of products is quite similar, then on average countries that have a comparative advantage in one product are also likely to have a comparative advantage in the other. Using this metric of "distance between products" it is possible to place all products in a network, like the network representation in figure 4 below.

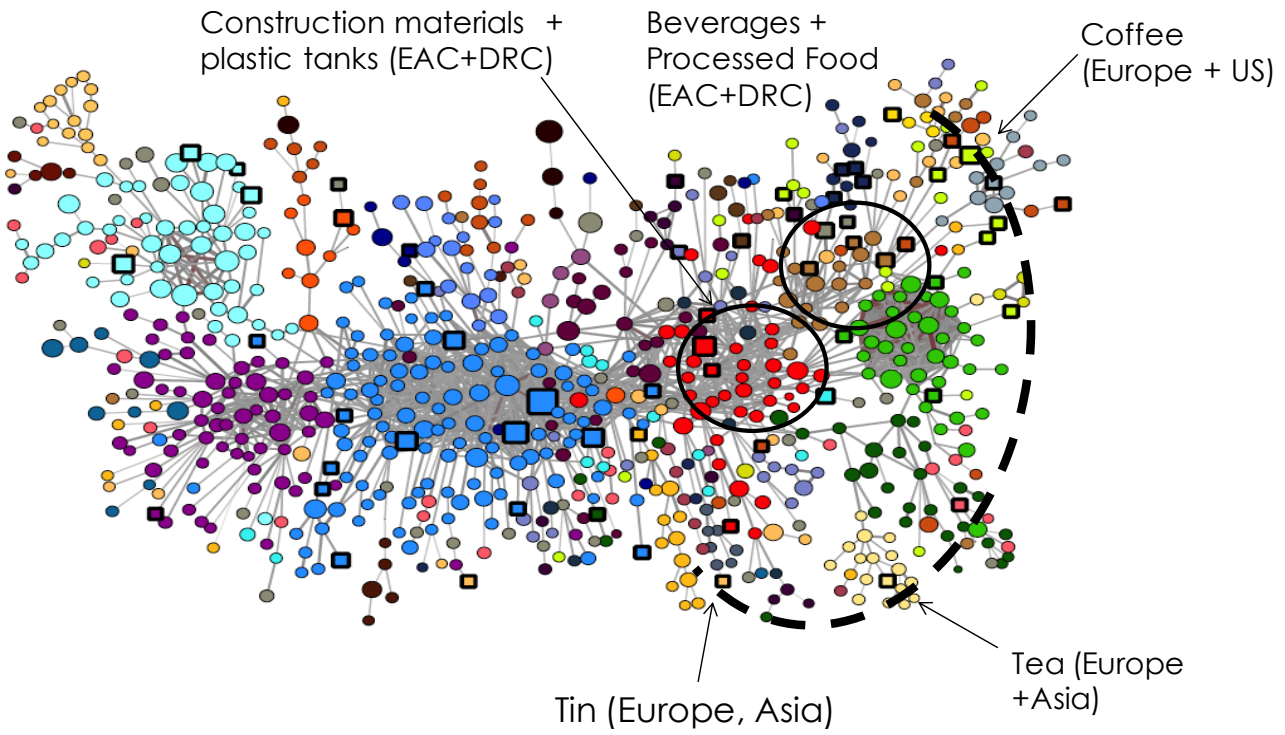
Another important insight that Hausmann et al derive from the product space and which will help us understand new product discovery in Rwanda, is that some products are better connected than others. It is more likely for a company that produces electronic computer chips for example to have the capabilities to start producing a whole range of other products (e.g. mobile phones, laptops, radios, television sets, etc.) than it is for a sugar producer. Some groups of products are very interconnected and require similar inputs, techniques and skills to be produced: examples include electronics, machinery, chemical products, construction materials, etc.; other products, at the periphery of the product space, are less well connected and don't lend themselves well to new product discovery. Typical examples include the crude oil sector, the production of raw agricultural products, mining. A firm's - and at the aggregate level, a country's - ability to diversify is dependent on its position in the product space. Diversification is in some ways path dependent: a firm and a country's current location in the product space, is a good predictor of what products it is likely to produce and export in the future. While these findings are empirically tested on average (Hausmann et al, 2006), it is important to note that a country's position in the product space can by no means be used to pick winners or select the industries of the future. It is a useful compass of where a country is and where it' likely to go and should be used as such

[18] As shown in Chapter 3, new product discovery contributed about 22% of exports growth between 2000-2010

[19] Brenton and Newfarmer, *Watching More than the discovery channel: export cycles and diversification in development*, World Bank Group, Policy Research Working Paper no4302, August 2007

So what does Rwanda's product space look like? In figure 4, we depict Rwanda' product space, highlighting where Rwanda's main export products are located. As can clearly be seen in the figure, Rwanda's main export products are located at the periphery of the product space: this includes tea, coffee and mining exports (tin and tungsten) which account for about 88% of Rwanda's exports. The fact that the latter are at the periphery of the product space means that in theory there are few new products that firms in these sectors could organically diversify into. We see this happening in practice in Rwanda's coffee, tea and mining sectors. All of Rwanda's coffee producers only make coffee; all tea producers are exclusively in the tea business; and all mining firms only do mining. These companies might diversify within their sector – i.e. coffee companies moving from semi-washed to fully washed coffee, or tea companies moving from black tea, to green tea, white tea and orthodox tea – but they are unlikely to diversify into new products/sectors altogether. The skills and equipment required to process tea and coffee, or to mine tin and tungsten, are specific and non-transferrable.

Figure 4: Rwanda's Product Space



Source: http://atlas.media.mit.edu/

New discovery is more likely to happen in Rwanda's light manufacturing and agribusiness sectors which are located in a denser / more connected part of the product space. This includes the beverages and processed food sector, the furniture sector, the plastics products sector, as well as the fast moving consumer goods (FMCG) and the construction materials sectors. Even though these sectors only account for a small share of Rwanda's exports, light manufacturing and agribusiness firms in Rwanda are much more diverse than coffee, tea and mining companies.

This is substantiated by firm-level data: firms in Rwanda's construction materials sector - such as Uprotur, Master Steel, Safintra, Tolirwa - make roofing sheets of various shapes, sizes and colours, steel and plastic tubes, nails, steel frames for doors and windows, barbed wire, etc.; furniture companies such as Mutara Enterprises and Manumetal, make all kinds of furniture using wood, steel and aluminium, as well as office partitions and carpeting; agribusiness companies, such as Urwibutso, produce everything from juices, to chili sauces, biscuits, wine, water and flour; beverage companies, such as Inyange, make milk products, juices, and yogurts; and, Sulfo Industries alone, which is Rwanda's largest fast moving consumer goods company, produces detergent, talc, body lotions, soap, shoe polish, sweets, water, margarine, and packaged

tea bags. These companies have not only started producing these products, but some already export to neighboring Burundi and DRC in particular.

4b. New product discovery in Rwanda

We take a closer look at new product discovery in Rwanda by dividing export products into 5 categories:

(i) **Established export products,** which we define as products that were first exported before the year 2000, and that have been exported for at least 4 years between 2006-2010 with exports amounting to at least US$10,000 in 2010;

(ii) **New product discoveries**, consisting of products that were first exported after 1999, that have been exported for at least 4 years between 2006-2010, and for which exports were worth at least US$10,000 in 2010;

(iii) **Incipient product discoveries,** defined as products that Rwanda first started exporting after 2007, for at least two years between 2008-2010 and for which exports in 2010 were worth at least US$10,000;

(iv) **Non-surviving export products**, which Rwanda stopped exporting before 2008;

(v) **Intermittent exports**, consisting of products that Rwandan firms either don't export consistently or for which total exports in 2010 were less than US$10,000.

Table 3 summarizes the contribution of each of these product categories to exports growth based 2000-2010 export data. Results have, to the extent possible, been cleaned, excluding evident re-exports such as cars, trucks, machinery, engines, aviation oils, petroleum, etc. As can be seen in the table, the majority of growth over the past decade has come from increased exports in established products[20]. In 2010, 5 products accounted for 96% of established product exports: tin ores, coffee, tea, niobium and beer. Other significant established export products include:

- Fast- moving consumer goods such as beauty products, hair products, and soaps (for a total of USD$1.5 m);
- Cement (US$1.2m);
- Pyrethrum (US$1.1m); and,
- Agricultural products such as kidney beans and peas (US$0.5m), maize (US$0.15m), potatoes (US$0.1m) and rice;

Table 3: Contribution to Export Growth by Export Product Category

Product Category	Total exports	Contribution to exports growth (2000-2010)
Established export products	170m	74.6%
New Export Discoveries	38m	19.5%
Intermittent	9m	4.3%
Incipient	4m	1.6%

So what new surviving export product discoveries has Rwanda made over the past decade? Using the definition outlined above, we find that Rwanda exports a total of about 40 new products. As can be seen in table 4 however, two types of products alone account for approximately 70% of new export discoveries including:

- Fully washed coffee (or specialty coffee), which Rwanda has been aggressively targeting since the early '2000s;
- New mineral exports, including tungsten (also known as wolfram) and chromium ores and concentrates;

[20] Note that we distinguish between ordinary and fully washed coffee. Ordinary is considered old, whereas fully-washed coffee is considered new.

Table 4: Main New Export Discoveries

New export products	Number of products	Share of new products	Value (USD)
Fully washed (specialty) and roasted coffee	1	41%	15.5m
Minerals (tungsten + chromium)	2	26%	9.8m
Live animals and raw hides and skins	7	17%	6.4
Beverages (fruit juices)	2	4%	1.6m
Plastic shoes	1	3%	1.2m
Beans (dried and shelled)	3	2%	0.9m
Smoked and dried fish	2	2%	0.8m
Plastic tanks	1	1%	0.3m
Props for scaffoldings	1	1%	0.3m
Furniture (certain products)	3	1%	0.2m
Other		3%	1m
Totals	**22**	**100%**	**38m**

This implies that - in terms of volumes at least - new product discovery in Rwanda is still happening at the periphery of the product space, i.e. commodity exports. This is not surprising given the weight of these sectors in Rwanda's current export basket (>80%) and the fact that many of Rwanda's commodity exporters are owned by larger foreign groups - firms that export commodities such as coffee and minerals have the ability to bring new export products to scale much faster than comparatively smaller exporters in Rwanda's processed food and manufacturing sectors. To give the reader a sense of scale, Rwanda's exports of these new commodity products (specialty coffee, tungsten and chromium), are equivalent in size to all of Rwanda's processed food and manufactured products exports. Therefore, an export strategy focused on new product discovery in Rwanda's commodities sector would be more likely to result in rapid exports growth in the short term than a strategy focused on the agribusiness and manufacturing sectors. However, an increased reliance on commodity exports would expose Rwanda to larger export boom and bust cycles, and in the long term would hamper product discovery, diversification and improvements in the complexity and sophistication levels of Rwanda's exports.

Other significant new export products include live animals and skins (17% of new export products) and processed/manufactured products such as fruit juices, plastic shoes, plastic tanks, dried and shelled beans, props for scaffoldings and some furniture products (together 14% of new export products). Live animals and raw hides and skins products are also at the periphery of the product space. Exports of the latter had all but halted after the 1994 genocide, as Rwanda was rebuilding its depleted bovine, goat and sheep stocks, but have steadily increased over the past decade. Processed food and manufactured products only account for 14% of new product exports and have contributed 2.7% or about US$6m to exports growth over the past decade. Even though volumes for these products remain low, the fact that Rwanda has consistently been exporting them since 2005 signals that Rwandan firms have developed the knowledge and capabilities to not only produce these kind of processed food or manufacturing products, but also to export them. The main challenge is to bring the production and exports of these products to scale.

Out of Rwanda's incipient products, which totaled about US$4m in 2010, many are likely to fail and few likely to survive. Rwanda's main incipient export products since 2008, have been:

- Wheat bran for which exports in 2010 amounted to US$2.3m or 80% of total incipient product exports that year. Wheat bran is currently exported by Pembe Flour Mills, Rwanda's largest manufacturing/agribusiness firm after Bralirwa, and Bakhresa Grain Milling. Wheat bran is a by-product of wheat-based flour production and is used for animal feed;

- Rebars for the construction sector, which only started in March 2011, but have now been exported for two consecutive years. Exports of locally produced rebars by Steelrwa are currently estimated at US$3.2m[21].
- Aluminum alloy plates for the construction sector, which in 2010 amounted to about US$0.2m, and are currently exported by one of Rwanda's largest construction materials firm, Master Steel.

Intermittent products, that Rwanda has been exporting on and off over the past decade but has not managed to export consistently, include mineral products such as zirconium (US$1.4 in 2010), flat rolled non-alloy steel products for the construction sector (US$1.3m in 2010), tanned hides and skins (US$1.1 in 2010, but have stopped since), maize flour (US$0.4m in 2010) and natural gum (US$0.3 in 2010). These are products that are either on the verge of failure, such as tanned hide and skin exports which have stopped altogether after the closing of Rwanda's main tanneries, or that require additional investments and support to survive.

4c. What products is Rwanda likely to "discover" in the near future?

Based on a country's position in the product space, it is possible to shed some light on which new export products that country is most likely to "discover" in the near future. Again, this is just an indication and by no means a way of picking winners. What a country already exports, on average, is a good predictor of what that country is likely to learn how to produce and export in the near future. We can illustrate how this works with a very simple example: Assume for example that we are interested in the question of whether Rwanda is likely to start exporting jumpers, and that we know for a fact that the most similar products to jumpers in the product space are t-shirts, socks, and trousers. If Rwanda were not exporting any of the latter, and were only an exporter of tea, coffee and minerals - which require very different skills to be produced than jumpers - then we could say with a certain degree of confidence that it is unlikely for Rwanda to start exporting jumpers in the near future. If however Rwanda were already exporting t-shirts, the idea that it could also move into the production of jumpers would sound somewhat more plausible, given that it is already an exporter of textile products. If in addition Rwanda were not only exporting t-shirts, but also socks and trousers, then the likelihood that firms in the country would "discover" or simply start exporting jumpers would be significantly higher. In this case we could say that jumpers are "close" to Rwanda's current product space, and that is likely for the country to start exporting jumpers in the near future. Using a similar logic, it is possible to measure how close a certain product is to Rwanda's product space, by measuring how closely connected it is to products that Rwanda already exports. This measure, introduced by Hausmann et al (2007) in the context of the product space, is called "density".

The starting point of this analysis is to first identify what products Rwanda has a comparative advantage in. To do this we use Balassa's Revealed Comparative Advantage (RCA), using various cut-off rates. Balassa's RCA index, basically measures in relative terms how much more or less of a product a country exports compared to the rest of the world. As a rule of thumb, if a country's RCA index in a certain product is greater than 1 – which would indicate that the weight of that product in the country's export basket is greater than the world average - we say that the country has a revealed comparative advantage in that product; if the RCA index of a product is smaller than 1, then the country does not have a comparative advantage in that product. Based on the 2010 RRA exports dataset, we find that using this cut-off, the main products in which Rwanda had comparative advantage are:

- Mineral products (tin ores and concentrates, chromium, niobium, and tantalum);
- Coffee and Tea;
- Beverages (beer, milk, water, fruit juices);
- Construction materials (cement, flat rolled steel products, bricks, tiles, barbed wire);
- Plastic products (plastic tanks)

[21] Based on interview with Steelrwa on January 26th, 2012 for *Understanding Rwanda's Manufacturing and Agribusiness Sectors*, The International Growth Center, Conference Version, July 2012

- Raw Hides and Skins;
- Products of the milling industry (cereal flours, starch, dry vegetable meals);
- Essential oils, parts of plants, vegetable saps and extracts (including Pyrethrum);
- Beauty products (hair and skin);
- Plastic shoes; and,
- Some textile products.

To calculate the density of new products in relation to Rwanda's product space, we add to this list what we call "transitional products". Following Hausmann et al, we call any product in which Rwanda has an RCA greater than 0.5 but smaller than 1 a "transitional product"; i.e. Rwanda is already exporting that product, but does not yet have a comparative advantage in it.

If we take a sector view of the density data and focus on the 5% of products that are closest to Rwanda's product space, we find that Rwanda's export sector is likely to organically grow into exporting more agricultural products (fruits, nuts, spices, vegetables, fats), flowers, some processed food products (sugar confectionery), leather, textile products and shoes[23]. These findings do not imply that Rwanda has a latent comparative advantage in these product areas; what they do suggest is that these are the products that require the most similar production capabilities to the capabilities the Rwandan economy has today.

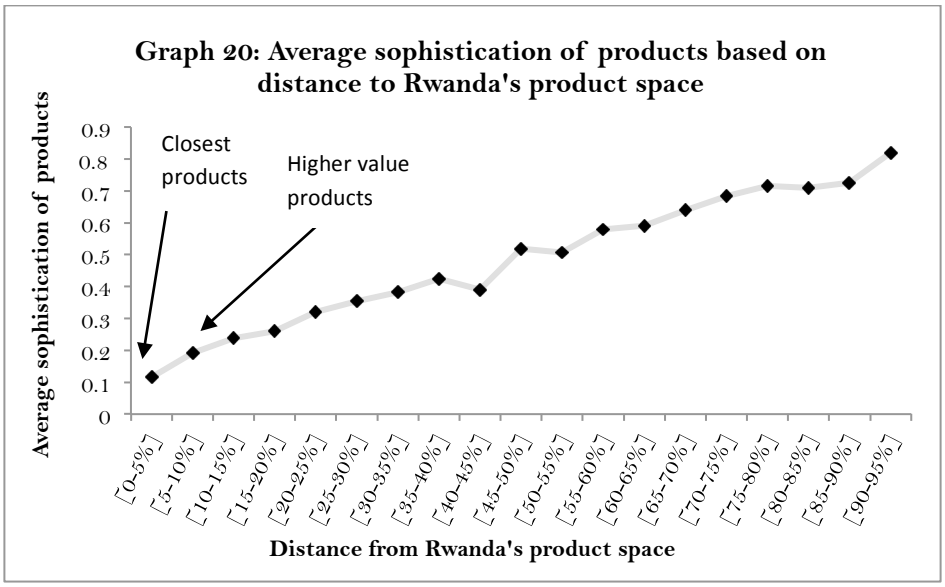
Table 5: Closest Products to Rwanda's Product Space

Sector (hs2 level)	Products (hs6 level)
Sugars and confectionery	Raw sugar cane, refined sugar, molasses
Oil seeds and various grain seeds	Sesamum seeds, ground nuts, oil seeds, seeds fruits and spores for sowing, flour or meal of oil seeds
Flowers	Cut flowers, foliage
Fruits and nuts	Cashew nuts, bananas, plantain, citrus fruits, guavas, mangoes, avocadoes, papaya, other dried fruits and nuts
Spices	Capsicum, bay leaves, thyme, ginger
Edible vegetables and certain roots and tubers	Legumes, peas, lentils, chickpeas, aubergines, arrowroots, dried leguminous vegetables, manioc, cassava, capers, broad beans, sweet potatoes
Raw hides and skins and	Various skins and leathers
Vegetable textile fibres	Jute and bast fibres, vegetable fibers, sisal
Apparel	Various garments, including trousers, t-shirts, etc.
Footwear	Waterproof and plastic shoes
Vegetable fats	Maize oil

However the realm of the possible is larger than this narrow group of close products. We therefore focus on a second group of products, which we call "higher value products". As can be seen in graph 20, products that are in the 5-10% range of closest products– still relatively close to Rwanda's product space - are on average more sophisticated than the first group. These include:

- staple crops (such as rice, maize);
- processed food and beverage products (cereals, confectionary, honey, milk, juices);
- packaging products (glass containers);
- rubber products (natural rubber and inner tubes of tires);
- wood products (wood, sawn wood, wood charcoal);
- construction materials (rebars, marble or other stone based construction materials); and,
- the extraction of the essences of coffee or tea.

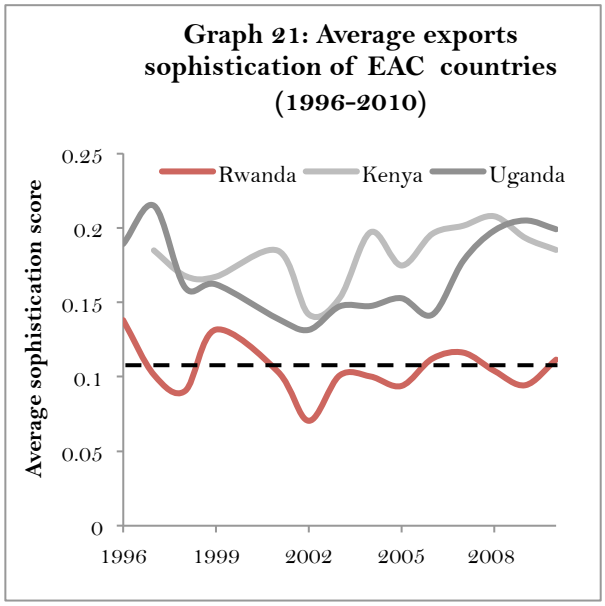
[23] We have cleaned the data to exclude products we assume that Rwanda is unable to produce due to geographic or climatic parameters, e.g. cocoa and other minerals

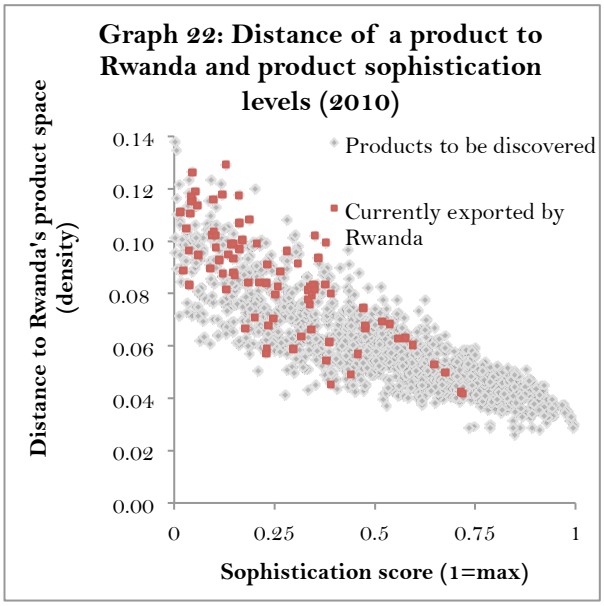


Many of the products identified are already being produced for the domestic market. This means that there might be an opportunity for Rwanda to bring some of these products to scale for the exports market.

4d. Have exports led to product upgrades?

The average sophistication level of Rwanda's export products, weighted by export volumes, has remained relatively constant over the past 15 years.[24] The reason we observe this level of flatness is because export volumes are still overwhelmingly tilted towards coffee, tea and mineral products, which have relatively low levels of sophistication. Moreover, as outlined above, 85% of growth from "new product discovery" over the past decade has come in the form of new coffee, minerals and live animal products. Graph 21 below, shows that as a consequence Rwanda has not managed to bridge the export product sophistication gap with other EAC countries, such as Kenya and Uganda.





[24] We measure product sophistication using the Method of Reflections introduced by Hausmann and Hidalgo (2009), which takes into account the ubiquity of a product (how many countries are capable of producing it – the fewer the more sophisticated) and the average diversity of countries that export that product with a comparative advantage (the more diverse the countries that export a certain product on average, the more sophisticated it is likely to be).

The average sophistication level does not tell the whole story however. As can be seen in graph 22, which compares the sophistication and density of Rwanda's current export portfolio to the products it has yet to discover, we find that there is quite a lot of disparity in the sophistication of the products the country exports. While the majority of Rwanda's export products are clustered in the left hand corner of the graph (i.e. high density and low levels of sophistication), there are nevertheless a few products in the bottom right hand corner (i.e. low density and high sophistication). These include comparatively more complex products such as paints, aluminum tanks, and beauty products. So while the average weighted sophistication of Rwanda's exports sector has not moved significantly over the past 15 years, at the granular level entrepreneurs and investors have been diversifying into the production and exports of more sophisticated products. As we have shown in the section on destinations, the main market for these more sophisticated products are the EAC and DRC.

But has product discovery also led to quality improvements and increased value added in Rwanda's exports sector? While it is difficult to show this at the aggregate level given a number of data constraints – e.g. the Harmonized System HS classification does not enable us to distinguish between a good, well packaged, and tested product and a bad product - we can find anecdotal evidence of this happening at the firm level. Cases that stand out include product upgrades in Rwanda's tea and coffee sectors.

Tea: Sorwathé is one of Rwanda's largest tea exporters and has been leading new product development in Rwanda's tea sector. Product diversification at Sorwathé was in large part a response to demand patterns in the global tea market and has required new capital investments and capacity building. Sorwathé was the first tea factory in Rwanda to introduce green tea, white tea, silver tip tea and orthodox tea. Sorwathé started producing green tea in 1996 – a process that is based on a minimal oxidation of the tea leaf and required new capital investments. In 2008, Sorwathé invested in a new production line and started the production of orthodox tea, which is a higher grade black tea. Over the past two years the company has also introduced white tea and sliver tips, which is a premium and expensive tea product. While not capital-intensive, the processing of white tea requires extensive training in particular at the plucking stage; white teas are based on young tea leaves with a lot of fine hair and therefore have to be selected with care. Each of these steps in Sorwathé's diversification process have led to higher value addition and have enabled the company to enter niche markets in the global tea sector.

Coffee: Rwanda's coffee sector has also been heavily investing in improving the quality of its produce. The gradual transition from semi-washed coffee (ordinary coffee) to the higher-value fully-washed coffee (specialty coffee), has required significant investments in terms of quality and process control. Almost all of Rwanda's large coffee processors such as CBC, Rwacof and RTC are investing heavily in: (i) human capital, by hiring qualified staff and bringing in consultants to improve processes; (ii) cupping labs and cupping specialists to test and improve the taste of the coffee produce; (iii) capacity building, to ensure the delicate process of producing specialty coffee is better controlled from the pre-harvesting stage through to dry-milling; and (iv) acquiring certain standards and certifications to increase the value of their products on global export markets (e.g. Rwacof has the Starbuck's C.A.F.E certification, the 4C certification and expected to receive Fair Trade certification by mid-2012).

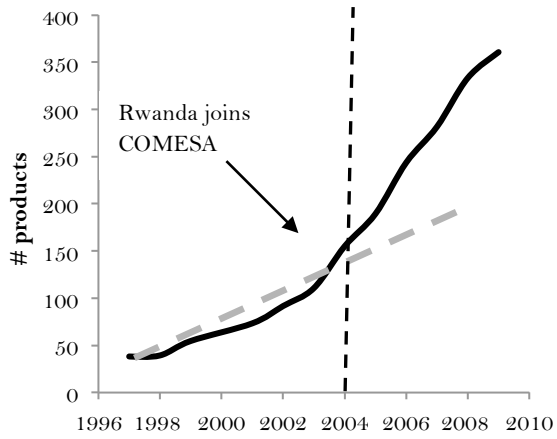
In general, based on our interviews with 43 of Rwanda's largest manufacturing and agribusiness firms, we find that many exporters and potential exporters are investing in improving processes and acquiring quality certifications to enable them to compete on regional and global export markets.[25] In order to export within the EAC, exporters require RBS certification, which comes along with certain quality requirements. In order to compete on global markets, other certifications – in particular industry-specific ISO certifications – are required. A number of companies, such as Bralirwa, Sulfo Industries, Utexrwa, and Inyange Industries are already ISO certified, while others, such as Steelrwa, are in the processing of obtaining certification.

[25] Gathani and Stoelinga, *Understanding Rwanda's Manufacturing and Agribusiness Sectors*, The International Growth Center, Conference Version, July 2012

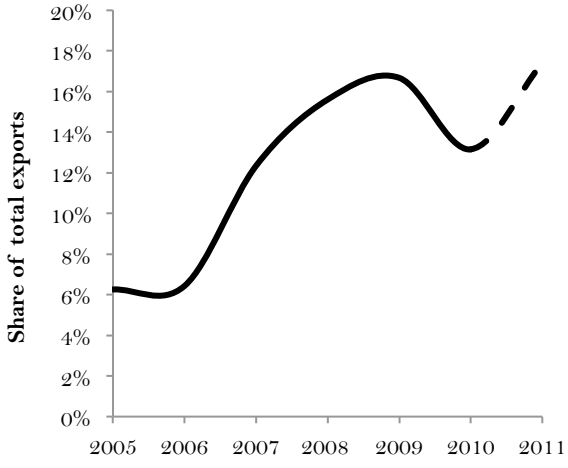
4e. Is product discovery a constraint to exports growth?

Despite the fact that 89% of Rwanda's exports are at the periphery of the product space, which is a limiting factor for new product discovery, product discovery does not seem to be a binding constraint to growth in Rwanda's exports sector. As can be seen in graph 23 the rate of growth in the number of products Rwanda exports has accelerated over the past 15 years. The rate started to accelerate in 2004, which incidentally also corresponds to the date when Rwanda joined COMESA (although we do not seek to establish a causality relationship here). From an economy that exported only 32 products in 1996, Rwanda exported an estimated total of between 340-390 products in 2010.[26] Moreover, the share of non-commodity exports over total exports has increased significantly, from 6% in 2005 to more than 12% in 2010 (double), pointing towards increased export diversification (see graph 24).

Graph 23: Number of products exported - 3 year moving average (1996-2010)



Graph 24: Share of non-commodity exports (2005-2011)



Prospects for future new export product discovery are also quite promising. Most of the "close" products" identified above are products that Rwanda either already has incipient exports in or already produces for the local market. Rwanda already produces sugar, fruits (bananas, guavas, mangoes, avocadoes, papaya), nuts (cashew nuts, macadamia nuts), edible vegetables and roots and tubers (cassava, broad beans, sweet potatoes, peas, lentils, etc.), footwear (plastic shoes), and apparel. "Higher value" products that Rwanda already produces include: staple crops (rice, maize), rebars for the construction sector – which are already exported, and processed food and beverages (honey, milk, juices). Moving from the local production of these products to exports is less of a leap than developing industries in these sectors from scratch.

Rwanda's problem is less a problem of product discovery, and more of a problem of scale. We estimate that despite the increase in the number and share of non-commodity products, Rwanda's non-commodity export sector remains very small with exports in 2010 of about US$23.8m, a mere 0.42% of GDP. That amounts to about US$75,000 per product, compared to US$5m for commodity products. The issue seems to be that firms in the non-commodity sector are hesitant to enter the exports market. Based on data of 50 non-commodity manufacturing firms for which we have both Business Income and exports data, we estimate that the average export orientation of Rwanda's manufacturing sector is 4.31%.

The key to successful export product discovery for Rwanda will be an increase in the export orientation of its larger groups that have the required financial and human resources to invest in R&D, upgrade systems, acquire all the required product certifications, build lasting trade relationships and survive sudden changes in the competitive landscape and the business cycle. We already see this happening to some extent

[26] We find that Rwanda exported 337 products in 2010 using RRA data and applying the product and firm-level filters we developed; using Comtrade data, to which we apply a product filter but not a firm filter, we find 393 products.

with the growing presence in Rwanda of large business groups, both local and foreign-owned. Examples of companies that are owned by larger groups and that have successfully entered the exports market include: Bralirwa – a beer and soda exporter (owned by Heineken); the Sulfo Group (which is Rwanda's most diversified manufacturer and also has a plant in DRC); Steelrwa that produces rebars for the construction sector (owned by the Manji family that have existing businesses in DRC, Angola and Burundi); Pembe Flour that exports wheat bran to Kenya (owned by EAC groups); Bakhresa Grain Mills (owned by the Bakhresa Group of Companies) that exports wheat flour to DRC; and Inyange – a juice and water exporter (owned by the Crystal Ventures Group). These are the companies that are driving export product discovery in Rwanda.

5. Firm level dynamics

The final branch of the exports dynamics tree focuses on the following question: what are the characteristics of exporting firms? We focus on two main dimensions: the productivity of exporting firms and their size. First we show that in the Rwandan context it is not possible to isolate the difference in productivity between exporters and non-exporters, partly because of the structure of the exports sector, but also because there are very few export oriented firms. This makes it difficult to test the learning-by-exporting hypothesis in the case of Rwanda, which asks whether firms increase their productivity as a result of exporting or whether firms with the highest productivity levels self-select into the exports sector (see for example Clerides, Lach, and Tybout, 1998; Delgado, Farinas, and Ruano, 2002; Aw, Chung, and Roberts, 2000; Bigsten et al., 2004; and Van Biesebroeck, 2005; Bigsten et al, 2009). This was initially one of the key questions of this study. Next we show that in terms of official merchandise exports, size matters a lot. Larger firms are much more likely to be exporters than smaller firms and as a result account for the vast majority of the Rwanda's exports. Lastly we show that new entrants supported by large groups, both regional and domestic, are gradually changing the landscape of Rwanda's exports sector.

5a. Measuring value addition and defining exporters

To measure the productivity differential between exporters and non-exporters we first need to determine: (i) how to measure firm-level productivity using available firm-level data; and (ii) how to define what constitutes an exporting firm.

We chose to measure firm-level performance using an estimate of labor productivity. Based on available Rwanda Revenue Authority data (including CIT, PIT, and PAYE), we estimate labor productivity using a measure of value added per employee based the following formula:

$$Value\ added\ per\ employee\ (v) = \frac{Sales - Estimated\ Cost\ of\ Intermediate\ Inputs}{Number\ of\ employees}$$

which we calculate using the following variables:

$$v = \frac{Business\ Income - (Cost\ of\ Goods\ Sold + Expenses - Wages)}{Number\ of\ employees}$$

Unfortunately, Rwanda Revenue Authority data does not enable us to distinguish between the cost of intermediate inputs (such as the cost of raw materials and energy) and other costs. We therefore estimate the cost of intermediate inputs using a second-best solution, which consists in subtracting wages from total costs. Another way of writing this measure of labor productivity is:

$$v = \frac{EBITDA^{27} - Wages}{Number\ of\ employees}$$

The next question is how to determine which firms qualify as exporters and which not. We consider three possible definitions:

- any firm with exports greater than zero in any given year;

[27] EBITDA is Earnings Before Income, Taxes, Deductions and Amortization

- any firm with exports of at least a certain threshold in a given year (we use USD$50,000 as the threshold, which at the scale of large exporting firms is very small); and,
- any firm that makes more than a certain percentage of its revenues from exports (we use a very lax threshold of 10%).

Our sample of exporters and non-exporters – the sampling frame is limited to tax payers for which revenue, employment, and area of activity data was available for 2010 - varies significantly depending on the definition we use:

Table 6: Definition of Exporters (based on 2010 data)

Definition	Number of Non-Exporters	Commodity exporters	Exporters that are retail, wholesale, or transport firms	Other exporters	Total number of exporters
1. Exports > 0	1170	27	50	43	120
2. Exports > USD$50,000	1223	26	18	24	68
3. Exports/sales > 10%	1234	26	14	17	57

Each of these three definitions are valid in their own way and lead to different results. As can be seen in table 7, the more stringent the conditions the fewer the number of exporters. Using definition 1, we identify 120 exporters in our sample of 1290 firms (i.e. 9.3% of our sample); using definition 2 only 68 exporters (5.3% of the sample), and using definition 3 just 57 exporters (or 4.4% of the sample). While the selected definitions do not make any difference to the number of commodity exporters in the sample, they do alter the number of exporters that are not commodity exporters or retail, wholesalers or transportation firms. Using definition 3 for example, we find that there are only 17 firms (just over 1% of firms) that fall in this category, compared to 43 using definition 1.

5b. How do exporting firms compare to non-exporting firms?

As can be seen in table 8 below, we find that the median value added per employee in exporting firms tends to be higher than in non-exporting firms. The estimated difference ranges from about US$1000 to US$1500 per worker per year for exporters that are not commodity exporters or retail, wholesalers or transportation firms (i.e. 40-70% higher); the same difference is about US$2200 for exporters of tea, coffee and minerals (i.e. 100% higher)[28]. Based on a sample of 501 firms for which we have extensive data in 2010, we find that when controlling for returns to capital[29], returns to labor, sector, location (Kigali vs. non-Kigali), and legal status (individual vs corporation), the median labor productivity of exporting firms is about 50% higher than non-exporting firms using definition 1. However we find no significant differences between exporters and non-exporters using definitions 2 and 3, possibly due to multicollinearity given the small number of exporters involved (some sector dummies perfectly identify whether a firm is an exporter or not, leading to likely multicollinearity).

Table 7: Median Value-Added per Employee (2010)

Exporter definition	Median Non-commodity exporters (non-retail or transport)	Median commodity exporters (tea, coffee, minerals)	Median Non-Exporter
Firm exports>0	USD$3739	USD$4462	USD$2199
Firm exports >$50,000 per year	USD$3500	USD$4451	USD$2287
Firm exports>10% of sales	USD$3260	USD$4451	USD$2298

[28] It is important to note however that these numbers do not reflect data on smaller producers and exporters for which we do not have all the required data

[29] We estimate firm-level capital using RRA import data for the 2005-2010 period on machinery and vehicle imports, discounting estimated capital by 15% per year.

5c. Is it possible to test the learning-by-exporting hypothesis in the case of Rwanda?

The term "learning-by-exporting" has usually been associated with research focused on understanding why, in most countries, exporting firms tend to have higher levels of productivity than non-exporting firms. The debate has centered on two competing (and non-mutually exclusive) explanations of why this might be the case: either the act of exporting and competing in global markets makes firms more competitive and encourages increased value addition; or the observed productivity wedge is due to the fact that the most productive firms self-select into the exports sector in the first place. Finding evidence of learning-by-exporting entails establishing a causal relationship between the act of exporting and productivity improvements over time at the firm level.

In the best of cases finding evidence of this causal relationship is a very complicated endeavor, given that firm level productivity is driven by a whole range of factors – internal and external to the firm - and is very sector specific; in the case of Rwanda, we argue that it is close to impossible. The main reasons are:

(i) *The majority of exporters are tea, coffee processors, and mining firms which are all, and without exception, export oriented.* There are no comparator processors solely focused on the domestic market that could serve as a reference point for what the labour productivity of a non-exporter of coffee and tea would look like for example. Moreover, these firms tend to be non-diversified and highly specialized: they focus only on the their specific commodity as opposed to non-commodity firms which tend to be more diversified. Furthermore their performance is largely driven by external factors, including fluctuations in global prices for these commodities and in the case of tea and coffe agro-climatic conditions on the ground.

(ii) *Out of non-commodity firms that could qualify as exporters, there is only a handful that export more than 10% of their output.* Out of 1223 firms in our 2010 sample that are not commodity producers, there were only 31 firms that exported more than 10% of their output, half of which were transporters and or retail/whosallers. In 2010 for example, there were only 3 medium to large agribusiness/manufacturing firms that exported more than 50% of their output: Société Rwandaise de Chaussures (plastic shoes), Sopyrwa (pyrethrum), and Kigali Cement Company (cement). Given the very low export orientation of firms (4.2% in our sample of non-commodity firms) it is more likely that any labour productivity differential observed is the result of the idiosyncratic performance of individual firms rather than learning-by-exporting. Moreover, the vast majority of non-commodity exporters do not compete on global exports markets but export to neighboring DRC or EAC partners.

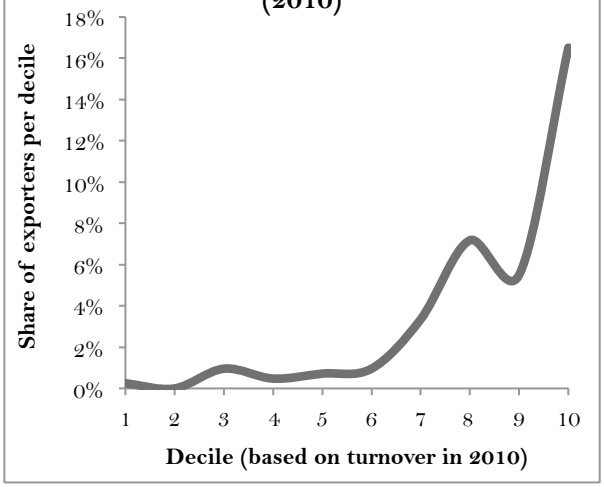
(iii) *It is very difficult to disentangle the effects of exports and imports on labor productivity.* Firms in Rwanda face steep competition from imports and also rely heavily on imports for intermediary inputs. Both dynamics affect firm level productivity. Competition from cheaper imports can drive domestic firms out of the market, force them to expand their market by exporting to neighboring countries, or force them into niche higher value products (this has been the case for example of the construction materials and furniture markets[32]). Prices for intermediary inputs fluctuate a lot, directly affecting the productivity levels of domestic firms. Given the small number of firms per sector in Rwanda, and in particular the small number of exporters, disentangling the effects of imports and exports on productivity is almost an impossible exercise.

[32] Gathani and Stoelinga, *Understanding Rwanda's Manufacturing and Agribusiness Sectors*, The International Growth Center, Conference Version, July 2012

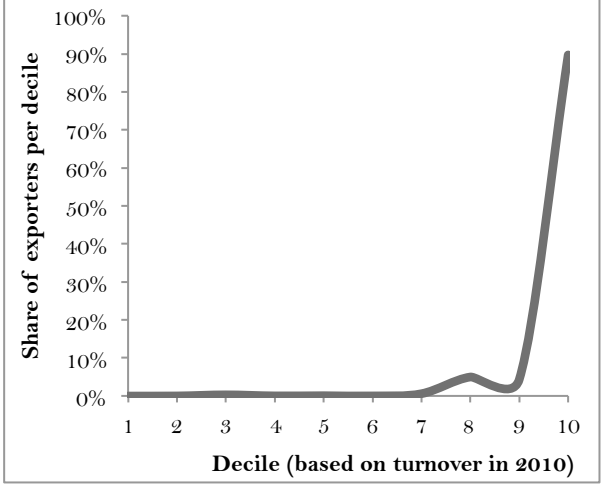
5d. Does firm size matter?

While it is difficult to determine whether exporting leads to higher firm level productivity, we find that firm size is an important determinant of whether a firm exports or not. Larger firms are more likely to export and account for a vast majority of official merchandise exports in Rwanda. Possible explanations as to why this might be the case is that larger firms are in a better position to overcome export related constraints, that they are more likely to enter the export sector in order to expand their market and benefit from economies of scale, or simply that larger firms have higher productivity levels because they do not face the same constraints that smaller firms face, in particular access to skilled technicians and administrators, access to finance, and supply related constraints.

Graph 25. Share of firms that are exporters based on turnover decile (2010)



Graph 26. Share of total exports by turnover decile (2010)



As can be seen in graphs 25 and 26, we find a clear link between firm size and exports (this data accounts for an estimated 95% of exports). In 2010, we estimate that the 10% of largest firms (i.e. with a turnover of US$1.2m or more) accounted for 90% of total merchandise exports and included 50% of the country's "exporters". Firms in the 90th percentile (in terms of turnover) were at least 2.5 times more likely to export than firms at the 70th and 80th percentile, 5 times more likely to export than firms at the 60th percentile, and more than 15 times more likely to export than the median firm, etc. The number of exporters increases expontentially with size. In line with these trends we find that firm size in Rwanda is also associated with the number of products and destinations a firm exports to: on average larger firms export more products to more destinations than comparatively smaller firms.

Another way to look at this issue of exports and size is to ask the question: how many firms account for what share of exports? We find that a handful of firms account for the vast majority of exports in Rwanda. 26 commodity exporters accounted for 90% of the exports of coffee, tea and minerals in 2010, while 50 non-commodity exporters accounted for 90% of exports in the non-commodity sector. Even though the firm-level concentation of exports has been steadily decreasing over time (see graphs 8 and 9, p12), the current composition of the exports sector is heavily tilted towards large exporters.

Table 8: Cumulative share of exports accounted for by largest exporters (2010)

Cumulative share of exports accounted for	Number of commodity product exporters	Number of non-commodity product exporters
50% of exports	8	7
75% of exports	15	21
90% of exports	26	50
Total number of exporters	77	331

New large firms are changing the landscape of Rwanda's merchandise export sector. While the number of exporters has been increasing rapidly, it is a handful of new large firms that are making the difference. A good example to illustrate this are Steelrwa and Bakhresa Grain Milling, which started operations in Rwanda in 2011 and are owned by very large regional groups/investors. By the end of year one of operations, Steelrwa and Bahkresa were exporting an estimated US$14m to the Democratic Republic of Congo(DRC), Burundi and other regional destinations[33]. That compares to total official non-commodity exports of US$24m in 2010; all else equal two companies alone will have contributed to a 60% increase in Rwanda's non-commodity exports sector in the space of one year.

5e. Low export orientation of firms is a constraint but could also be an opportunity

Even though larger firms are more likely to export than smaller firms, the problem in the non-commodity exports sector is that Rwandan manufacturing and agribusiness firms are not exporting, and if they are, they are not exporting very much. We can restate this issue as a lack of "learning-to-export" or "learning-how-to-export" (see Eliasson et al, 2009), rather than learning-by-exporting. Rwanda has few manufacturing and agribusiness firms to start with, and the few firms that Rwanda has do not export very much. Out of the 1291 firms for which we have business income data in 2010 (after applying an activity filter to exclude wholesalers, retailers, transporters and exporters of commodity products), there are only 10 non-commodity firms for which the Exports (FOB) over Business Income ratio is more than 10%;

The fact that the export-orientation of firms in these sectors is low could be the consequence of: (i) low productivity levels, making the output of Rwanda's agribusiness and manufacturing sectors non-competitive even in regional markets, in which case the challenge is one of firm-level productivity; (ii) the land-locked nature of the country and associated transportation costs, which make competing in regional and other destination markets very difficult (even if productivity at the firm-level is relatively high); (iii) the fact that the local agribusiness and manufacturing sectors are not yet in the position to fully satisfy the rapidly growing demand of the Rwandan market, and hence do not consider the exports sector as a priority; and (iv) firms in Rwanda's manufacturing and agribusiness sectors, which were completely ravaged during the genocide, are still comparatively young and are in the process of equipping themselves, putting in place more effective management and production systems, building more robust supply chains and distribution networks, etc.

The answer is probably a mix of all these factors, but one issue in particular that we feel is worth highlighting, is low capacity utilization in Rwanda's agribusiness and manufacturing sectors. This leads to low returns to scale, low productivity, and limits the ability firms in these sectors to export. Based on interviews with the CEOs and/or Managing Directors of Rwanda's 43 largest manufacturing and agribusiness companies between January and May 2012, we estimate that the average capacity utilization of firms in these sectors is less than 50%[34]. The problem therefore is not that firms are technologically less competitive than in neighboring countries – on the contrary, given the re-tooling that happened in the late 90s and early 2000s, machinery tends to be quite modern – but that firms do not have the ability to run their machines at full capacity.

The reasons for low capacity utilization are firm-specific, but a number of systemic issues that emerged from a study that we conducted in parallel to this exercise are[35]:

- Firms face a skills constraint for mid-to-senior level manager positions and technical positions. There is an immediate short-term solution to this problem however, which is the importing of skilled labor from abroad and the region in particular. Firms in Rwanda's manufacturing and

[33] Interviews with the CEO of Steelrwa and Bahkresa Grain Milling, April-May, 2012
[34] Gathani and Stoelinga, *Understanding Rwanda's Manufacturing and Agribusiness Sectors*, The International Growth Center, Conference Version, July 2012
[35] Ibid.

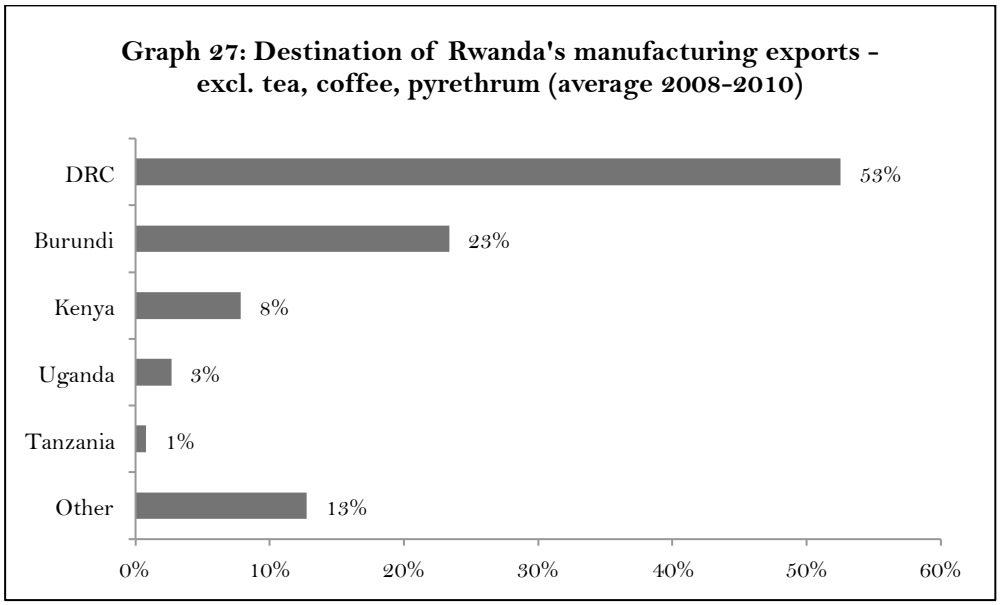
agribusiness sectors have already been investing heavily over the past few years in acquiring these skills and have done so quite successfully. Low skills are therefore not a binding constraint to increased capacity utilization and productivity.

- Firms need to deal with seasonality and fluctuations in demand and have a low capacity to respond to these changes because of a long order-to-delivery time lag. Firms in the construction sector for example can face an order-to-delivery delay of up to four months for large orders, as they need to first import the raw material from Asia mostly (e.g. cold-rolled coils) before they can start production.

- There are systemic costs that Rwanda needs to tackle in the medium to long term, including high transportation and energy costs. High transportation costs are a double-edged sword for manufacturing firms, given that the vast majority of raw materials for the manufacturing sector need to be imported first, before the final product can be exported thereafter. High electricity costs and the low supply of electricity are also binding, in particular for electricity-intensive sectors, such as the textile and construction sectors. What high electricity costs mean for the construction sector for example, is that it only makes sense for firms to run their machines (which consume a lot of electricity) once they have received more than a certain threshold of orders which more than compensates for the cost of electricity; otherwise they would be running the machines at a loss. Firms sometimes need to wait for months before they have enough orders to justify running the machines.

- Our assessment, however, is that the most constraining factor is access to raw materials, both internally and from abroad. Minimex for example, Rwanda's largest maize miller, is running well below capacity because it cannot procure enough good quality maize on the local market; Kabuye Sugar Works, Rwanda's only sugar producer, is running below capacity because sugarcane production in Rwanda is low and very vulnerable to weather fluctuations; Sorwatom, which produces tomato paste, has had to import semi-processed tomato paste from China because the local supply of fresh tomatoes is low and of bad quality; ICM Rwanda Agribusiness, the largest rice processor, also faces shortages because of the quality and quantity of rice production; Ruliba Clays, which produces clay products for the construction sector and procures its raw materials locally, is running below capacity because of the absence of structured supply chains and the geographical disparity of the raw material sources; Bakhresa Grain Milling and Pembe Flour Mills, which produce wheat flour, import more than 95% of the wheat from abroad, in particular Australia; Steelrwa, which produces rebars for the construction sector, is running below capacity because of the lack of metal scrap on the local market, and the list goes on.

Therefore one of the keys to reducing low capacity utilization, improving firm-level productivity, and increasing the chances of exports growth, is to resolve Rwanda's raw materials sourcing problem, which is a domestic supply chain problem and an imports problem.



The low export orientation of large manufacturing and agribusiness firms, combined with the regular entry of new large firms into the exports market – a trend that has been ongoing since Rwanda entered the East African Community in 2007 – points to the fact that there is a latent potential for exports growth in Rwanda's manufacturing and agribusiness sectors. The main two markets for Rwanda's manufacturing and agribusiness sectors at this point in time are the Democratic Republic of Congo (DRC) and Burundi. We estimate that between 2008 and 2010 75% of Rwanda's non-commodity exports went to these two destinations and that these markets grew from a total of US$1m in 2005 to more than US$15m in 2008, and an estimated minimum level of US$30m in 2011 based on early figures (see Graph 27). While small and volatile (both from an economic and political perspective), these export markets present a major opportunity for Rwanda's non-commodity exports sector. These are the destinations where Rwandan firms are best placed to learn how to export. They are geographically close, have comparatively less developed agribusiness and manufacturing sectors, and offer a much larger potential consumer market than Rwanda.

6. Conclusion

In summary, the main findings from this paper are:

Macro perspective of Rwanda's Merchandise Exports
To understand Rwanda's merchandise exports sector one needs to distinguish between commodity products (which account for about 85-90% of exports) and non-commodity products (10-15%). The dynamics of destination discovery, product discovery and firm-level productivity are very different for each. Commodity exporters tend to be large, foreign owned firms, and export to established commodity markets such as Switzerland, Belgium and China. We estimate that 99% of commodity exports go to Europe, Asia and North America. Non-commodity exporters, tend to be owned by domestic or regional firms, and mostly target the DRC and EAC markets. Some interesting trends to follow in Rwanda's merchandise exports sector include: (i) the very rapid increase in the number of firms and products exported to the Democratic Republic of Congo (DRC) and the EAC; (ii) a gradual increase in the share of non-commodity exports over total merchandise exports, although growth stalled somewhat between 2008 and 2010 after a very rapid increase during the 2006-2008 period; (iii) an increase in the number and share of trading firms (retailers and wholesalers) in Rwanda's exports sector; (iv) the collapse of the leather sector and leather exports which accounted for 70% of non-commodity exports in 2005 compared to less than 5% today; and (v) the emergence of new export products, albeit on a small scale, such as beverages, plastic shoes, plastic tanks, some construction materials, and furniture.

Destination Discovery
Destination discovery has contributed very little to exports growth between 2000-2010. We find that while new destination discovery is low, it is not a constraint for Rwanda in major commodity markets such as the tea, coffee and minerals sectors, given that export destinations are already relatively diverse for these products, that there is a lot foreign investment in these markets and the fact that buyers bear a lot of the searching costs in identifying suppliers (i.e. firms in Rwanda), rather than the other way around. It could however, be a constraint for firms operating in non-commodity markets. Between 2005-2010 the share of non-commodity exports that went to the EAC and DRC doubled, and currently accounts for about 90% of total non-commodity exports. The situation is even more striking for the agribusiness and manufacturing sectors (excluding pyrethrum, tea, coffee, and minerals), where we estimate that more than 99% of processed or manufactured products went to the DRC and EAC in 2011,compared to less than 50% in 2005. While growth in exports to the EAC and DRC could be indicative of Rwanda's rapidly increasing export capacity to these destinations, it also reveals the difficulties non-commodity exporters face in competing in alternative destinations. Increasing the competitiveness of Rwanda's non-commodity products to these global markets will require significant long-term investments aimed at reducing factor costs, improving labor productivity and the quality of the exported products. We argue that in the short term, a more successful strategy for Rwanda would be to focus on regional markets – in particular Burundi and DRC - where there is proven and unmet demand for Rwanda's manufacturing and agribusiness products and where Rwanda has the competitive advantage of proximity.

New Product Discovery
Product discovery (at the hs6 level) has contributed about 22% to exports growth between 2000-2010 and was driven largely by new commodity export products, such as specialty coffee, tungsten and chromium. However, given that Rwanda's commodity products are at the periphery of the product space, the tea, coffee and mining sectors are unlikely to be the source of much product discovery in the future. Future product discovery will come from firms operating in Rwanda's non-commodity exports sector and is likely to happen mainly in the agriculture/floriculture sector, followed by food-processing, the construction materials sector, and other sector such as the rubber products, wood, textile sectors. While the speed of product discovery is limited by Rwanda's current position in the product space (88% of exports are at the periphery of the

product space), product discovery per se is not a major constraint to exports growth, given that that many of these products are already being produced for the domestic market. The main problem is that firms in Rwanda's agribusiness and manufacturing sectors don't have the ability to bring the exporting of these new products to scale. While there are new products being exported (either consistently or sporadically) to neighboring countries, the scale of these exports is limited.

Firm-Level Dynamics

Given the structure of Rwanda's export sector it is not possible to determine whether the learning-by-exporting hypothesis on the impact of exporting on firm-level productivity holds, even though exporters tend to have significantly higher productivity levels than non-exporters. The three reasons why this is not possible in the case of Rwanda are: (i) the majority of exporters are tea, coffee processors, and mining firms which are all, and without exception, export oriented; (ii) out of non-commodity firms that could qualify as exporters, there is only a handful that export more than 10% of their output; and (iii) it is very difficult to disentangle the effects of exports and imports on labor productivity. In addition to having higher levels of productivity, we find that firm size matters. The larger the firm (in terms of turnover), the more likely it is to export. Moreover, large firms account for the vast majority of exports: the 10% of largest firms account for 90% of exports. New entrants in the manufacturing and agribusiness sectors, backed by large regional groups, are making a big difference to exports in the non-commodity sector and in particular to destinations such as Burundi and DRC. Nevertheless, even the largest firms remain domestic oriented. The biggest issue seems to be *learning-to-export*, as opposed to *learning-by-exporting*, and the fact that firms (large and small) in Rwanda's agribusiness and manufacturing sectors do not export much. One of the reasons firms are not very export oriented seems to be low productivity to start with, resulting from an underutilization of capacity. Low export orientation combined with the recent growth in non-commodity exports to Burundi and DRC and the entry of multiple large manufacturing and agribusiness firms since 2007, points to the fact that there is a latent potential for exports growth in the manufacturing sector.

But what do these findings imply in terms of policy?

We propose a number of overarching principles that we believe could help guide future policy design in the exports sector:

1. Policy makers should make it a point to make a very clear distinction between policies for the commodity exports sector (tea, coffee minerals), where the target is to increase volumes and the value-added of the product, and policies for the non-commodity exports sector, where the main constraints to export growth seem to be the low export orientation of manufacturing and agribusiness firms, stemming from a number of factors (related to human capital constraints, factor costs, the youth of the sector, etc) but in particular low capacity utilization and supply constraints. Increasing the share of the non-commodity exports sector is key if Rwanda wants to diversify its exports base, gradually increase the sophistication of its economy, break away from its dependence on the terms of trade for tea, coffee and minerals, and actively participate in regional trade.

2. The number one priority for Rwanda's exports sector in terms of destinations should be to increase exports to the East African Community (EAC) and the Democratic Republic of Congo. Currently EAC only accounts for 5.3% of Rwanda's merchandise exports package (this is excluding tea exports that transit through Mombasa). Exports to the EAC account for less the 0.5% of GDP, which either signals that Rwanda is not producing very much or that Rwandan firms are not competitive in the regional market. One of the significant benefits of being part of a common market is to boost production and domestic job creation through regional exports growth. This is an engine of growth that Rwanda is not yet fully benefitting from, with insignificant exports to large markets such as Kenya, Uganda and Tanzania. The case of the DRC and Burundi is slightly different. These are markets where Rwandan manufacturing and agribusiness firms are well placed to compete given the

geographic proximity and comparatively less developed agribusiness and manufacturing sectors. The proof that this is the case is that a number of large regional groups have already invested in factories in Rwanda with an eye on the DRC and Burundi markets. This is an opportunity that Rwanda should focus on, but an opportunity that could be at risk given the political instability in these countries.

3. Increasing the destination diversity of the non-commodity exports sector to include more developed countries will only come hand in hand with product diversification. As the numbers show, with more than 90% of non-commodity exports currently going to the EAC and DRC, the current products of Rwanda's manufacturing and agribusiness sectors cannot compete on international markets, with the exception of pyrethrum, which is a successful example of how Rwanda can export high value crops to countries like the United States. As the product space analysis reveals - and we should note here again that this by no means a way of picking winners of products that Rwanda should export in the future – there are many high value crops that Rwanda could in theory have the capacity to export, including essential oils, vegetable extracts, fruits and nuts, spices and potentially even flowers. Actively seeking investment opportunities with regional and international investors in high value crops with high potential should be an important priority for policy makers. A number of experiments with macadamia nuts, soybeans, mushrooms, avocadoes, essential oils are already underway, but remain marginal at this point in time.

4. Large firms are the key to exports growth in the short term; attracting investment from large regional and international groups is Rwanda's best chance to increase exports in the short term. Recent research[36] indicates that small firms in Rwanda (<US$5m in annual turnover) face binding constraints that larger firms are able to overcome. Large firms that are part of larger groups are able to attract and afford high skilled technicians and managers, invest in the best machinery available, overcome supply constraints by leveraging sister companies or pooling supplies across companies in the region, and benefit from economies of scale. With large internal resources, large firms also do not face the same constraints in accessing finance. Rwanda has had some success in recent years in attracting regional and international investment in the manufacturing and agribusiness sectors (with companies such as Pembe Flour, ICM Rwanda Agribusiness, Bakhresa Grain Mills, Safintra, Steelrwa, etc), but strengthening this trend will be the key to increasing Rwanda's exports performance.

[36] Gathani and Stoelinga, *Understanding Rwanda's Manufacturing and Agribusiness Sectors*, The International Growth Center, Conference Version, July 2012

Annex 1: Data

This study is based on five sets of data sources: (i) Rwanda Revenue Authority (RRA) data on detailed firm-level imports and exports (2001-2011), corporate and personal annual income tax (2008-2010), Pay-As-You-Earn (2008-2011) and a taxpayers roster (detailing firm location and sector of operation); (ii) Comtrade data on Rwandan exports between 1996-2010; (iii) 2007 BACI data on global exports which we used to compute product space statistics (see the section on product discovery for more details)[37]; (iv) 43 interviews with the CEOs of Rwanda's largest manufacturing and agribusiness firms conducted by Laterite Ltd.[38]; and (v) World Development Indicators (World Bank) for certain macroeconomic indicators of interest.

The main dataset we use throughout this study is RRA's firm-level exports data, which covers all exports between 2001 and June 2011 at a high level of disaggregation. Each entry corresponds to the export of a certain product (identified at the HS8 level), on a certain date, by a certain firm (identified by a TIN number), to a certain destination, and for a certain value (expressed in RWF freight-on-board). We only look at product exports classified as "direct exports", as opposed to "re-exports", which limits our data-set to the 2005-2011 period – this distinction is not available in the data before 2005. For any analysis covering longer periods of time we use Comtrade data, which by and large matches official RRA data, but at the expense of firm-level information (Comtrade data covers exports and the product and destination dimensions, but does not include information on exporting firms). Export snap-shots provided in the paper focus on the most recent year of complete data available, 2010.

While the quality of the exports data post-2005 is good, we have identified some significant errors and misclassifications that we have tried to the extent possible to correct. Suspected errors include:

- The misclassification of some exports to Switzerland (for which the iso2 identifier is "CH") as exports to Swaziland (for which the iso2 code is "SW"), which made Swaziland one of Rwanda's largest export destinations. We suspect this is an error because the largest export product to Swaziland in 2010 was coffee, and we know for a fact that no Rwandan coffee exporter exports to Swaziland, whereas Switzerland is the largest destination for Rwandan coffee. In the paper, we therefore re-assign Rwanda's exports to Swaziland as exports to Switzerland, given that Rwanda's exports to Swaziland should in theory be negligible.

- Many exports have mistakenly been classified as direct exports, while they are in fact re-exports. These include the re-exports of machinery, automobiles, engines, fuel, spare-parts, etc. These misclassifications create a lot of noise in the exports statistics, and in particular lead to overstating official exports to neighboring EAC countries and the Democratic Republic of Congo. While the size of the dataset has made it impossible to eliminate all the noise, we have eliminated certain entries based on a number of filters: a product filter, to eliminate evident re-exports; and an activities filter, to eliminate firms that we strongly suspect re-export (for examples garages, petroleum companies, government institutions, etc).

- Another item, which is not an error per se, but has a significant impact on balance of trade calculations with neighboring EAC countries is the assignment of tea exports that transit through the tea auction in Mombasa on to other global destinations, as exports to Kenya. This is not

[37] The BACI database is a world trade database developed by CEPII at a high level of product disaggregation. BACI is developed using a procedure that reconciles the declarations of the exporter and the importer, based on original data provided by the United Nations Statistical Division (COMTRADE database). BACI provides bilateral values and quantities of exports at the HS 6-digit product disaggregation, for more than 200 countries.

[38] Gathani and Stoelinga, *Understanding Rwanda's Manufacturing and Agribusiness Sectors*, The International Growth Center, Conference Version, July 2012

insignificant as tea exports assigned to Kenya account for about 14% of Rwanda's total exports of goods and almost 90% of exports to Kenya, making Kenya one of Rwanda's largest trading partners, when in fact trade with Kenya is significantly smaller. We find the same issue with exports to Switzerland, which is more of a commodity-trading hub than a direct consumer of Rwanda's coffee and minerals in particular.

We have also adjusted tea exports to match the National Bank of Rwanda estimates, by revising the price of tea exports upwards to reflect export prices at the Mombasa auction. When tea transits to Kenya en route to the Mombasa auction it is registered in the official exports data at a given price. This price is then revised to include the final selling price in Mombasa by the National Bank of Rwanda. We have adjusted tea prices each year by multiplying all tea exports by a given factor. This does not enable us to make any distinctions at the firm level, but it does not matter as the firm-level analysis presented in this paper is not affected.

To calculate firm-level productivity we combined 2008-2010 RRA data on firm-level exports, income tax, employment and wages[39], using firm TIN numbers as the unique identifier. The resulting dataset contains information on annual firm exports, imports, sales, expenses, input costs, employment, average wages, capital (including land, buildings and machinery), location, legal status, and sector of operation. While the level of detail of this dataset is exceptional, there are nevertheless significant shortcomings that have limited our ability to conduct regression analysis: (i) many observations were lost in the process of merging these RRA datasets as the required information was not available for all firms; (ii) in many cases the sector of activity of firms has been misclassified; and (iii) noise in the exports data, makes it difficult to distinguish between real exporters and firms that are simply re-exporting machinery, used cars, equipment, etc..

The data sources used at various stages of the analysis are highlighted and referenced.

[39] Average annual employment levels and wages were derived from the Pay-As-You-Earn dataset, which accounts for monthly firm-level employment and wage figures.

References

Ana Fernandes, Alberto Isgut, *Learning-by-exporting effects: are they for real?*, March 2008

Andres Zahler, *Decomposing world export growth and the relevance of new destinations* ,MPRA Paper No. 30295, posted 14. April 2011

Andres Zahler, *Essays on Export Dynamics*, Harvard University, 2011

Arne Bigsten, Mulu Gebreeyesus, *Firm Productivity and Exports: Evidence from Ethiopian manufacturing*, WORKING PAPERS IN ECONOMICS, No 303, April 2008

Arne Bigsten, Paul Collier, Stefan Dercon, Marcel Fachamps, Bernard Gauthier, Jan Willem Gunning, Abena Oduro, Remco Oostendorp, Catherine Pattillo, Mans Soderbom, Francis Teal, Albert Zeuf, "*Do African manufacturing firms learn from exporting?*," Development and Comp Systems 0409071, EconWPA, 2004

Aw, Bee Yan, Sakkyun Chung and Mark J. Roberts, *Productivity and Turnover in the Export Market: Micro-Level Evidence from the Republic of Korea and Taiwan* (China), World Bank Economic Review, 14, 65–90, 2000
C. A. Hidalgo, B. Klinger, Barabasi, R. Hausmann, *The Product Space Conditions the Development of Nations*, Quantitative Finance Papers 0708.2090, arXiv.org. 2007

Brenton and Newfarmer, *Watching More than the discovery channel: export cycles and diversification in development*, World Bank Group, Policy Research Working Paper no4302, August 2007

Céline Carrère, Vanessa Strauss-Kahn & Olivier Cadot, *Trade Diversification: Drivers and Impacts*, March 2011

Cesar A. Hidalgo & Ricardo Hausmann, *The Building Blocks of Economic Complexity*, Quantitative Finance Papers 0909.3890, arXiv.org, 2009

Dany Bahar, Ricardo Hausmann, Cesar Hidalgo, *International Knowledge Diffusion and the Comparative Advantage of Nations*, CID Working Paper, No 235, 2012

Dany Bahar, Ricardo Hausmann, Cesar Hidalgo**,** *The Structure and Dynamics of The Network of Export Similarity*, PNAS, 2012

David Greenaway & Joakim Gullstrand & Richard Kneller, *Live or Let Die? Alternative Routes to Industry Exit*, Open Economies Review, Springer, vol. 20(3), pages 317-337, July 2009

De Loecker, Jan, *A Note on Detecting Learning by Exporting*, CEPR Discussion Papers 8121, C.E.P.R. Discussion Papers, 2010

Elhanan Helpman, Marc Melitz, Yona Rubinstein, *Trading Partners and Trading Volumes*, DEGIT Conference Papersc011_022, DEGIT, Dynamics, Economic Growth, and International Trade, 2006

Gathani et Stoelinga, *Understanding Rwanda's Agribusiness & Manufacturing Sectors*, The International Growth Centre, Conference Version, June 2012

International Finance Corporation, *Discussion Paper: Options for reforming Rwanda's greenleaf pricing mechanism to increase industry output and farmers' incomes*, 2012

Jan De Loecker, *Do Exports Generate Higher Productivity? Evidence from Slovenia*, LICOS Discussion Papers 15104, LICOS - Centre for Institutions and Economic Performance, K.U.Leuven, 2004

Jonathan Eaton, Marcela Eslava, Maurice Kugler & James Tybout, *Export Dynamics in Colombia: Transactions Level Evidence*, Borradores de Economia 522, Banco de la Republica de Colombia, 2008

Jonathan Eaton, Samuel Kortum, Francis Kramarz, *Dissecting Trade: Firms, Industries, and Export Destinations*, American Economic Review, American Economic Association, vol. 94(2), pages 150-154, May, 2004

Joze P. Damijan, Marko Glaznar, Janez Prasnikar, Saso Polanec, *Export vs. FDI Behavior of Heterogenous Firms in Heterogenous Markets: Evidence from Sovenia*, LICOS Discussion Papers 14704, LICOS - Centre for Institutions and Economic Performance, K.U.Leuven, 2004

Kennet J. Arrow, *The economic implications of learning-by-doing*, The Review of Economic Studies, Vol. 29, No. 3 (Jun., 1962), pp. 155-173

Kent Eliasson, Pär Hansson, Markus Lindvert, *Do Firms Learn by Exporting or Learn to Export? Evidence from Small and Medium Sized Enterprises(SMEs) in Swedish Manufacturing*, August 2009

Martijn Adriaan Boermans, *Learning-by-Exporting and Destination Effects: Evidence from African SMEs*, 12th European Trade Study Group (ETSG) Annual Conference Proceedings, HEC Lausanne, 2010

Martin Andersson & Hans Loof, *Learning-by-Exporting Revisited: The Role of Intensity and Persistence*, Scandinavian Journal of Economics, Wiley Blackwell, vol. 111(4), pages 893-916, December 2009

Mats Granér, Anders Isaksson , *Firm Efficiency and the Destination of Exports: Evidence from Kenyan Plant-level Data*, 2007

Miguel Delgado, Jose Farinas, Sonia Ruano, *Firm Productivity and export markets: a non-parametric approach*, Journal of International Economics, June 2001

Pedro Martins & Yong Yang, 2009. *The impact of exporting on firm productivity: a meta-analysis of the learning-by-exporting hypothesis*, Review of World Economics (Weltwirtschaftliches Archiv), Springer, vol. 145(3), pages 431-445, October.

Pedro S. Martins & Yong Yang, *The Impact of Exporting on Firm Productivity: A Meta-Analysis*, Working Papers 6, Queen Mary, University of London, School of Business and Management, Centre for Globalisation Research, 2007

Ricardo Hausmann, Lant Pritchett, Dani Rodrik, *Growth Accelerations*, Working Paper Series 10566, National Bureau of Economic Research, June 2004

Ricardo Hausmann, César Hidalgo, *Country Diversification, Product Ubiquity, and Economic Divergence*, Working Paper Series rwp10-045, Harvard University, John F. Kennedy School of Government, 2010

Ricardo Hausmann, César Hidalgo, *The network structure of economic output*, Journal of Economic Growth, Springer, vol. 16(4), pages 309-342, December 2011

Sofronis K. Clerides, Saul Lach, James R. Tybout, *Is Learning By Exporting Important? Micro-Dynamic Evidence From Colombia, Mexico, And Morocco*, The Quarterly Journal of Economics, MIT Press, vol. 113(3), pages 903-947, August 1998

Taye Mengistae, Catherine Pattillo, *Export Orientation and Productivity in Sub-Saharan Africa*, IMF Staff Papers 51, 327-353, 2004

Van Biesebroeck, Johannes, *Exporting raises productivity in sub-Saharan African manufacturing firms*, Journal of International Economics, Elsevier, vol. 67(2), pages 373-391, December 2005

Wolfgang Keller, *International Technology Diffusion*, Journal of Economic Littérature, Vol. XLII (September 2004) pp. 752–782