

INTERNATIONAL TRADE

Export innovation of SMEs through the extensive margin in Latin America

Hyunju Park
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Foreign Affairs

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Abstract

In Latin America and the Caribbean, there is little direct evidence on export innovation of small and medium-sized enterprises in (SMEs). This type of innovation refers to the adaptation of products and business processes to technical standards, tastes and other customer requirements in the target markets. The successful fulfillment of these requirements by a firm can be measured indirectly through the sale of a new product to an existing market, the entry of an existing product to a new destination, or both. These movements can be measured using firm-level customs data, as is done in this study for Chile, Colombia, Costa Rica, and Mexico for the period 2000 to 2015.

The results confirm the well-known fact that a high share of SMEs enter and leave the universe of exporting firms each year. Among the four countries, exporting SMEs in Costa Rica had the lowest entry and exit rates and the highest survival rates. On average, SMEs in Costa Rica and Mexico incorporated more new products into their export basket than those in Chile and Colombia. This is because SMEs in the latter two countries exported mostly natural resources concentrated in few products, while SMEs in the former two countries were selling a relatively more diversified basket of manufactures. Within the sample, Costa Rica was the country where exporting SMEs added more destinations to their export basket each year. In contrast, Mexico was the one where SMEs added the smallest number of new destinations (less than one) on average, due to their great dependence on the United States as an export market.

Export innovation is also analyzed with respect to the three dimensions (firms, products, and markets) simultaneously. For this purpose, the change in export value of each firm during this period is broken down into two parts. The first is the intensive margin, which refers to the change in export value of the same firms selling the same products to the same destinations. The second is the extensive margin, which has two components: (i) the extensive margin of entry (which reveals export innovation), including new combinations of companies, products and target markets, and (ii) the extensive margin of exit, referring to combinations of companies, products and destination markets that cease to exist. In all countries except Costa Rica, the extensive margin contributed proportionately more to the growth of exports of SMEs than to that of large companies. In Chile and Colombia, export innovation was concentrated in selling existing products to new markets. In contrast, in Costa Rica and Mexico the export of new products to established destinations was the predominant type of export innovation.

Introduction

For SMEs in Latin America, few surveys exist on export innovation, which refers to changes of products and business processes required by consumers in destination markets. These adaptations have three dimensions: compliance with certification and norms, adaptation of products to the preferences of clients, and identification of distribution channels. Indirect evidence can be collected by looking at the “revealed” export innovation performance of a firm through its sale of a new product to an existing market, the entry of an existing product to a new destination, or both. These new combinations of products and markets show that a company was successful in complying with the customer and market requirements.

This paper analyzes this “revealed” export innovation performance using firm-level customs data in the selected Latin American countries between 2000 and 2015. These data are used to study three dimensions of export innovations in terms of new combinations of firms, products, and destinations. These four countries have different types of export specializations: natural resources in the cases of Chile and Colombia, manufacturing in the case of Mexico, and a mix of both in the case of Costa Rica. In this sense, the extensive margin contributes to the diversification of exports.

The selected countries in Latin America show significant differences in their economies and export patterns. Chile is a high-income country, whereas the other three are middle-income economies. The size of their economies and populations strongly differs, which is also reflected in the value of their exports: USD 9.8 billion in Costa Rica, USD 30.2 billion in Colombia, USD 58.5 billion in Chile, and USD 373 billion in Mexico in 2016 (United Nations, 2017).

The composition of the export baskets also varies among the selected countries. Chile and Colombia are highly specialized in exporting few natural resources. In Chile, the top exports were copper ore, refined copper, sulfate chemical wood pulp, fish fillets, and wine. Copper and copper-related products accounted for almost 50 percent of total exports in 2015 (MIT, 2017). In Colombia, top exports of Colombia were crude petroleum, coal briquettes, coffee, refined petroleum and cut flowers, with mineral products representing 53 percent of total exports in 2015 (MIT, 2017).

As the extraction and production of petroleum and minerals is highly capital intensive, exports in Chile and Colombia are dominated by a few large companies. In Chile, the largest exporter (accounting for 15 percent of the total exports in 2015) is the state-owned company Codelco, which produces copper. Large companies also dominate exports of other minerals such as iron, zinc, and coal. In other processed

natural resource sectors, exports are also dominated by few companies. For example, in the wood, pulp and paper industry, exports are concentrated in two companies: Celulosa Arauco y Constitución and CMPC Celulosa S.A. (Meersohn, 2016). In Colombia, the main export items are petroleum oil and its derivatives, which are extracted and sold abroad also by few domestic and foreign multinational companies.

In contrast, the export baskets of Mexico and Costa Rica are much more diversified than those of Chile and Colombia. Mexico's exports include many manufacturing products such as cars, trucks, vehicle parts, computers, and telephones. Mexico's top exporting companies are: Volkswagen de México and Nemak (exporting motor vehicles, engines, and components and parts); América Móvil (telecommunication products); Grupo México (metallic and non-metallic ores and multimodal freight railroad); and Alfa (manufactured goods) (Alatorre, 2015). Costa Rica also had a diversified export basket, including manufactured goods such as microchips until 2015 and other electronic and medical devices produced mainly by subsidiaries of multinational companies, as well as agricultural products such as bananas, coffee, and pineapples. The main exporters were St. Jude Medical Costa Rica Ltda., Agricultural Development Corporation of Monte SA, Coca Cola Industrias Ltda., Hospira of Costa Rica Ltda., and Boston Scientific of Costa Rica SRL (Procomer, 2016).

The four countries also show different export trends between 2000 and 2015 (see figure). First, Chile and Colombia showed much faster growth in the value of exports than Costa Rica or Mexico (see Panel A). However, this mostly reflects the price increase of the main export commodities of the former two countries particularly coal, copper and oil. The stagnation of Chile and Colombia's export value after 2011 can be mostly attributed to the price drops of these products. In contrast, the value of exports of Costa Rica and Mexico grew more slowly but more steadily, as these are concentrated in manufactures, which prices fluctuated little over time. Trends in export volumes are more synchronized across all four countries, except for Chile after 2010 (see Panel B). This country's export volume suffered from the financial crisis in 2009, followed by a recovery in 2010 and stagnation afterwards.

Different trade specializations of the two groups of countries also explain why exports of SMEs and large firms grew faster in Chile and Colombia compared to Costa Rica and Mexico (see Panel C and D). In Chile and Colombia, large firms are more concentrated in commodities than SMEs, which explains the high growth rate of their value of exports. In contrast, in Costa Rica and Mexico, exports by large firms grew only slightly faster than those of SMEs.

The concentration of export markets shows the opposite between the two groups of countries: Chile and Colombia have more diversified export markets than Mexico and to a lesser degree Costa Rica, which mostly export to the United States (see table). This country is a significant partner for all four countries, but it is clearly more so for Mexico, exporting approximately 80 percent to its northern neighbor (United Nations 2017). This reflects its strong integration into US production networks facilitated by the North American Free Trade Agreement (NAFTA). Costa Rican exports are moderately concentrated across partners, selling about 40 percent of its total to the United States and over 70 percent to North and Central America (United Nations, 2017). In contrast, Colombia's and Chile's exports to United States represented only 34 and 14 percent, respectively, of total export in 2015. In the case of Chile, its exports are more concentrated in China and the rest of East Asia, representing about than half of the total (United Nations 2017).

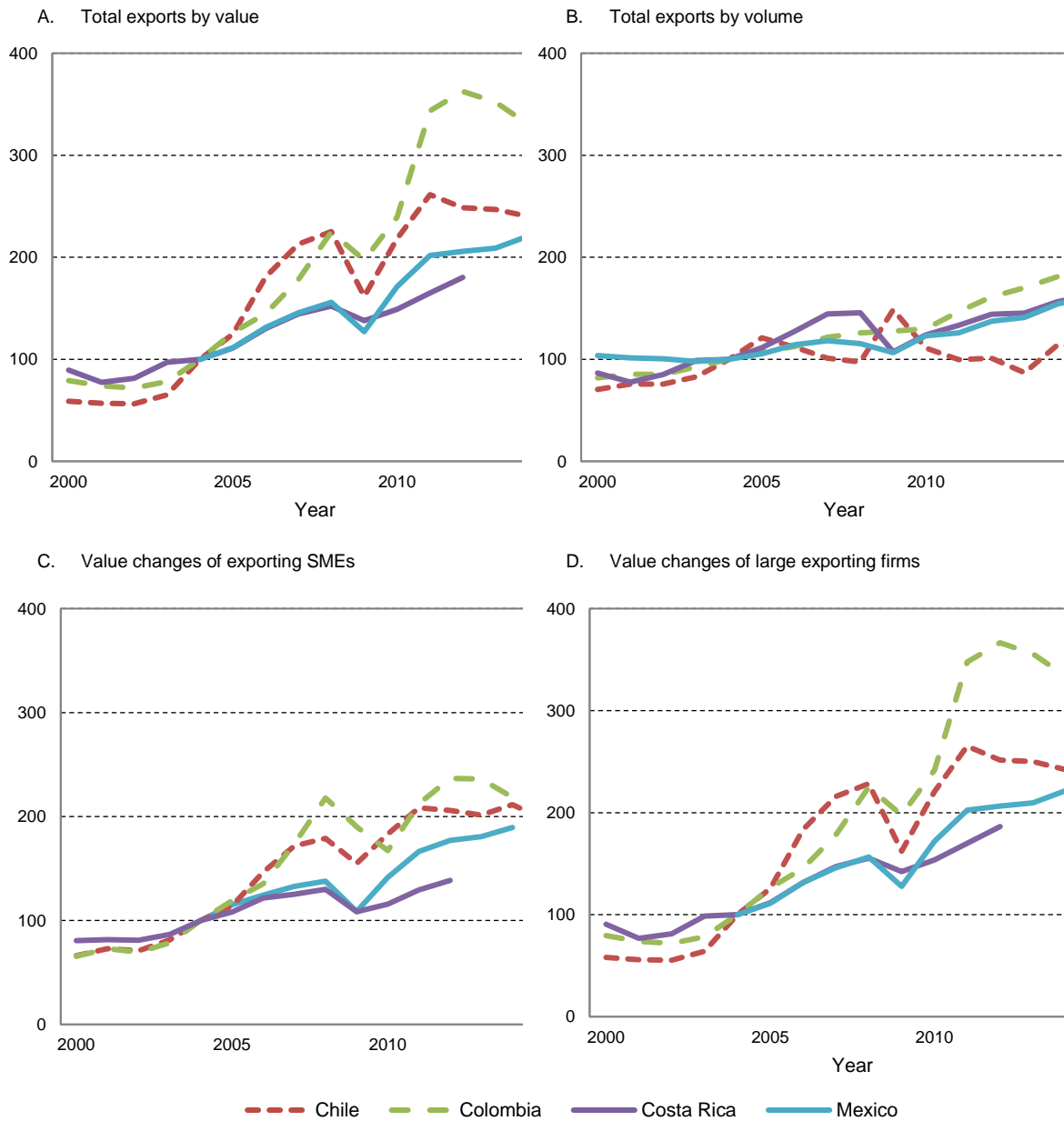
The paper is organized as follows. After the introduction, section I presents a short review of the literature on intensive and extensive trade margins and their use as a proxy of export innovation. Section II presents the decomposition method of export growth into different components of the intensive and extensive margins used in this study, together with the data used. Section III analyzes three separate dimensions of export innovation by firm, product and destination. Section IV presents the joint decomposition into all three dimensions simultaneously, followed by some conclusions and avenues for future research in the final section.

Table
Latin America (selected countries): characteristics of goods exports, 2016

| | Chile | Colombia | Costa Rica | Mexico |
|---|---|---|--|---|
| GDP (billion USD) | 247 | 282 | 57.4 | 1046.92 |
| Goods exports (Billion USD) | 58.5 | 30.2 | 9.8 | 373 |
| Rank among exporting countries | 35 | 45 | 67 | 13 |
| Main export products | Copper ore, refined copper, sulfate chemical wood pulp, fish filets, and wine | Crude petroleum, coal briquettes, coffee, refined petroleum, and cut flowers | Medical instruments, bananas, tropical fruits, orthopedic appliances, and other edible preparations | Cars, vehicle parts, delivery trucks, computers, and telephones |
| Main export markets (Billion USD) | China (17.1), United States (8.4), Japan (5.2), South Korea (4.1), Brazil (3.0) | United States (10.2), Panama (1.91), the Netherlands (1.2), Ecuador (1.2), Spain (1.16) | United States (4.1), the Netherlands (0.6), Panama (0.6), Belgium (0.5), Nicaragua (0.5) | United States (30.2), Canada (10.4), China (5.4), Germany (4.0), Japan (3.8) |
| Level of concentration of export products | Concentrated | Concentrated | Diversified | Diversified |
| Level of concentration of export destinations | Diversified | Diversified | Moderately concentrated | Highly concentrated |
| Average annual growth rate of export value over last 5 years (Percentage) | -5.0 | -13.6 | 3.5 | -1.8 |
| Largest exporting companies | Codeco Chile, Minera Escondida, Anglo American Sur, Minera Los Pelambres, Com. Metalúrgico Alto Norte, Minera Doña Inés de Collahuasi, Celulosa Arauco y Constitución, Minera Centinela, Minera Spence, CMPC Celulosa | Polipropileno del Caribe, Sociedad de Fabricación de Automotores, Mexichem Resinas Colombia, Bayer, Colombiana, Dow Agrosciences de Colombia, C.I. de Azucares y Mieles, Colombiana Kimberly Colpapel, C.I. Biocosta, C.I. Acepalma | St. Jude Medical Costa Rica, Agricultural Development Corporation of Monte, Coca Cola Industrias, Hospira of Costa Rica, Boston Scientific of Costa Rica | Cemex, Volkswagen de México, América Móvil, Grupo México, Nemak, Alfa, Petróleos Mexicanos, Industrias Peñoles, Gruma, Mexichem |

Sources: Elaborated by the authors based on Alatorre, Gerardo Esquivel (2015), "Ranking: las 100 exportadoras más importantes de México [Ranking: top 100 exporters of Mexico]", Mundo Ejecutivo, May, digital.virtuallibertechnologies.com.mx/510193-mayo-2015/39 [accessed on 6 February 2018]; Dinero (2016), "Ranking de las 200 mayores exportadoras de Colombia [Ranking of top 200 exporters of Colombia]", Dinero, 13 October, www.dinero.com/edicion-impresa/informe-especial/articulo/ranking-de-las-200-mayores-exportadoras-de-colombia/234942 [accessed on 6 Feb 2018]; MIT (Massachusetts Institute of Technology) (2017), "The Observatory of Economic Complexity" [online database] <http://atlas.media.mit.edu/> [accessed on 23 May 2017]; Procomer (Promotora del Comercio Exterior de Costa Rica) (2016), "Estadísticas de comercio exterior de Costa Rica 2016" [online] https://procomer.com/es/estudios/anuario_estadistico_2017 [accessed on 6 February 2018]; and United Nations (2017), Statistical Database on Commodity Trade (COMTRADE) [online] [accessed on 23 May 2017].

Figure
Latin America (selected countries): export value by all firms, exporting SMEs and large firms, 2000-2015
(Index 2004=100)



Sources: Elaborated by the authors based on transaction-level customs data of these four countries; and Economic Commission for Latin America and the Caribbean, "Databases and Statistical Publications," <http://estadisticas.cepal.org> [accessed on 16 May 2017].

I. Short literature review

From the late 1960s onwards, several theoretical and empirical studies have tried to explain the growth of exports using the concepts of the intensive and extensive margins of exports. These studies adopted multiple definitions of the intensive and extensive margins. In general, the intensive margin refers to the growth of exports of permanent combinations of countries, firms, products and/or markets, while the extensive margin refers to export growth related to new combinations of these variables.

Early trade models explained export growth by either the intensive or extensive margin. Armington (1969) assumes that all countries produce and export a single product variety. Exports can only grow by selling more of the same product, which is the intensive margin. In contrast, Krugman (1981)'s model assumes that the number of product varieties for exports depends directly on the per capita income of countries. He also assumes that all countries export the same quantity per variety. Therefore, all export growth originates from the extensive margin. More recently, Melitz (2003) developed the so-called the "new-new" trade theory incorporating firm heterogeneity and fixed costs of exporting into existing trade theories such as Krugman (1980 and 1981). In his works, firms start to export as they become more productive, as part of the extensive margin.

Since Melitz (2003), other studies have been developed to analyze which firms enter the export market and how they grow using slightly different concepts of the intensive and extensive margins. Hummels and Klenow (2005) define the extensive margin as the increase in the share of the export basket of goods of a country in world trade. Brenton and Newfarmer (2007) define the extensive margin as the sum of either a new product or destination and the intensive margin as the change in existing products to current destination. Felbermayr and Kohler (2006) focuses these concepts on countries, with the extensive margin being trade emerging from a newly established bilateral trade relationship, in contrast to changes in trade within existing bilateral trade ties (the intensive margin). Chaney (2008) focuses on firms and defines the extensive margin as firms that enter the export universe, whereas change in the value of sales abroad by continuous exporters refers to the intensive margin. Helpman et al. (2008) focus on number of exporters (the extensive margin) and trade value per exporter (the intensive margin). Cadot et al. (2011) and Reis and Farole (2012) use similar concepts.

Based on the reviewed studies, the extensive margin is a more refined concept than diversification. At the macro level, export diversification can be expressed by the Herfindahl, Gini or

Theil indices (Cadot et al., 2011; Reis and Farole, 2012). At the micro level, diversification refers to decisions about the introduction of something new (firm, product, or destination) in exports (Cirera et al., 2015). Diversification can be found at the intensive margin as well as in the extensive margin in each dimension. For example, a firm can diversify the range of cars it produces. This kind of diversification cannot be identified at the 6-digit level of the Harmonized System, but it is a diversification within the intensive margin. In this context, the extensive margin is a sub-concept of diversification.

The contribution of each margin to export growth has been assessed by several studies:

- Evenett and Venables (2002) examined intensive and extensive margins related to export destinations of 23 developing countries from 1970 to 1997. They found that the intensive margin contributed about 60 percent to export growth.
- Brenton and Newfarmer (2007) did a similar analysis for 99 countries from 1995 to 2004. They found that the intensive margin was the most important in all regions and income groups, except in Africa. In Latin America and the Caribbean, the intensive margin contributed 75 percent and the extensive margin 25 percent to export growth.
- In general, the contribution of the extensive margin cannot be large, since trading values of exports of new products and new destinations are mostly small (Cadot et al., 2011).
- Lederman et al. (2011) examine entry and exit patterns of export firms in Costa Rica from 1997 to 2007. They conclude that firms that enter have a very high probability to exit the market after the first year. Once they survive, they stay in the market for a long time.
- Fernandes et al. (2013) examined the export margins of 11 Latin American countries (Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, El Salvador, Guatemala, Mexico, Nicaragua, and Peru) from 2005 to 2009. The study presents the rates of entry, exit, and survival of firms in addition to the contribution to export growth made by entrants, incumbents, and leavers in each dimension of firm, product, and destination. The results resemble those of Lederman et al. (2011): entry and exit rates are about one third, while about a half of entrants exit the market in the first year. They also find that the size of entrants was smaller than that of the incumbents, especially in natural-resource abundant countries.
- Based on their analysis of Colombia exports from 1996 to 2005, Eaton et al. (2007) show that many new firms start selling abroad each year but these firms represent only a small share of total exports and show a high failure rate in the first year.
- These results coincide with those of Besedeš and Prusa (2006), using import data of the United States, who confirm that a firm's survival in the first year reduces the probability of exit in later years.
- Although its contribution to export growth is generally small, its importance should not be underestimated. This is because a large part of the trade adjustment is concentrated in the extensive margin (Helpman et al., 2008).

Several studies have analyzed the determinants of the extensive margin (Arkolakis et al., 2016; Besedeš and Prusa, 2011; Chaney, 2008; Evenett and Venables, 2002; Helpman et al., 2008; Hummels and Klenow, 2005; and Silva et al., 2014).¹ Among these studies, Chaney (2008) finds that the extensive margin is sensitive to trade barriers when products of new entrants are highly differentiated whereas the extensive margin is not affected much by trade barriers when products of new firms could be easily substituted. Other determinants of the extensive margin in bilateral trade flows are the distance between trade partners, joint borders, geographic condition (island, landlocked), colonial tie, common currency, common regional trade agreement, common language, WTO membership, and religion.

¹ Although they do not use the terms “intensive” and “extensive margins”, Evenett and Venables (2002) decompose bilateral export growth of 23 developing countries by products and destinations.

The extensive margin is indirect evidence of export innovation at the firm level. Export innovation can be defined as changes introduced into products or production processes by firms in response to demands of export markets. These demands refer to acquiring certification and norms, adapting products to clients, and finding new distribution channels (Frohmann et al., 2016, 41). This definition is based on the Oslo Manual, which states that “an innovation is the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organizational method in business practices, workplace organization or external relations” (OECD, 2005, 46). This definition of innovation broadens the traditional meaning of innovation, which only referred to technological products and processes.

The introduction of new products and/or new destinations by firms provides indirect proof that firms have been successful in introducing new innovations related to product standards, consumer tastes and distribution networks. Products here are defined as tariff lines of the Harmonized System. This meaning of export innovation is consistent with the definition of the extensive margin in Brenton and Newfarmer (2007). Export innovation is a sub-concept of the extensive margin as it refers the extensive margin of entry of new combinations of firms, products and destinations. Some authors refer to export entrepreneurship (Cadot et al., 2011; Fernandes et al., 2013; Freund and Pierola, 2010; Lederman et al., 2011).² In addition to the extensive margin of entry, there is also the extensive margin of exit. The latter refers to disappearing combinations of firms, products and destinations. The “total” extensive margin or simply extensive margin is the net result of entry and exit.

² Hausmann and Rodrik (2003) separate entrepreneurship from diversification.

II. Methodology and data

This study decomposes annual changes in the value of exports in terms of continuing, new or disappearing combinations of firms (f), products (p), and destinations (d) using customs data of the selected Latin American countries. Previous studies (Eaton et al., 2007; Fernandes et al., 2013; and Lederman et al., 2011) did similar decomposition exercises but only regarding one dimension such as firms or destination markets. Here the unit of analysis is (f,p,d) . These are compared between t and $t-1$ to identify continuing, new or disappearing combinations. Annual export innovation is shown by new combinations of firms, products or destinations. This can be done for each variable separately or combined. For example, at the firm level, a firm that did not export in year $t-1$, but exports in t , is part of the extensive margin of entry. In contrast, the intensive margin refers to the annual change in export value of a firm that also exported any good in the previous year. The same logic applies to products and destinations.

The change in export value between t and $t-1$ can be decomposed into three components:

- the intensive margin, which is the change in export value of the same combinations of firms, products or destinations.
- the extensive margin, which consists of two parts:
 - extensive margin of entry or export innovation, which refers to the exports of a new combinations of firm, product or destination market;
 - the extensive margin of exit, being exports of combinations of a firm, product and destination that disappeared over time

The extensive and intensive margins can be analyzed combining the three dimensions, which leads to a joint decomposition of changes in export values into eleven components (C1 to C11) as shown in diagram 1. The upper left orange cells are the components of export innovation (i); the lower right blue cells are those of the extensive margin of exit (ii); and the grey cell in the middle is the intensive margin (iii). Components from C2 to C6 refer to the export innovation, representing new combinations of firm, product, and/or destination in year t and compared to $t-1$ as follows:

- A firm starts to export (C2);
- An incumbent firm exports a new product to a new destination (C3);

- An incumbent firm sells a product it already exported in $t-1$ to a new destination (C4);
- An incumbent firm sells a new product to a destination it already exported to in $t-1$ (C5);
- An incumbent firm sells a new combination of product to a destination not present in $t-1$ (C6).

The difference between C2 and other components lies in the fact of whether export innovation occurs at the firm dimension. In other words, C2 represents export innovation of new firms while C3 to C6 refers to innovation by incumbent firms. The same logic applies to the extensive margin of exit where C11 is the exit of firms, whereas C7 to C10 are disappearing combinations of incumbent firms.³ Diagram 2 summarizes export innovation, the intensive margin, and the extensive margin of entry considering each dimension.

Diagram 1
Components of the joint decomposition of the extensive and intensive margins

| | | DESTINATION | | |
|--------------------------|--------------|--|--|--|
| | | New | Continuing | Disappearing |
| PRODUCTS | New | New firm [C2] | New product and continuing destination by incumbent firm [C5] | Previous destination and continuing product by incumbent firm [C9] |
| | | New product and new destination by incumbent firm [C3] | | |
| | Continuing | New destination and continuing product by incumbent firm [C4] | New combination of continuing product and continuing destination by incumbent firm [C6] | |
| | | | Continuing combination by incumbent firm [C1] | |
| | | | Previous combination of continuing product and continuing destination by incumbent firm [C7] | |
| | Disappearing | Previous product and continuing destination by incumbent firm [C8] | Previous product and disappearing destination by incumbent firms [C10] | |
| Disappearing firms [C11] | | | | |

Source: Elaborated by the authors.

Notes: C1 represents the intensive margin; cells from C2 to C6 represent each component of export innovation as a part of the extensive margin of entry, where C2 is export innovation by a new firm and the rest are export innovation by incumbent firms; cells from C7 to C11 represent each component of the extensive margin of exit where C11 is the extensive margin of exit by a disappearing firm and the rest are the extensive margin of exit by continuing firms. The orange and blue cells are mirror images. For example, C11 refers to the exit of same combination of firm, product and destination as the entry in C2.

³ The components of C7 to C10 are expressed as previous combinations instead of disappearing ones. This is because C7 to C10 are not just losses for firms. Although the combinations in C7 to C10 do not exist in the export innovation, they are the base of the export innovation appearing in C3 to C6.

Diagram 2
Intensive margin and extensive margins of entry and exit

| | Extensive margin of entry (export innovation) | Intensive Margin | Extensive margin of exit |
|--|---|--|--|
| Margin related to firm-product-destination | New combinations of product or destination [C2+C3+C4+C5+C6] | Continuing combinations by incumbent firms [C1] | Previous combinations of product or destination [C7+C8+C9+C10+C11] |
| Margin related to products | Combinations including new products [C2+C3+C5] | Combinations including continuing product [C1+C4+C6+C7+C9] | Combinations including disappearing product [C8+C10+C11] |
| Margin related to destinations | Combinations including new destination [C2+C3+C4] | Combinations including continuing destination [C1+C5+C6+C7+C8] | Combinations including disappearing destination [C9+C10+C11] |
| Margin related to firms | New firms [C2] | Combinations by incumbent firm [C1+C3+C4+C5+C6+C7+C8+C9+C10] | Disappearing firms [C11] |

Source: Elaborated by the authors.

Every combination of firm, product and destination in year t can be allocated to one of the cells in the abovementioned decomposition depending on its existence in year $t-1$. As such each combination is grouped under either the extensive or intensive margins, and within the latter as export innovation or the extensive margin of exit. Below the decomposition is presented formally. First, total export growth is split between that of SMEs and large firms:

$$\frac{X_t^n - X_{t-1}^n}{(X_t^n + X_{t-1}^n)/2} = \frac{X_t^{n,S} - X_{t-1}^{n,S}}{(X_t^n + X_{t-1}^n)/2} + \frac{X_t^{n,L} - X_{t-1}^{n,L}}{(X_t^n + X_{t-1}^n)/2} \quad (1)$$

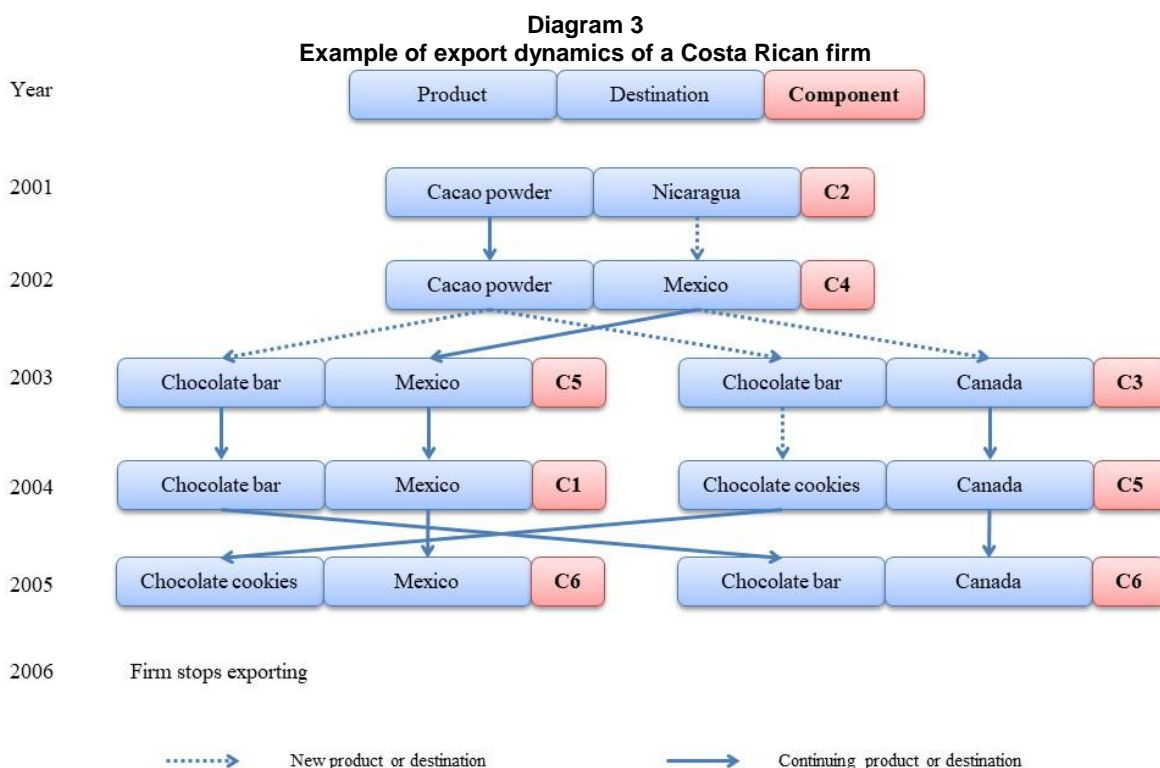
where X_t and $X_{(t-1)}$ are export values in years t and $t-1$, respectively; superscripts S and L refer to SMEs and large firms, respectively; and superscript n indicates the country. The left side shows total export growth between years, while the right-hand side shows export growth of SMEs and large firms. Equation (2) presents the decomposition into eleven components as explained above. The changes in export values are decomposed using a joint decomposition method that considers three dimensions: firm, product, and destination. This formula builds on that of Eaton et al. (2007), which decomposes the extensive margin into two components. The joint decomposition is expressed as follows:

$$\begin{aligned} \frac{X_t^n - X_{t-1}^n}{(X_t^n + X_{t-1}^n)/2} &= \sum_{k \in S, L} \sum_{i \in C_1^k} \frac{[x_{i,t}^n(f, p, d) - x_{i,t-1}^n(f, p, d)]}{(X_t^n + X_{t-1}^n)/2} \\ &+ \sum_{k \in S, L} \sum_{j=2}^6 \frac{\sum_{i \in C_j^k} x_{i,t}^n(f, p, d)}{(X_t^n + X_{t-1}^n)/2} \\ &- \sum_{k \in S, L} \sum_{j=7}^{11} \frac{\sum_{i \in C_j^k} x_{i,t-1}^n(f, p, d)}{(X_t^n + X_{t-1}^n)/2} \end{aligned} \quad (2)$$

where C_j^k stands for each decomposed element appearing in the decomposition matrix where $j \in \{1, 2, \dots, 11\}$ matches to the numbers of the components in figure 2, and the variable $x_{(i,t)}^n(f, p, d)$ refers to export value of firm f with product p to destination d at time t and where subscript i means an observation. The first term on the right hand side is the intensive margin, which equals the growth of the

continuing combinations of firms, products and destinations between time $t-1$ and t . The second term is the export innovation (intensive margin of entry) being new combinations that add to the value exports in time t . The third term is the extensive margin of exit, which refers to disappearing combinations between $t-1$ and t .

A hypothetical example can illustrate the above methodology. Consider a Costa Rican firm that exported cacao powder for the first time in 2001 to Nicaragua. In 2002, it switched markets to Mexico selling the same product. In 2003, the firm exported chocolate bars to Canada and Mexico. In 2004, it exported the same product to Mexico, but changed to chocolate cookies to Canada. In 2005, it switched the combinations of product and destination. Finally, in 2006 the firm stopped exporting (see diagram 3).



Source: Elaborated by the authors.

The example above can illustrate different types of export innovation. In 2001, the entry of the firm to the export universe reveals an export innovation at the firm level. The switch from Nicaragua to Mexico in 2002 and the inclusion of Canada in 2003 are export innovations at the destination market level. The market entry shows that the firm managed to comply with the phytosanitary regulations, adapted its product to the taste of consumers of these markets, and found new distribution channels. The switches from chocolate powder to chocolate bar in Mexico in 2003 and from chocolate bar to chocolate cookies in Canada in 2004 illustrate export innovation at the product level, as the firms succeeded in complying with different regulations, tastes, and distribution channel may apply for these new products.

The continuing exports of cacao powder, chocolate bars, and chocolate cookies in all years except for 2003 illustrate the intensive margin at the product level as these products continue to be exported. Similarly, the continuing exports to Mexico from 2002 to 2005 and to Canada from 2003 to 2005 illustrate the intensive margin at the destination level as the countries continue being export markets.

Export innovation (as a part of the extensive margin) is measured using transaction-level customs data from Latin America (selected countries). These four countries are selected based on data availability covering at least a decade, and because they offer a representative mix of export specializations (natural resources and manufactures) in the region. Table 1 summarizes the sample periods, total number of

exporting firms, products and destinations of the selected countries. Customs registers are restricted to data on exports, and exclude other variables such as sales and employment. However, customs data allow the measurement of the extensive and intensive margins (see Helpman et al., 2008).

The following variables of each transaction are used in this study: firm, year, product, destination market, and export value. The unit of analysis is the combination $(f,p,d)_t$, where f is firm, p is the 6-digit product code of the Harmonized System (HS), d is destination, and t is year (see Cadot et al., 2013). The codes for products and export markets were adapted to facilitate international comparisons. The product codes from national classifications were converted to 6-digit codes of the HS. Although most national classifications use the HS at least up to the 6-digit level, some differ. In these cases, the product descriptions of the national custom authority are used to find the equivalent in the HS. Export markets are classified according to the country classification of United Nations Conference of Trade and Development (UNCTAD) (UNCTAD, 2017).⁴ Export values equal to zero are also eliminated (Fernandes et al., 2013). In Chile and Colombia, domestic sales to free zones or customs warehouses are excluded, while the data of Costa Rica exclude transactions below USD 12,000, which affects the results as commented below.

Table 1
Latin America (selected countries): summary statistics of customs data, 2000-2015
(number)

| | Sample Period | Firms | Products | Destinations |
|------------|---------------|---------|----------|--------------|
| Chile | 2000-15 | 34 584 | 5 367 | 209 |
| Colombia | 2000-14 | 58 308 | 5 328 | 216 |
| Costa Rica | 2000-12 | 6 459 | 4 789 | 203 |
| Mexico | 2004-14 | 128 704 | 5 566 | 227 |

Source: Elaborated by the authors based on transaction-level customs data of these four countries.

Note: Destinations refer to countries and territories as defined by UNCTAD, which identifies 237 countries and territories.

This paper compares the export innovation behavior between SMEs and large firms, which requires a threshold to separate both groups. No national definitions of export thresholds are available, and those for total sales vary too much across countries to be used for international comparisons. Therefore, a standard definition of a threshold is needed to compare nations. A fixed amount of exports is not reasonable as countries with higher levels of productivity also have higher levels of exports per head of population. The definition used here is that of Urmeneta (2016), which is an adjusted version of Gibson and Van der Vaart (2008). They define SMEs as firms with sales below 1,000 times the per capita income level at purchasing power parity, which is a proxy for labor productivity. As data in this paper refer to exports, which is a fraction of sales, Urmeneta (2016) multiplies the previous definition by the export to GDP ratio with the latter being a proxy of sales. This adjustment accounts for the fact that firms in larger economies export a lower share of sales than firms in smaller ones, which should be reflected by a lower threshold of exports. Data on GDP per capita and the ratio of export in GDP are taken from the World Bank's World Development Indicators (World Bank, 2017). The number and share of SMEs and large firms are displayed in table 2.

⁴ Mainland China is separated in the analysis from Hong Kong and Macau. Liechtenstein was included in Switzerland. This study considers seven geographic areas: Africa, Asia, Europe, LAC, North America, Oceania, and Others.

Table 2
Latin America (selected countries): numbers and shares of firms by size, 2000-2015

(Numbers and percentage points)

| | Chile | | | Colombia | | | Costa Rica | | | Mexico | | |
|-------|--------|------------------|------------------|----------|------------------|------------------|------------|-----------------|------------------|---------|-------------------|------------------|
| | Total | SMEs (Share) | Large (Share) | Total | SMEs (Share) | Large (Share) | Nb. | SMEs (Share) | Large (Share) | Total | SMEs (Share) | Large (Share) |
| 2000 | 5 666 | 5 131 (90.6) | 535 (9.4) | 7 472 | 6 090 (81.5) | 1 382 (18.5) | 1 618 | 1 387 (85.7) | 231 (14.3) | - | - | - |
| 2001 | 6 009 | 5 513 (91.8) | 496 (8.3) | 8 592 | 7 016 (81.7) | 1 576 (18.3) | 1 674 | 1 440 (86.0) | 234 (14.0) | - | - | - |
| 2002 | 6 118 | 5 615 (91.8) | 503 (8.2) | 8 973 | 7 475 (83.3) | 1 498 (16.7) | 1 646 | 1 422 (86.4) | 224 (13.6) | - | - | - |
| 2003 | 6 436 | 5 948 (92.4) | 488 (7.6) | 10 008 | 8 522 (85.2) | 1 486 (14.9) | 1 741 | 1 523 (87.5) | 218 (12.5) | - | - | - |
| 2004 | 6 639 | 6 146 (92.6) | 493 (7.4) | 11 362 | 9 838 (86.6) | 1 524 (13.4) | 1 776 | 1 572 (88.5) | 204 (11.5) | 37 414 | 33 542 (89.7) | 3 872 (10.4) |
| 2005 | 6 880 | 6 399 (93.0) | 481 (7.0) | 11 583 | 10 066 (86.9) | 1 517 (13.1) | 1 894 | 1 681 (88.8) | 213 (11.3) | 37 365 | 33 511 (89.7) | 3 854 (10.3) |
| 2006 | 6 973 | 6 521 (93.5) | 452 (6.5) | 11 205 | 9 664 (86.3) | 1 541 (13.8) | 2 018 | 1 803 (89.4) | 215 (10.7) | 36 100 | 32 301 (89.5) | 3 799 (10.5) |
| 2007 | 7 917 | 7 449 (94.1) | 468 (5.9) | 11 218 | 9 560 (85.2) | 1 658 (14.8) | 2 071 | 1 840 (88.9) | 231 (11.2) | 35 930 | 32 107 (89.4) | 3 823 (10.6) |
| 2008 | 8 240 | 7 690 (93.3) | 550 (6.7) | 11 171 | 9 506 (85.1) | 1 665 (14.9) | 2 117 | 1 869 (88.3) | 248 (11.7) | 35 022 | 31 166 (89.0) | 3 856 (11.0) |
| 2009 | 7 517 | 6 967 (92.7) | 550 (7.3) | 10 623 | 9 021 (84.9) | 1 602 (15.1) | 2 035 | 1 788 (87.9) | 247 (12.1) | 33 209 | 29 124 (87.7) | 4 085 (12.3) |
| 2010 | 7 447 | 6 903 (92.7) | 544 (7.3) | 9 399 | 8 178 (87.0) | 1 221 (13.0) | 2 126 | 1 852 (87.1) | 274 (12.9) | 34 364 | 30 222 (88.0) | 4 142 (12.1) |
| 2011 | 7 684 | 7 100 (92.4) | 584 (7.6) | 9 498 | 8 375 (88.2) | 1 123 (11.8) | 2 412 | 2 120 (87.9) | 292 (12.1) | 34 399 | 30 275 (88.0) | 4 124 (12.0) |
| 2012 | 7 462 | 6 878 (92.2) | 584 (7.8) | 9 685 | 8 552 (88.3) | 1 133 (11.7) | 2 504 | 2 221 (88.7) | 283 (11.3) | 34 366 | 30 177 (87.8) | 4 189 (12.2) |
| 2013 | 4 644 | 7 031 (92.0) | 613 (8.0) | 10 021 | 8 896 (88.8) | 1 125 (11.2) | - | - | - | 33 367 | 29 178 (87.5) | 4 189 (12.6) |
| 2014 | 8 195 | 7 605 (92.8) | 590 (7.2) | 10 052 | 8 930 (88.8) | 1 122 (11.2) | - | - | - | 34 206 | 29 956 (87.6) | 4 250 (12.4) |
| 2015 | 8 097 | 7 547 (93.2) | 550 (6.8) | - | - | - | - | - | - | - | - | - |
| Total | 34 584 | 33 892 (98.0) | 692 (2.0) | 58 308 | 55 851 (95.8) | 2 457 (4.2) | 6 459 | 6 173 (95.6) | 286 (4.4) | 128 704 | 123 326 (95.8) | 8 813 (4.2) |

Source: Elaborated by the authors based on transaction-level customs data of these four countries.

Note: Total numbers are unique number of firms during the sample period.

III. Three dimensions of export innovation: firm, product and destination

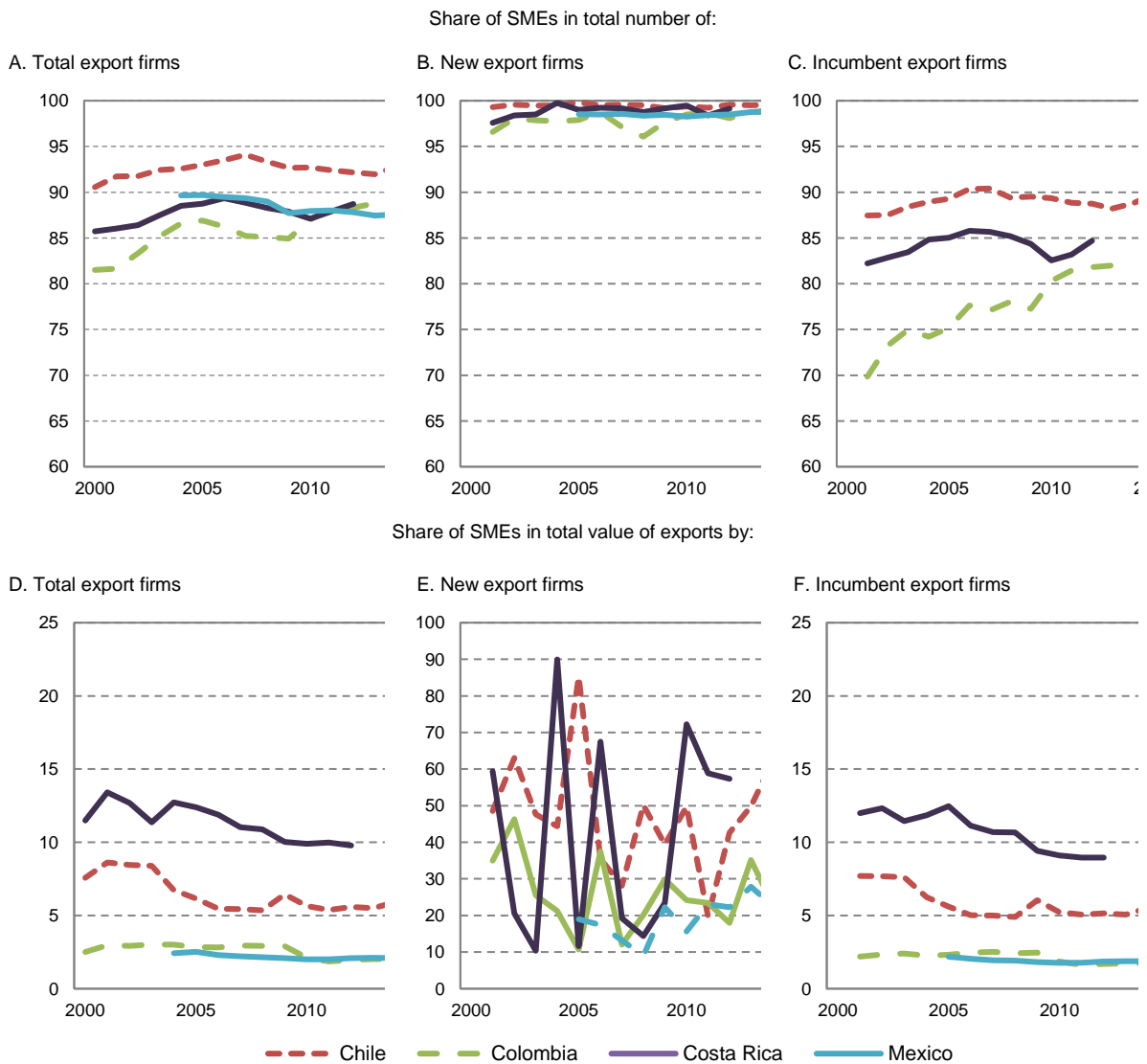
This section analyzes export innovation by looking at three dimensions separately: firms, products, and destinations. For this purpose, transaction-level customs data are consolidated according to each of these dimensions.

A. Firm dimension

Export innovation at the firm dimension is said to take place when a firm enters the export universe for the first time. In the four countries, SMEs accounted for the largest number of new and incumbent exporting firms (Panels A and C of figure 1). Incumbent firms refer to those that also exported in the previous year. However, SMEs accounted for low shares of total exports of total and incumbent firms (Panel D and F of figure 1). This is because exports are concentrated in large firms. Among the four countries, Chile had the highest share of SMEs in the total number of export firms and Costa Rica the highest share of SMEs in exports. In Colombia, SMEs represented the lowest shares of the total number of firms and export value.

SMEs play a relatively important role in export innovation at the firm dimension. This is shown by the much higher shares of SMEs in the total number and export value of new firms (Panels B and E) in comparison to similar shares in the total number and export value of incumbent firms. SME exports in Costa Rica and Chile represented 48 and 42 percent, respectively, on average of the export value of new firms between 2000 and 2015. SME exports in Colombia and Mexico accounted on average for 26 and 19 percent, respectively, of the total export values of new firms.

Figure 1
Latin America (selected countries): share of SMEs in total number
of firms and export values, 2000-2015
(Percentages)

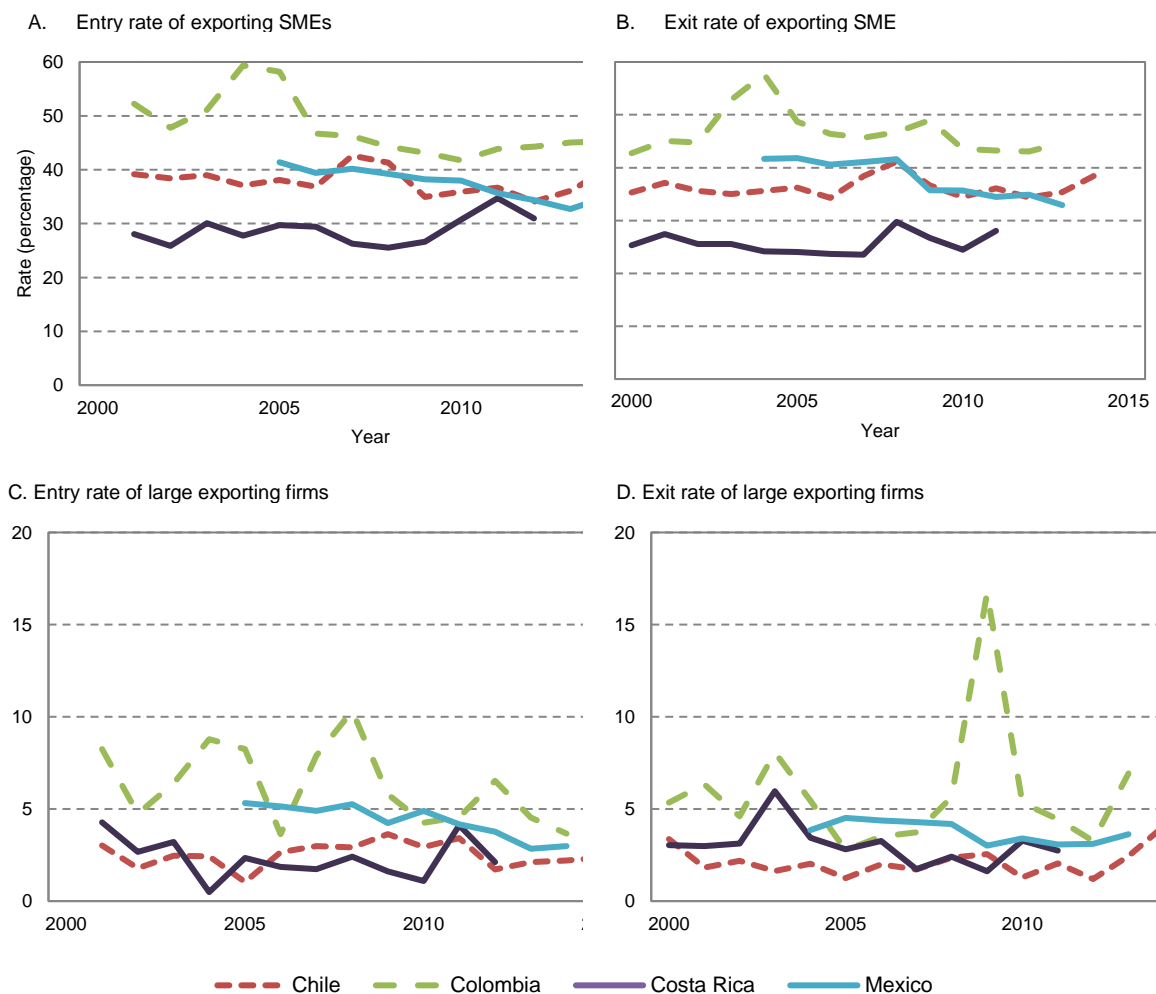


Source: Elaborated by the authors based on transaction-level customs data of these four countries.

In all four countries, exporting SMEs are characterized by high annual entry and exit rates (Panel A and B of figure 2). This means that each year, many SMEs export for the first time while many other SMEs stop exporting. A firm that exported in year t but not in the previous one is considered an entrant firm. In contrast, if a firm exported in year $t-1$ but not in year t is an exit firm. Colombia showed the highest entry and exit rates with about half of all SMEs entering and leaving the export universe every year. In contrast, Costa Rica showed lowest entry and exit rates, between 20 and 30 percent. Chile and Mexico had very similar rates between 30 and 40 percent. High entry and exit rates may reflect difficulties of SMEs to continue exporting, but may also be due to other factors such as fluctuations in

exchange rates and relative prices or demand shocks. Entry and exit rates of large firms were much lower than those of SMEs (below 10 percent), as shown in Panel C and D of figure 2.⁵

Figure 2
Latin America (selected countries): entry and exit rates of exporting SMEs and large firms, 2000-2015
(Percentage points)



Source: Elaborated by the authors based on transaction-level customs data of these four countries.

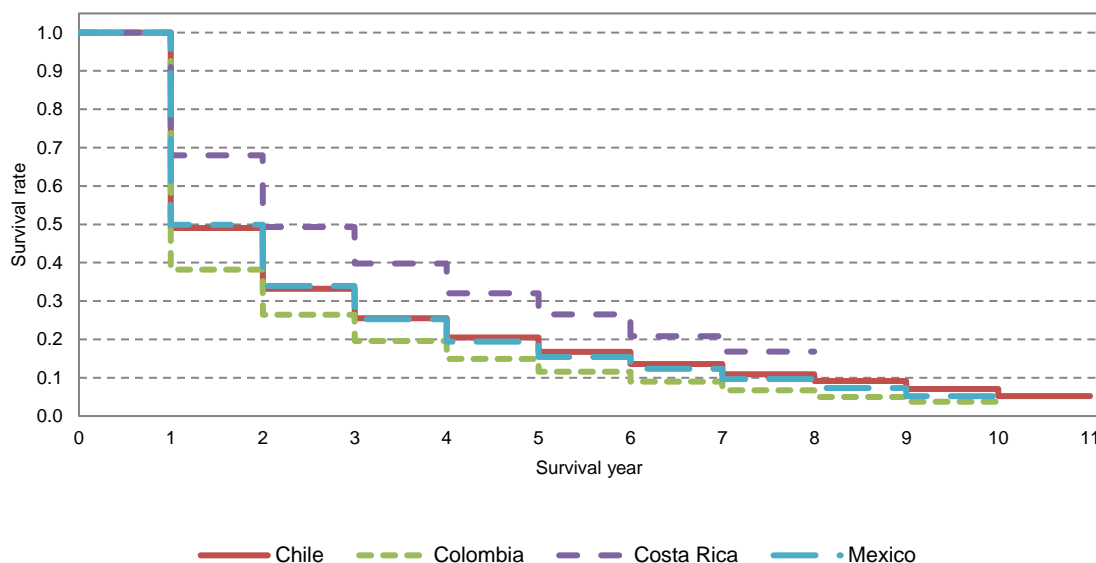
In a context of high entry and exit rates, the question arises about for how long exporting SMEs survive. Using the Kaplan-Meier estimator, survival rates are estimated for SMEs that started to export in 2005 (see figure 3).⁶ This cohort is selected, because data was available only from 2004 onwards for some countries. Costa Rica had the highest survival rate, followed by Chile and Mexico, and Colombia. After one year, between 32 percent (Costa Rica) and 61 percent (Colombia) of exporting SMEs stopped exporting (figure 3). The survival rates after the second and subsequent years improved strongly. Costa Rica showed persistently higher survival rates from the first to the seventh year. Almost 20 percent the 2005 cohort survived throughout 2012. Trends for the 2006, 2007, and 2008 cohorts were very similar.

⁵ These results resemble those of Eaton et al. (2007), Fernandes et al. (2013) and Lederman et al. (2011), which refer to all firms instead of SMEs. As SMEs account for almost all firms, entry and exit rates of total firms are very similar to those of SMEs.

⁶ For more information, see Kaplan and Meier (1958). For its application to international trade at the firm level, see Nicita et al. (2013).

The country order in this figure is opposite that of entry and exit rates presented in figure 3. In other words, survival rates are negatively associated with entry and exit rates.⁷

Figure 3
Latin America (selected countries): survival rates of 2005 cohorts of exporting SMEs
(Rates in numbers)



Source: Elaborated by the authors based on transaction-level customs data of these four countries.

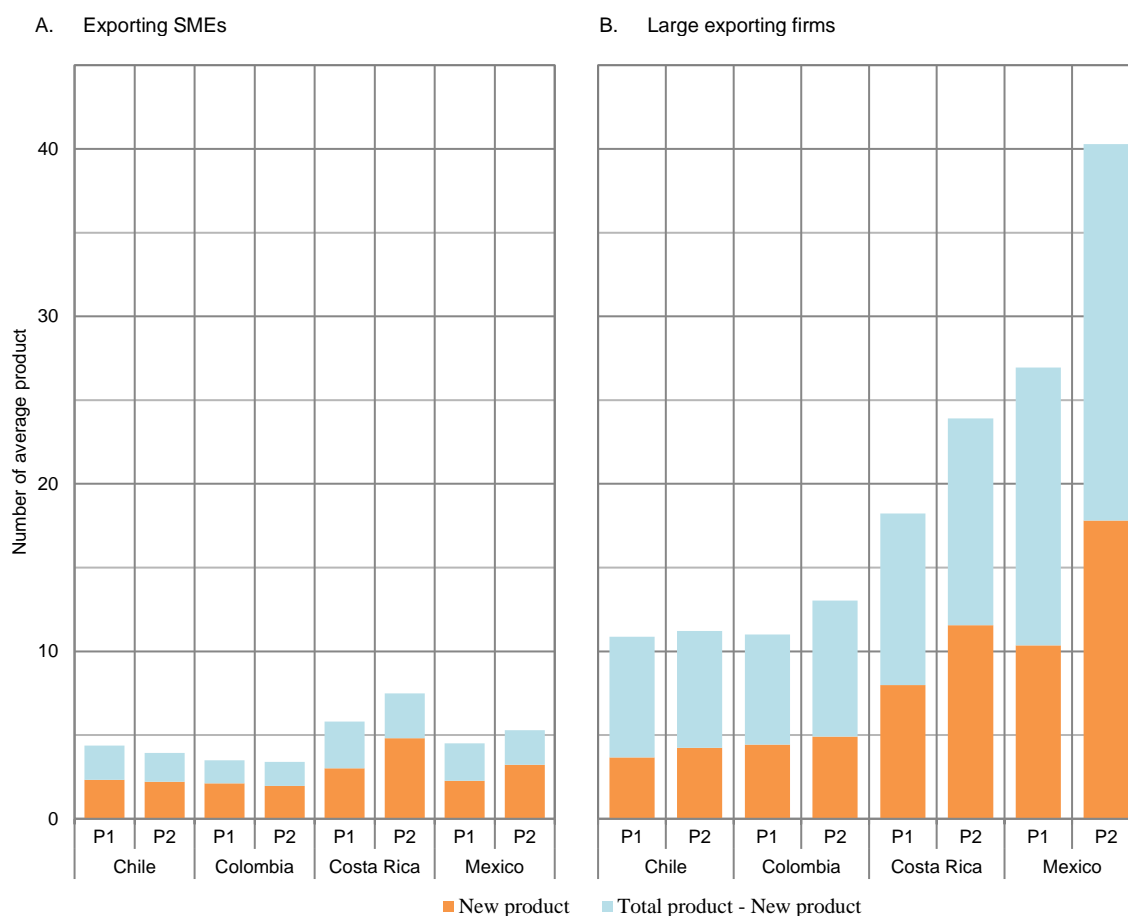
In sum, SMEs represent a relatively high share of the export value of new entrants, but many of those firms cease to export after one year. From the survival analysis, the exit rates drop sharply after the first year. In Costa Rica, new exporting SMEs represented a higher percent of export values to other countries and also showed the highest survival rates of exporting SMEs in the four countries.

B. Product dimension

Export innovation at the product level takes place when a firm adds a new product to its export basket for the first time even though the same product may already be exported by other firms. The revealed product innovation performance of exporting SMEs and large firms in Costa Rica and Mexico was significantly better than that of Chile and Colombia. Also, differences between SMEs and large firms were bigger in Costa Rica and Mexico compared to those in Chile and Colombia. This may be because the latter two countries mostly export natural resources that are concentrated in few products, whereas the former two export a more diversified range of manufactures. Exporting SMEs in the four countries also showed significant differences in the number of total and new products exported in the periods before (P1) and since the beginning of the financial crisis in 2009 (P2) (Panel A in figure 4). These two country groups also differed regarding the number of newly exported products by SMEs before and after the financial crisis: in the former two countries it increased, whereas it fell in the latter two.

⁷ These results coincide with previous findings on the region which showed high entry and exit rates, as well as increasing survival rates over time (Eaton et al., 2007; Fernandes et al., 2013; and Lederman et al., 2011).

Figure 4
Latin America (selected countries): average numbers of new and total exported products
by type of firm, periods before and after 2009
(Numbers)



Source: Elaborated by the authors based on transaction-level customs data of these four countries.

Note: P1 indicates the period before 2009, and P2 indicates the period from 2009 onwards.

New products played a relatively more significant role in the export basket of SMEs than of large firms. Costa Rica was the country where SMEs exported the highest numbers of new and total products and where the increase between the pre —and post— crisis was the largest. In the case of large exporting firms, Mexico showed the largest increase in new and total products from the first to the second period. Exporting SMEs in Costa Rica in P2 had the largest share (64 percent) of new products in the total export basket, and exporting SMEs in Mexico in P1 the smallest share (50 percent). In the case of large firms, the highest share of new products in total exports was 48 percent in Mexico in P1. Overall, the results confirm an export innovation performance gap at the product level between Chile and Colombia versus Costa Rica and Mexico.

The four countries also showed important differences regarding the three main newly exported products before and after the financial crisis (see table 3). In Chile, Costa Rica, and Mexico, the main new products were from agriculture or aquaculture. Most of them were primary goods, although the number one new product of SMEs in Chile was agricultural services. In these three countries, the ranks are the same in each period. New exports by Colombian SMEs included household items, furniture, clothes, and some agricultural commodities.

Table 3
Latin America (selected countries): top three new export products by SMEs,
periods before and after 2009

| | P1: Period to 2009 | | | P2: Period from 2009 onwards | | |
|------|--|---------------------|------------------|---|---------------------|------------------|
| Rank | Product description | Value (million USD) | Export share (%) | Product description | Value (million USD) | Export share (%) |
| | Chile (2000-2008) | | | Chile (2009-2015) | | |
| 1 | Services relevant to exports of sugars and sugar confectionery (chapter 17), or oil seed, fruits, grain, seeds | 24.4 | 5.1 | Services relevant to exports of sugars and sugar confectionery (chapter 17), or oil seed, fruits, grain, seeds (chapter 12) | 74.5 | 9.8 |
| 2 | Grapes, fresh or dried | 16.9 | 3.6 | Grapes, fresh or dried | 25.9 | 3.4 |
| 3 | Fish fillets and other fish meat (whether or not minced), fresh, chilled or frozen | 15.9 | 3.4 | Fish fillets and other fish meat (whether or not minced), fresh, chilled or frozen | 22.7 | 3.0 |
| | Colombia (2000-2008) | | | Colombia (2009-2014) | | |
| 1 | Cut flowers and flower buds of a kind suitable for bouquets | 14.4 | 6.9 | Supplementary arrangement to pack or protect special household items** | 6.3 | 2.2 |
| 2 | Other furniture and parts thereof | 5.1 | 2.5 | Live bovine animals | 5.9 | 2.1 |
| 3 | Women's or girls' suits, ensembles, jackets, blazers, dresses, skirts, divided skirts, trousers, bib and brace overalls, breeches and shorts (other than swimwear) | 4.3 | 2.1 | Cut flowers and flower buds of a kind suitable for bouquets | 5.9 | 2.1 |
| | Costa Rica (2000-2008) | | | Costa Rica (2009-2012) | | |
| 1 | Bananas, including plantains, fresh or dried | 9.9 | 7.6 | Bananas, including plantains, fresh or dried | 21.3 | 9.4 |
| 2 | Dates, figs, pineapples, avocados and mangosteens, fresh or dried | 7.9 | 6.0 | Dates, figs, pineapples, avocados and mangosteens, fresh or dried | 11.2 | 4.9 |
| 3 | Melons (including watermelons) and papaws (papayas), fresh | 4.0 | 3.1 | Manioc, arrowroot, sweet potatoes and similar roots | 11.3 | 4.8 |
| | Mexico (2004-2008) | | | Mexico (2009-2014) | | |
| 1 | Live bovine animals | 49.9 | 3.5 | Live bovine animals | 88.6 | 5.2 |
| 2 | Other vegetables, fresh or chilled | 30.8 | 2.2 | Other vegetables, fresh or chilled | 44.8 | 2.5 |
| 3 | Crustaceans, whether in shell or not | 28.1 | 2.0 | Crustaceans, whether in shell or not | 35.8 | 2.1 |

Source: Elaborated by the authors based on transaction-level customs data of these four countries.

Notes: Descriptions are from Commodity List of HS at digit 4 level, United Nations Commodity Trade Statistics Database [accessed on 18 May 2017], <https://comtrade.un.org/db/mr/rfCommoditiesList.aspx>; * the description is found in *Arancel Aduanero Vigente, Aduanas Chile* [Chilean Customs] [accessed on 23 May 2017], <https://www.aduana.cl/arancel-aduanero-vigente/aduana/2016-12-30/090118.html>; ** the description is found in *Consulta General de la Nomenclatura, Dirección de Impuestos y Aduanas Nacionales* [Colombian Customs] [accessed on 23 May 2017], <https://muisca.dian.gov.co/WebArancel/DefConsultaGeneralNomenclaturas.faces>.

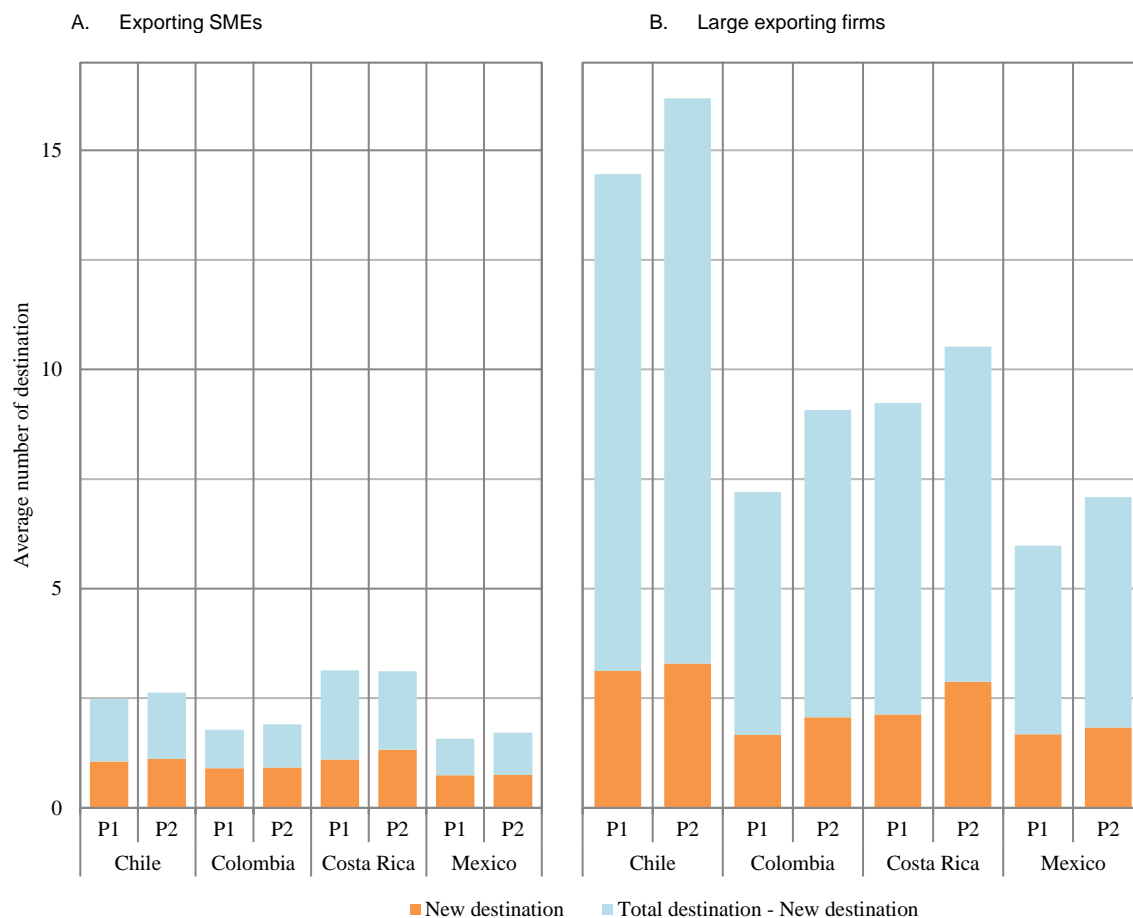
In sum, export innovation at the product dimension was particularly important for SMEs in all four countries, as expressed by high shares of new products in the total number of exported products per firm. Costa Rican SMEs were the most dynamic in terms of adding new products to their export baskets. Moreover, the new products exported by SMEs were mainly concentrated in agriculture and aquaculture goods, with some exceptions in Colombia. In addition, the ranks of those products did not change over time except for Colombia.

C. Destination dimension

The export innovation performance can also be analyzed for market destinations. As expected, large firms exported to more destination markets than SMEs, especially in Chile and Costa Rica. The increase between the two periods is also greater for large exporting firms than exporting SMEs. Figure 5 shows how many new market destinations exporting SMEs and large firms added each year on average in the

years before 2009 (P1) and from 2009 onwards (P2). Costa Rican exporting SMEs added the highest number of new destinations per year on average. However, the share of these new destinations in the total number of destinations was the lowest in Costa Rica before 2009 (35 percent), and the highest was Colombia during the same period (51 percent). Mexico added the fewest number of new destinations (less than one). Exporting SMEs added more destinations to their export baskets in the period after 2009, particularly in Costa Rica. Chile showed a similar pattern as Costa Rica. Colombia and Mexico added fewer destinations to their export basket.

Figure 5
Latin America (selected countries): average numbers of new and total destinations
by type of firm, periods before and after 2009
(Numbers)



Source: Elaborated by the authors based on transaction-level customs data of these four countries.

Notes: P1 indicates the period before 2009, and P2 indicates the period from 2009 onwards.

Differences in the number of new export destinations for exporting SMEs between the four countries may reflect in part the relative importance of traditional trading partners. In the case of Mexico, the United States absorbs more than two thirds of its export demand, and therefore most SMEs export to this market only. This may explain why Mexico added the smallest number of export destinations among the four countries. For exporting SMEs in Chile and Costa Rica, the United States was also the largest new export market, while it was the second for Colombian exporting SMEs after the Bolivarian Republic of Venezuela. Other nations in the region, such as Ecuador, Guatemala, Nicaragua, and Peru, were also important new trading partners for exporting SMEs in all countries of the sample. From 2009 onwards, China also became one of the most important new destinations, not only for large firms but also for exporting SMEs. The top three new destinations were similar in the first and second

period with only a few changes, suggesting that SMEs were seeking the same new markets in the first and second period.

Table 4
Latin America (selected countries): top three new export destinations for SMEs, periods before and after 2009

| P1: Period before 2009 | | | | P2: Period from 2009 onwards | | |
|------------------------|---------------------|---------------------|---------------------------|------------------------------|--------------------|---------------------------|
| Rank | Main destinations | Value (million USD) | Export share (percentage) | Main destinations | Value (million SD) | Export share (percentage) |
| Chile (2000-2008) | | | | Chile (2009-2015) | | |
| 1 | United States | 61.5 | 12.2 | United States | 86.0 | 11.5 |
| 2 | Peru | 33.4 | 6.6 | Peru | 58.1 | 7.8 |
| 3 | Mexico | 26.5 | 5.2 | China | 51.0 | 6.8 |
| Colombia (2000-2008) | | | | Colombia (2009-2014) | | |
| 1 | Venezuela (B.R. of) | 51.2 | 27.2 | Venezuela (B.R. of) | 50.7 | 19.3 |
| 2 | United States | 34.0 | 18.1 | United States | 36.7 | 13.9 |
| 3 | Ecuador | 17.6 | 9.3 | Ecuador | 25.5 | 9.7 |
| Costa Rica (2000-2008) | | | | Costa Rica (2009-2012) | | |
| 1 | United States | 29.7 | 25.8 | United States | 37.5 | 20.3 |
| 2 | Nicaragua | 6.8 | 5.9 | Panama | 13.7 | 7.4 |
| 3 | Netherlands | 6.7 | 5.8 | Netherlands | 9.4 | 5.1 |
| Mexico (2004-2008) | | | | Mexico (2009-2014) | | |
| 1 | United States | 615.6 | 54.0 | United States | 651.4 | 48.9 |
| 2 | Guatemala | 34.9 | 3.1 | China | 44.9 | 3.4 |
| 3 | Canada | 31.7 | 2.8 | Guatemala | 41.2 | 3.1 |

Source: Elaborated by the authors based on transaction-level customs data of these four countries.

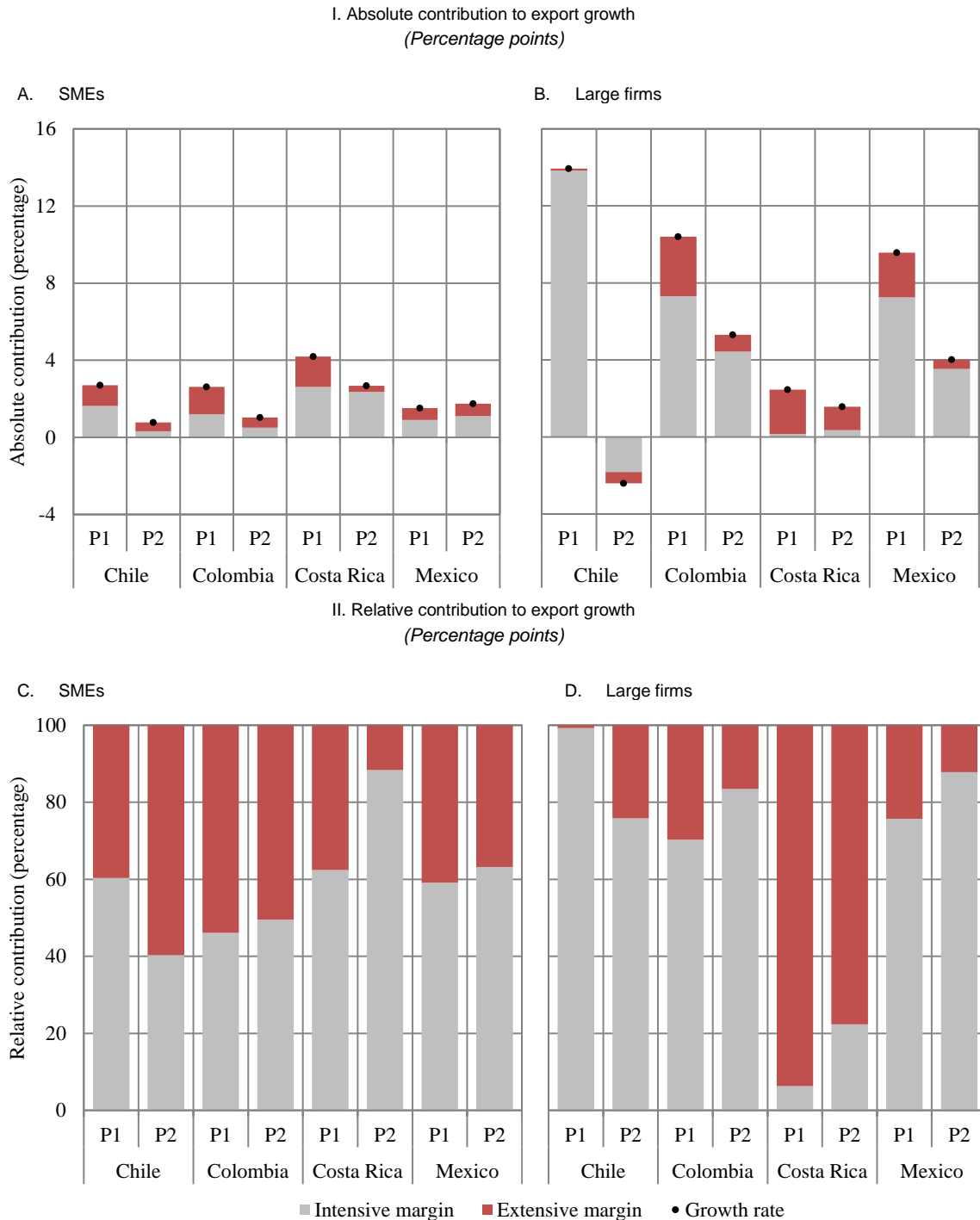
The comparison of the revealed export innovation at the product and destination market levels show interesting differences. The export innovation at the market destination level is smaller than at the product level, in part because there are simply far more products than destinations. Therefore, an average exporting SME adds a smaller number of new destinations than the number of new products to its export basket. Moreover, unlike the product dimension, new market destinations are not very different from traditional export partners.

IV. A holistic view of export innovation

This section analyzes changes in export values by looking at all three dimensions (firm, products, and destination markets) simultaneously. This joint decomposition shows how important the overall export innovation is in export growth compared to the “business as usual” as expressed by the intensive margin. Export innovation in this section refers to any new combination of firm, product, and destination appearing in the export universe. This joint decomposition is presented in four parts. First, changes in export values are decomposed into the extensive and intensive margins both in absolute and relative terms (see figure 6). Second, the extensive margin is split into two parts: that of new and disappearing firms and that of incumbent firms (see figure 7). Third, the extensive margin is divided into export innovation and the extensive margin of exit (see figure 8). Fourth, export innovation of new combinations of firms, products, and destination markets is decomposed into five components (see figure 9).

Figure 6 shows the contributions of the extensive and intensive margins to the average annual growth rate of exports before and after 2009. The extensive margin is the net result of export innovation (the extensive margin of entry) and disappearing combinations of firms, products, and destinations (the extensive margin of exit). In all four countries, the extensive margin contributed more in absolute terms (percentage points) to export growth of large firms than to that of SMEs in both periods (panels A and B). However, in relative terms the opposite result is found: the extensive margin contributed proportionally more to export growth of SMEs than to that of large firms in both periods except for Costa Rica (panels C and D). In Chile, Colombia, and Mexico, the extensive margin contributed between 40 and 60 percent of average annual export growth of SMEs. For large firms, this share was less than 30 percent. In Costa Rica, in contrast, the extensive margin contributed on average 48 percent and 12 percent to average annual export growth of SMEs in the periods before and after 2009, respectively, whereas the contribution for large firms was 94 percent and 78 percent, respectively.

Figure 6
Latin America (selected countries): contributions of the extensive and intensive margins to annual average export growth by type of firm, before and after 2009

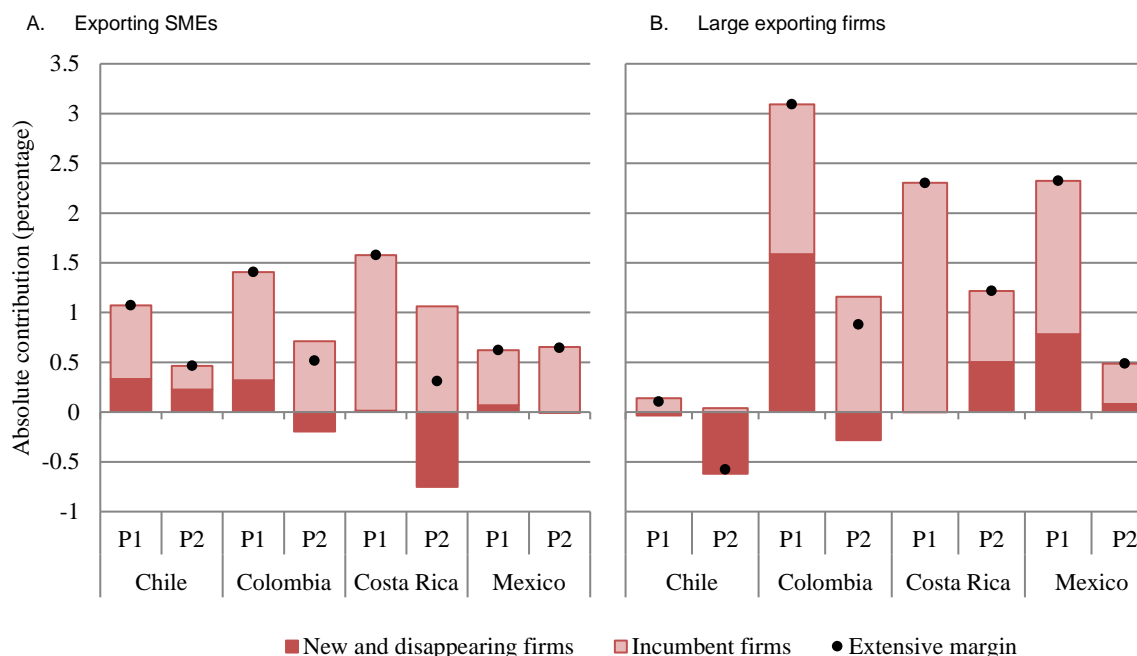


Source: Elaborated by the authors based on transaction-level customs data of these four countries.
 Note: P1 indicates the period before 2009, and P2 indicates the period from 2009 onwards.

In figure 7, the extensive margin is split into two parts. The red part of the bar is the extensive margin generated by the entry and exit of firms, which is the sum of the components of C2 and C11. The pink part of the bar is the extensive margin generated by incumbent firms (which is the sum of the C3 to

C6 and C7 to C10). In the case of SMEs, the extensive margin corresponding only to the entry and exit of firms was relatively larger in Chile and Colombia than in Costa Rica and Mexico in general. This pattern does not hold in the case of large firms.

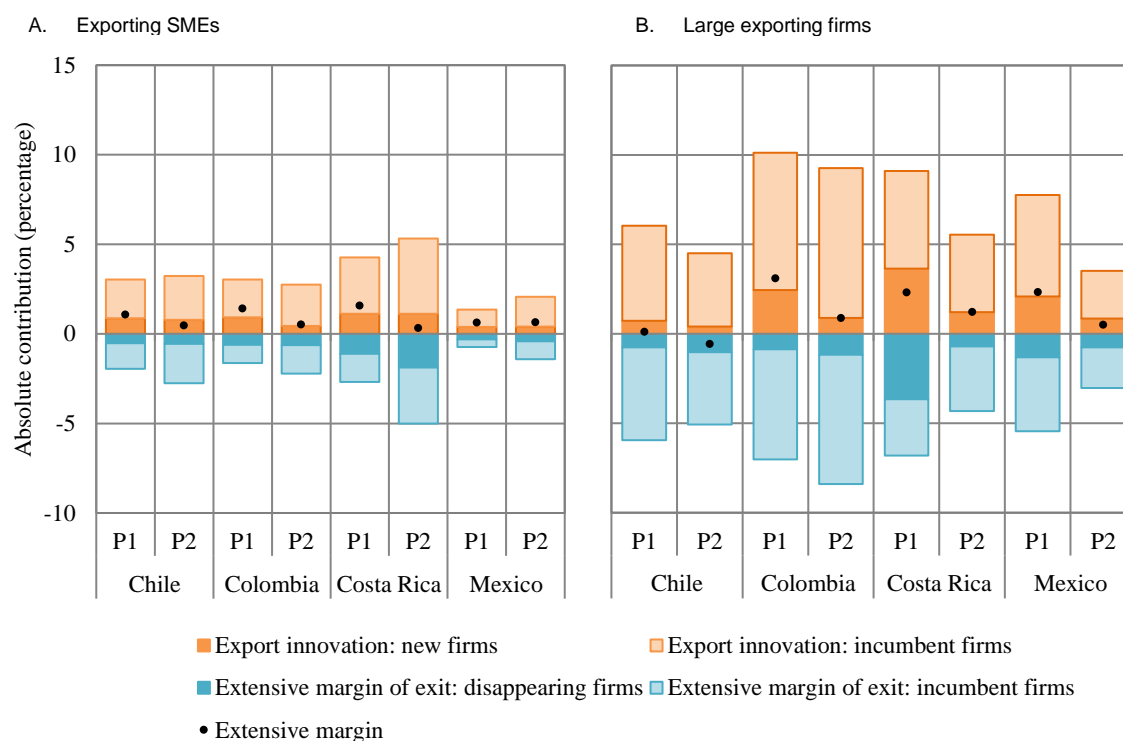
Figure 7
Latin America (selected countries): decomposition of the extensive margin: new, disappearing and incumbent firms, periods before and after 2009
(Percentage points)



Source: Elaborated by the authors based on transaction-level customs data of these four countries.
 Note: P1 indicates the years before 2009, and P2 indicates the years from 2009 onwards.

The extensive margin can be decomposed into four parts: export innovation (the extensive margin of entry) of new and incumbent firms and disappearing combinations (the extensive margin of exit) of disappearing and incumbent firms (see figure 8). In turn, each part can be split at the firm level. Note that export innovation is always positive as it adds new combinations of firms, products and destinations to exports. In contrast, the extensive margin of exit is always negative as it represents a loss these combinations. This decomposition shows that most of the positive contribution made by new firms is largely cancelled out by disappearing firms. Moreover, a large part of export innovation by incumbent firms is also removed by the extensive margin of exit. Nevertheless, the contribution of export innovation always exceeds that of the extensive margin of exit in SMEs and large firms. This result confirms that of Cadot et al. (2011), who found that most failures mostly occur at the level of new firms. The extensive margin of exit by incumbent firms could be interpreted as part of their export innovation strategy rather than a failure of incumbent firms. Firms define optimal combinations of products and markets, which is a dynamic process including the elimination of certain combinations of both. Also, results show that the absolute contribution of export innovation was higher for large firms than SMEs in all the four countries in both periods. In the case of SMEs, Costa Rica presented the largest contributions of both export innovation and the extensive margin of exit within the sample of four countries.

Figure 8
Latin America (selected countries): decomposition of the extensive margin into extensive margin of entry (export innovation) and extensive margin of exit, periods before and after 2009
(Percentage points)



Source: Elaborated by the authors based on transaction-level customs data of these four countries.
 Notes: P1 indicates the years before 2009, and P2 indicates the years from 2009 onwards.

In figure 9, export innovation is decomposed into the five components presented in section 2 for exporting SMEs and large firms. Two types of innovations are more important for SMEs than for large firms in all countries. The first type is exports of new products to new destinations by incumbent firms (C3), which reflects the fact that most SMEs start exporting a single product to a single destination and subsequently expand in both directions. The second type is exports of new products to existing destinations by incumbent firms (C5), which may be due to the fact that it is more difficult to export to other countries than to export new (but similar) products to existing destinations. In large firms, switching combinations of existing product and destination (C6) is more important than it is for SMEs. This is expected as large firms export more products to more destinations, which makes it easier for them to change combinations than for SMEs. A surprising result is that new firm entrants (C2) were not systematically more important for SMEs than for large firms in all four countries even though entry levels are much higher for SMEs everywhere. This may reflect the fact that the export value of new firms is relatively low in most countries.

Results also confirm some common patterns for Chile and Colombia, on the one hand, and Costa Rica and Mexico, on the other, in terms of the most important types of export innovation:

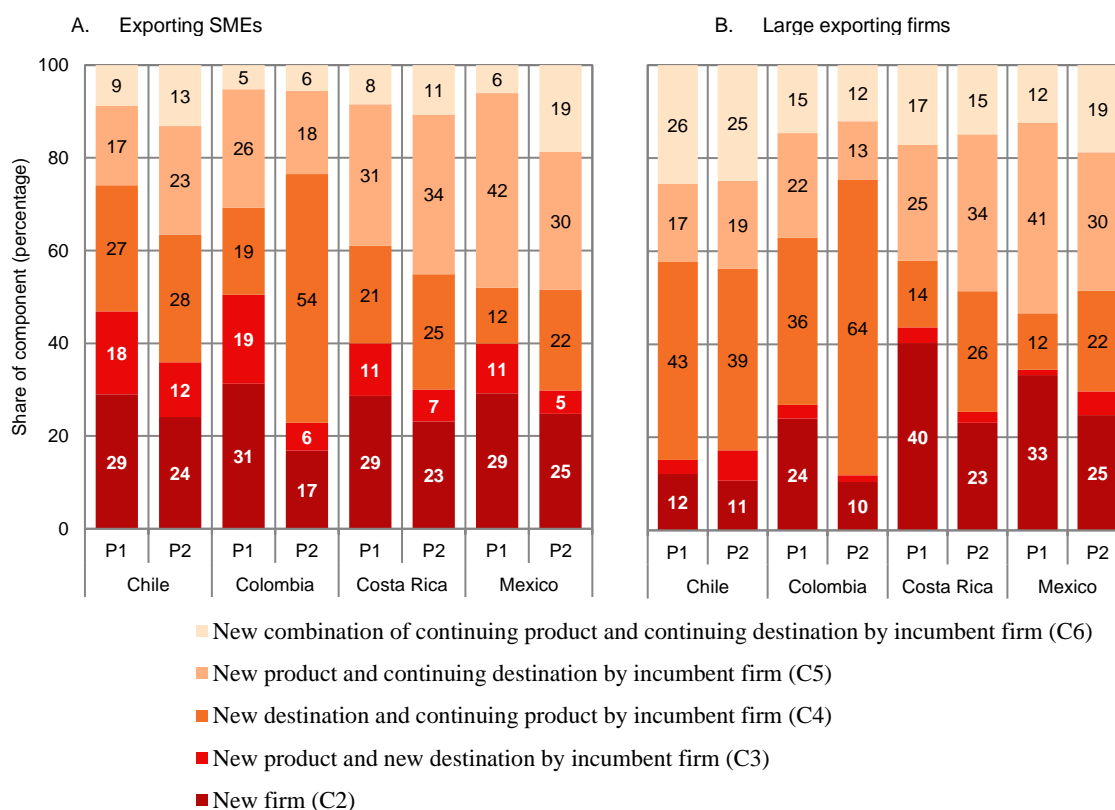
- In the case of exporting SMEs (Panel A): in Chile and Colombia, the entrance of new firms (C2) was the largest contributor to export innovation before 2009, (29 and 31 percent, respectively), which may be explained by rising commodity prices being an incentive to export. From 2009 onwards, the main contributor was exports to new markets with existing products (C4) (28 and 54 percent, respectively), in a context where commodity prices stagnated or declined and firms looked to new destination markets to expand sales. In contrast, in Costa Rica and Mexico, new products to continuing destinations (C5) contributed most to

export innovation in both periods: in Costa Rica 31 and 34 percent before and after 2009, respectively; and in Mexico 42 and 30 percent, respectively. This result may reflect the dominant position of the United States for Mexico, and to a lesser extent Costa Rica, and the fact that their manufacturing firms a larger potential to diversify exports in terms of products than countries specialized in natural resources such as Chile and Colombia.

- In the case of large firms (panel B): in Chile and Colombia, selling existing products to new destinations (C4) was the largest contributor to export innovation while in Costa Rica and Mexico, selling new products to existing destinations (C5) was the most significant. Similar reasons may explain these differences.
- In Chile and Colombia, export innovation in large firms was much more concentrated in two categories than in SMEs: selling existing products to new destinations (C4), followed by changing combinations of both existing product and destination (C6). In contrast, export innovation in SMEs showed higher contributions from new products and new destinations by incumbent firms (C3).

Figure 9
Latin America (selected countries): contribution of each component
of export innovation before and after 2009

(Percentage points)



Source: Elaborated by the authors based on transaction-level customs data of these four countries.
 Note: P1 indicates the years until 2009, and P2 indicates the years from 2009 onwards.

V. Conclusions

This paper analyzes the intensive and extensive margins of export growth at the firm level for four countries from 2000 to 2015. Two of these are specialized in natural resources (Chile and Colombia), one in manufactures (Mexico) and another in both (Costa Rica). Different export specializations explain in part why the value of exports of large firms grew much faster in Chile and Colombia than in Mexico and Costa Rica. In contrast, the exports by SMEs in the four countries grew much slower and at similar rates. The intensive margin, which is business as usual, refers to exports of the same products to the same destinations by the same firms. The extensive margin consists of two parts: (i) extensive margin of entry or export innovation, which are new combinations of firms, products and market destinations, and (ii) extensive margin of exit, which are combinations of firms, products, and market destinations that disappear from the export universe.

The results confirm the well-known high entry and exit levels of SMEs in all four countries. Colombia had the highest entry and exit rates with about half of the SMEs entering and leaving the export universe every year. In contrast, Costa Rica showed lowest entry and exit rates (between 20 and 30 percent). Chile and Mexico had similar rates between 30 and 40 percent. In this context, the question arises how long exporting SMEs survive. Results suggest that survival rates were highest in Costa Rica, followed by Chile, Mexico and Colombia. At the product level, SMEs in Costa Rica and Mexico added on average more products to their export basket every year than those in Chile and Colombia. This may be because SMEs in the latter two countries mostly export natural resources that are concentrated in fewer products, whereas the former two export a relatively more diversified basket of manufactures. At the destination level, SMEs in Costa Rica added the highest number of new destinations per year on average. Mexico added the fewest number of new destinations (below one). These differences reflect in part the relative importance of trading partners. In Mexico, the United States absorbs more than two thirds of its export demand, and therefore, most SMEs export to this market only.

In all countries except Costa Rica, the extensive margin contributed proportionally more to export growth of SMEs than to that of large firms. In Chile, Colombia, and Mexico, the extensive margin contributed between 40 and 60 percent of average annual export growth of SMEs between 2000 and 2015. For large firms, this share was less than 30 percent. In Costa Rica, in contrast, the extensive margin contributed 48 and 12 percent to average annual export growth of SMEs in the periods before and after 2009, respectively, whereas the contributions for large firms were 94 and 78 percent,

respectively. The decomposition of the extensive margin shows that a large part of the positive contribution made by export innovation (the extensive margin of entry) is cancelled out by the extensive margin of exit, but the extensive margin by incumbent firms always contributes positively to export growth. The three predominant components of export innovation of SMEs in the four countries are new firms, new destination and continuing products, and new product and continuing destination.

Among the four countries, Costa Rica showed the best export innovation performance. Costa Rican SMEs presented the highest survival rates. Moreover, they added on average the highest numbers of new products and new destinations to their export basket each year. In addition, the export growth rate of SMEs was the highest among the four countries. The joint decomposition of export growth showed that the absolute contribution of export innovation to export growth of SMEs was also the highest among the four countries.

The results presented here have some limitations. Although new combinations of firms, products, and destinations are used as a proxy of export innovation, it remains unclear which types of innovations were implemented by a firm to overcome different hurdles to enter new markets. Specific surveys are required to obtain this type of information. Also, the thresholds of SMEs are somewhat arbitrary, and more robustness tests are needed to check how sensitive results are to specific thresholds. Another shortcoming is that the general results presented here may hide different patterns across sectors.

In future studies, the joint decomposition could be conducted at a more detailed level to find out which sectors are most innovative. Finally, econometric analysis could be carried out to explain which factors drive differences in export innovation behavior between countries, firm classes, and time periods. Examples of variables include firm, sector, year, country, destination market and real exchange rate.

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