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The Source of Sustainable Growth in Costa Rica

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Abstract

Costa Rica has some concerns for the "middle income trap" stemming from her perceived weakening export competitiveness, intensifying competition in attracting FDI inflow; and apparent lack of innovation capabilities. Quantitative analyses on the impact of recent FTAs suggest only large firms benefit from FTAs suggesting the need for improving utilization by smaller firms. Continuing attraction of potential MNCs backed by human capital development is necessary. In pursuing its development goals, Costa Rica should be mindful of its reputation as an environmentally friendly place.

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Abstract

Costa Rica has some concerns for the "middle income trap" stemming from her perceived weakening export competitiveness, intensifying competition in attracting FDI inflow; and apparent lack of innovation capabilities. Quantitative analyses on the impact of recent FTAs suggest only large firms benefit from FTAs suggesting the need for improving utilization by smaller firms. Continuing attraction of potential MNCs backed by human capital development is necessary. In pursuing its development goals, Costa Rica should be mindful of its reputation as an environmentally friendly place.

Key words: Costa Rica, middle income trap, FTA, innovation

JEL Code: F15, F21, O31, O54

Introduction

Costa Rica has some concerns for the future growth prospects. The doubt for the continuing growth performance stems from her perceived weakening export competitiveness, intensifying competition with other countries on attracting FDI inflow; and apparent lack of innovation capabilities. These are common concerns shared among middle-income countries. Then the natural question to raise is, "Is Costa Rica in a middle income trap?" This paper assesses whether Costa Rica is in middle-income trap and how it may be able to escape from it.

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I. The background on the interest regarding the middle-income trap

The middle-income trap in general points to the situation where a country faces difficulties in smoothly shifting from growth strategies based on low labor costs to growth strategies based more on innovation and higher value-added activities. This term has been popularized recently (Gill and Kharas 2008;Kharas and Kohli 2011), but the interest in the differences in growth performance among countries are not new, especially in terms of comparing the growth performance of East Asian and Latin American countries. Since 1965, East Asian countries have collectively posted higher growth rates compared to Latin American countries (see Figure 1). The divergence in the growth performance was the largest from 1970 to 1990. Since then, the general trend in their growth pattern has been relatively similar, although still at a different magnitude.

Figure 1: Comparison of Growth Rates in East Asia and Latin America, 1965-2011
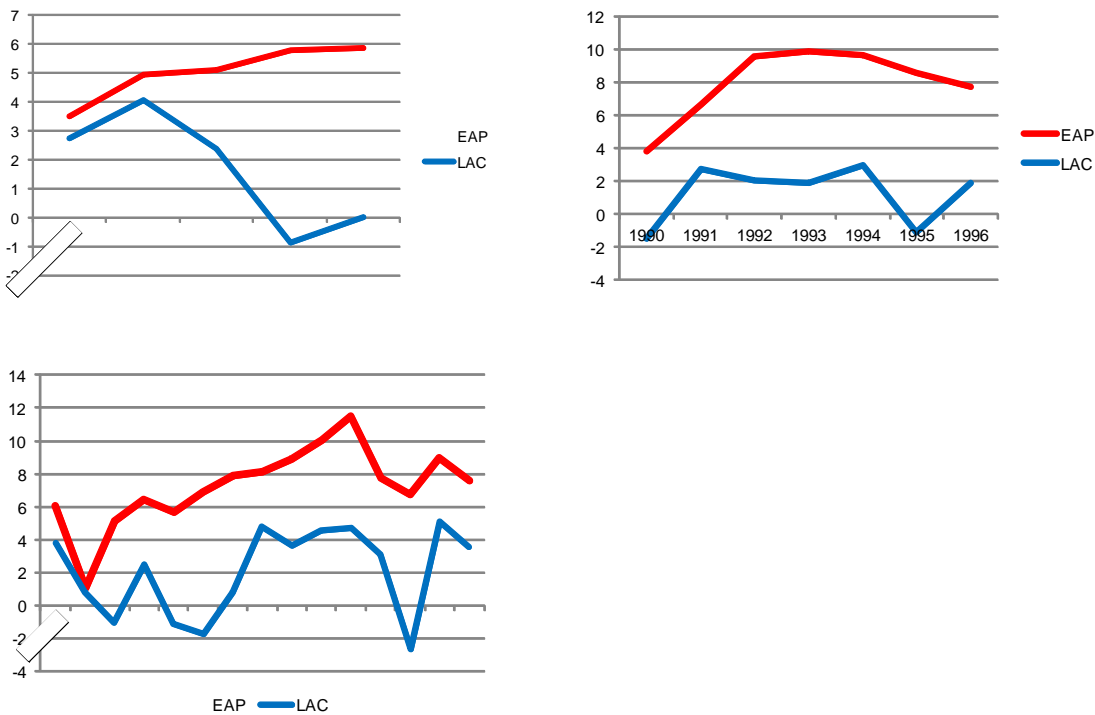
Source: Created by the author using data from World Development Indicators

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This difference in growth performance has led to changes in their relative income status. While all the countries were able to increase their real per capita income (measured in PPP) since 1950, the difference in growth performance led to changes in their relative position when ranked in descending order.   In 1950, per capita incomes of Central and South American countries were higher than those of East Asian countries, but by 2010, East Asian countries had moved ahead (see Table 1).

Table 1: Ranking of real per capita income in 1950 and 2010 for selected countries in East Asia and Latin America

	1950		2010
Venezuela	7,462	Hong Kong	30,725
Argentina	4,987	Singapore	29,038
Uruguay	4,659	Taiwan	23,292
Chile	3,670	Japan	21,935
Mexico	2,365	S. Korea	21,701
Peru	2,308	Chile	13,883
Singapore	2,219	Uruguay	11,526
Hong Kong	2,218	Argentina	10,256
Colombia	2,153	Malaysia	10,094
Guatemala	2,085	Venezuela	9,874

Source: Bolt and van Zanden 2013

This has stirred a debate on the causes of slow growth in Latin America and there have been a number of studies on this matter. In the meantime, the growth acceleration in East Asia was heralded as a miracle (World Bank 1993).   However, the euphoria of East Asia did not last long.   The onset of the Asian Financial Crisis in 1997 was a wakeup call to governments in East Asia and researchers alike to realize that the East Asia region was no different from other regions in terms of its vulnerability to crises if due care was missing to manage macroeconomic conditions (Stiglitz and Yusuf 2001).   Even though East Asian countries have been able to recover rather quickly from the crisis, the growth rates have been lower than the average prevailing before the crisis.

In addition, one of the characteristics of East Asian growth – the flying geese pattern[1] – was starting to change.   The rapid growth of China is disorienting the formation and this has changed the mindset of policymakers in East Asia.   In the past,

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[1] This was popularized by Akamatsu (1962).

if one believed in the flying geese pattern of growth, then all countries would move up step-by-step without changing the ordering (i.e. no one will be falling behind). It was as if the growth was guaranteed and their accession into the high-income categories was assured as occurred in the cases of Japan and Korea. However, China is likely to surpass other countries in the region due to its rapid and continuing growth. This means that the formation (or the current ordering of the income levels) is not assured and some countries may be left behind (achieving certain income levels later than anticipated). Coupled with the financial crisis in 1997, this has made the future growth prospects of East Asian countries uncertain. Vulnerability against crisis and the emergence of China contributed to the interest on future growth, and combined with the lackluster performance of Latin American countries in the past, the interest on the middle-income trap has increased in the recent years.[2]

II. The Definition of Middle Income Trap

Even though the interest on the middle-income trap has increased, its actual definition is still being debated (Im and Rosenblatt 2013). To define the middle-income trap, one needs to define both the level of income that constitutes "middle-income" and the condition in which a country is "trapped."

Definition of income level

There are two ways to define middle-income. The first is based on absolute levels of income with suitable thresholds and the second is based on incomes levels relative to a reference country.

If one uses the definition based on the absolute income levels, then one needs to specify the cutoff points for each income category. While this is conceptually simple, in practice, this will lead to the choice of an exchange rate conversion factor (whether to use purchasing power parity (PPP), current exchange rates, etc.) and of an income definition (GDP versus GNI, for instance). For instance, the World Bank defines a low-income country as a country with a per capita income less than US$1,005, based on GNI per capita using Atlas method, and a lower middle-income country as one with per

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[2] See for instance, Yusuf and Nabeshima (2009a).

capita income between $1,005 and $3,975; upper middle-income between $3,975 and $12,275; and high-income as $12,275 and above.

In another definition, Felipe (2012) defines a low-income country as a country with a per capita income less than $2,000; lower middle-income as between $2,000 and $7,250; upper middle-income as between $7,250 and $11,750 and high-income is above $11,750 based on GDP per capita using 1990 PPP.

Whichever measure is used, the implication of using an absolute level of income to classify countries in different income categories means that eventually a country can move to the high-income category as long as a country experiences positive growth on average.

The definition based on relative values is based on relative income levels to a specific reference country, typically 50~60% of US per capita income is used as a reference point for the high-income category. The use of relative income levels to define the threshold, means that for a country to move into the high-income category, it needs to grow faster than the reference country. Compared to the case where the absolute income level is used, the definition based on the relative income levels requires much stronger growth performance in order for middle-income countries to move to the high-income category.

The Definition of "Trap"

Similar to the case of defining the income level, a trap can be defined in an absolute or a relative manner. If we use the absolute definition, a country is trapped if it can never move up from the middle-income to the high-income category. Using the relative definition, a country is trapped if its transition from the middle to the high-income category is slower than average.

It is highly unlikely for a country to be trapped using the absolute definition. If the absolute definition for trap and the absolute income levels are used, then this means that a country can be considered trapped in the middle-income status forever if and only if its growth rates are non-positive in the past and in the future. While this is certainly possible, it is highly unlikely given the fact that this country has achieved middle-income status, with some productive capacity already installed. In contrast, the

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absolute definition of the trap used in conjunction with a definition of relative income levels is more plausible. In this case, a middle-income country failing to match the growth performance of a reference country will be trapped in the middle-income categories.

However, it is still unclear how long a country needs to be in the middle-income categories or order to say that a country is "trapped" using this definition. If a country is in a middle-income status for 10 years and its growth performance lags relative to that of a reference country, it is hard to say that this country is "trapped" because we do not know what the future growth performance will be. It could be the case that this country will grow faster than the reference country in future. In addition, the absolute definition will also not provide a good sense of duration of time in each income category. Without this piece of information, it is hard to say if a country is "trapped" (i.e. stagnating) or in transition to higher income categories.

The definition based on relative performance can provide some reasonable estimates regarding the duration that a typical country spends in each income category. In this case, a trap can be defined as a country spending more time than a typical country. Felipe (2012) uses an effective approach to make the assessment of the current situation and to predict whether a country will fall in a trap and what kind of performance is needed to escape from the trap. He uses the absolute income level categorization as described above and defines the durations for a typical country to stay in lower middle-income category as 28 years and upper middle-income category as 14 years. The durations for each income category are calculated as the median years spent in each income category based on the data from all the countries in the past. These durations imply that for a country to escape the lower middle-income trap, it needs to grow at 4.7% per year or faster and 3.5% per year or faster to escape from the upper middle-income trap. In this definition, any lower middle-income country spending more than 28 years in lower middle-income category is considered as being trapped. Similarly, upper middle-income countries spending more than 14 years without being able to move up are defined as being trapped.

Using this set of definitions, those countries that are trapped and those that are in danger of being trapped can be identified. Table 2 lists some of the countries currently

trapped in lower middle-income trap. The Philippines has stayed in this category for the last 34 years and is expected to stay there for 35 more years if there is no improvement in current growth rates. Similarly, Brazil and South Africa have been trapped for quite some time. Similarly, Table 3 lists countries in the upper middle-income trap. Malaysia is currently trapped [3] and so are Uruguay and Venezuela.

Table 2: Countries in lower middle income trap

Country	2010GDP	Years as lower middle income	Average growth rate (2000-2010)	Expected years to upper middle
Philippines	3,054	34	2.5	35
Brazil	6,737	53	2.0	4
South Africa	4,725	61	2.0	23

Source: Felipe (2012)

Table 3: Countries in upper middle income trap

Country	2010GDP	Years as upper middle income	Average growth rate (2000-2010)	Expected years to upper income
Malaysia	10,567	15	2.6	5
Uruguay	10,934	15	3.3	3
Venezuela	9,662	60	1.4	15

Source: Felipe (2012)

One of the advantages of using the definition proposed by Felipe (2012) is that it gives concrete criteria to assess which countries are trapped and which countries are expected to be trapped in future given the recent growth performance. For instance, Indonesia is expected to be trapped in the lower middle-income trap. Indonesia has stayed there for the last quarter century. A typical country will spend only 28 years in this income category, so Indonesia has only three years to spare. The implied growth rates to escape lower middle-income trap is 14.8% for the next three years, which given the recent growth rates, almost impossible to achieve (see Table 4). Similarly, Costa Rica, Mexico, and Thailand are expected to be trapped in the upper middle-income trap

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[3] On the growth prospects of Malaysia, see for instance, Yusuf and Nabeshima (2009a;b).

(see Table 5).   Mexico has spent 8 years as an upper middle-income country and has only 6 years left to escape from being labeled as "trapped."   However, given the recent growth performance of merely 0.7%, it is highly unlikely that Mexico can escape from this trap.   Thailand, in contrast, may have a better chance of escaping the trap. Actually, Thailand spent exactly 28 years in lower middle-income category, and was expected to spend 14 years in upper middle-income category.   This makes Thailand the typical country as defined by Felipe (2012). However, there is a question as to whether Thailand will be able to keep its growth momentum given the current political uncertainty.[4]

Table 4: Countries expected to be trapped in lower middle-income trap in near future

Country	2010GDP	Years as lower middle income	Years left	Average growth rate (2000-2010)	Implied growth rates needed
Indonesia	4,790	25	3	3.9	14.8

Source: Felipe (2012)

Table 5: Countries expected to be trapped in upper middle-income trap in near future

Country	2010GDP	Years as upper middle income	Years left	Average growth rate (2000-2010)	Implied growth rates needed
Costa Rica	8,207	5	9	2.9	4.1
Mexico	7,763	8	6	0.7	7.2
Thailand	9,143	7	7	3.6	3.6

Source: Felipe (2012)

Costa Rica is also at the borderline of being trapped.   The country achieved upper middle-income status in 2006 and if it can manage to continue growing at 3.4% or higher, it can escape the upper middle-income trap, although the growth rates from 2000-2010 were lower than the required 3.4%. The implied growth rate needed is 4.1%, which may prove quite difficult to achieve, especially given the fact that Costa Rica was

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[4] Anecdotal evidence suggests that some of the recent foreign direct investments in Southeast Asian countries specifically avoided Thailand because of political uncertainties and were diverted to other countries in the region.

previously trapped in lower middle-income trap due to slow growth. Costa Rica was classified as a lower middle-income country in 1952 (see Figure 2) and spent the next 54 years in this category, mainly due to the crisis in early 1980s. Recovery from this crisis was slow, but it seems that Costa Rica is back on its long-term growth trend.

Figure 2: Per capita growth of Costa Rica, 1950-2010
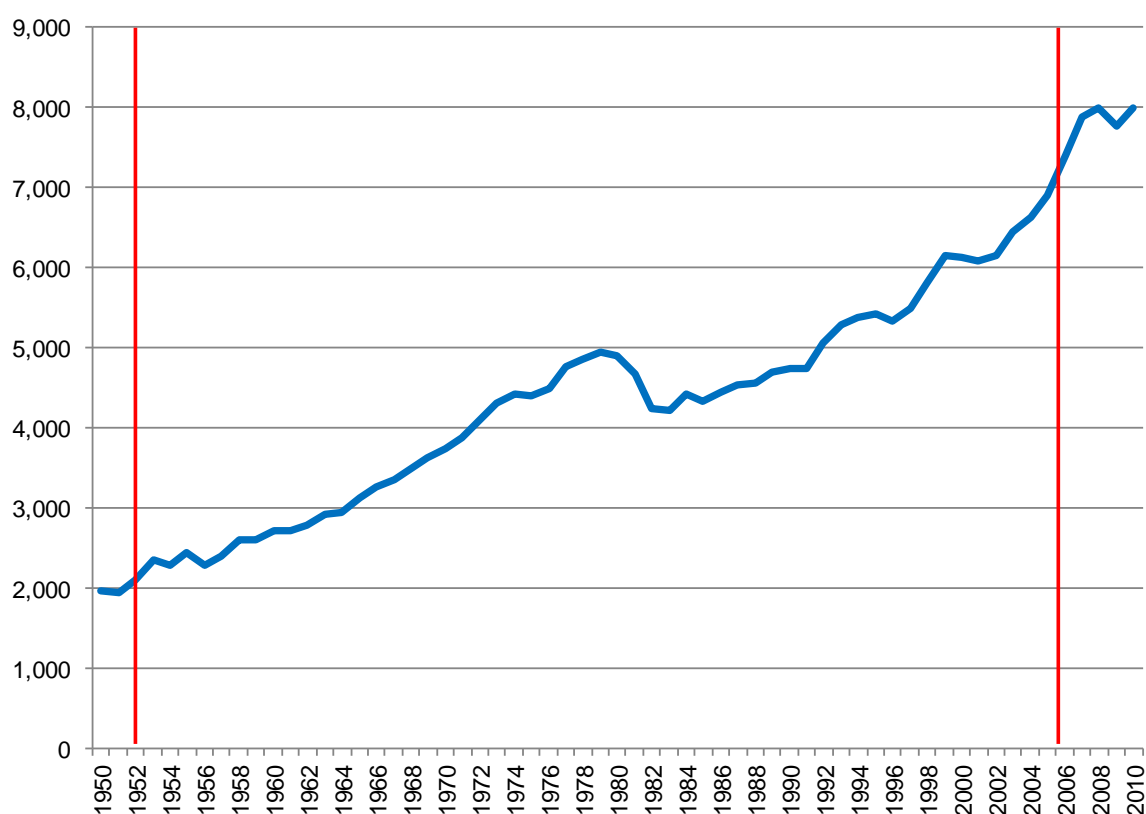
Source: Created by the author using data from Bolt and van Zanden 2013
Note: Costa Rica moved from being a low-income to a lower middle-income country in 1952 and moved to being an upper middle-income country in 2006.

For Costa Rica will need to increase its growth rate in order to escape from the upper middle-income trap. In order to do so, policymakers will need to assess the country's current strengths and weaknesses and improve upon these.

III. Assessment of Costa Rica's strengths and weaknesses

To assess the current strengths and weaknesses, a team from the Institute of Developing Economies has conducted a number of field visits to key players in Costa

Rica. [5]   The field visits involved interviewing various government agencies, non-governmental organizations, educational institutes, subsidiaries of multinational corporations (MNCs) operating in Costa Rica, and domestic firms.   Of these, the subsidiaries of MNCs comprise the largest number of interviews.   Many of these subsidiaries of MNCs are in the electronics, IT, and medical devices industries, reflecting the industrial subsectors in which Costa Rica has had the most success in attracting foreign firms.

Strengths

Interviews with these entities reveal that there are four broad areas of strengths in Costa Rica: good governance and policies; location; human capital; and industrial agglomeration.

Governance

For many MNCs, the political and macroeconomic stability are important factors when making FDI decision, especially in the Central America region, where such fundamental conditions often are not met.   In this regard, Costa Rica fares well relative to other countries in the region.   The political and macroeconomic conditions in Costa Rica have been rather stable (although there was a debt crisis in the early 1980s).   This stability has certainly increased the attractiveness of Costa Rica as a suitable destination for foreign direct investment.

In addition, the Ministry of Foreign Trade and CINDE are both capable and dedicated to the future development of Costa Rica.   Such dedication and capabilities on their part reminds us of those in Singapore and Penang (Malaysia).   Through these capable agencies, Costa Rica was able to attract key players in the electronics and medical device industries, which were instrumental in germinating clusters in Costa Rica.

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[5] There were two field visits conducted: from March 19 to March 23, 2012 and March 7th to March 12th, 2013.   The field research team of IDE consisted of Kaoru Nabeshima, Kiyoyasu Tanaka, Yasushi Ito, Mila Kashcheeva, Hiroshi Abe, and Yukiko Aoyama.   We are grateful to the assistance provided by COMEX to organize meetings with these entities.

Location

      Many firms expressed the importance of the proximity to the U.S., both in terms of physical travel time and the time zone. This may be partly because some of the firms that have established themselves in Costa Rica tend to have less experience in the globalization. It may also be because of the larger shares of services activities among MNCs relative to manufacturing. The service activities performed by MNCs in Costa Rica, tend to be of a higher order, where decisions may need to be made rather than simply processing administrative tasks. For these kinds of service activities, being in a same time zone seems to be a huge advantage. In contrast, those service activities that do not involve complex decision-making can be outsourced to far-flung locations such as India where the labor cost is much lower.

      Furthermore, Costa Rica offers attractive living conditions. Blessed with abundant of natural assets, Costa Rica is known for eco-tourism covering both marine and mountainous regions. Costa Rica is a popular destination for the young and the elderly alike. This is a key attribute to attract and retain high quality human capital, which are instrumental in pursuing innovation oriented growth strategy. Cities in Costa Rica are not yet classified as creative cities by Florida's (2004) definition, however, these cities have some chance of becoming creative cities with the right mix of policies.

Human Capital

      Interviews with MNCs reveal that the availability of human capital has enabled companies to branch into offering shared services for groups of firms as well as serving external clients either regionally or globally. MNCs feel that the availability and supply of human capital at the basic level is adequate. In addition, English language skills are valuable since many of the MNCs have their headquarters in the US. Adequate supply of English speaking workers also enabled these MNCs to branch into offering services activities where the language skills (both English and Spanish) are indispensable.

Agglomeration

The initial success in attracting some of the leading firm in electronics, IT, and medical devices is creating somewhat of a reputation effect, which is making Costa Rica an attractive location for other firms. From the discussion with MNCs in the medical devices industry, relative to other industries, the medical device industry seems to be less globalized in general. This means that the global supply chain in the medical device industry is still in its formation stage and Costa Rica can take advantage of this opportunity before other countries raise their hands. As more firms in downstream (mainly conducting assembly operations) are investing in Costa Rica, firms upstream are also being attracted to invest in Costa Rica and in fact, some of them have established their operations in Costa Rica. Once they establish their operations, more downstream firms are attracted to Costa Rica since more of the tasks along the supply chain can be done in Costa Rica. To create a viable cluster, this kind of virtuous cycle of investment needs to happen, and it seems that Costa Rica is at the initial stage of this cycle. In all, there are nine industries where agglomerations are identified in Costa Rica.[6]

Table 6: Agglomerations in Costa Rica

Industry	Cantons
Textiles	San José in San José Province
Wearing apparel	Montes de Oca and Pérez Zeledón in San José Province, San Ramón in Alajuela Province and Cartago in Cartago Province
Wood and wood products	San Ramón and San Carlos in Alajuela Province
Printing and reproduction of recorded media	Goicoechea and Tibasm in San José Province
Chemical and chemical products	Curridabat in San José Province
Fabricated metal products	Desamparados in San José Province
Computer, electronic and optical products	Heredia in Heredia Province
Furniture	Desamparados, Goicoechea in San José Province, Palmares and Valverde Vega in Alajuela Province

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[6] For the details on the agglomeration of industrial activities in Costa Rica, please see Kumagai and others (2014).

Repair and installation of machinery and equipment	Heredia in Heredia Province

Source: Kumagai and others 2014

Weaknesses

While a number of strengths were identified above, there were also some areas that warrant further attention. These are: lack of local linkages and local industry development; concerns on the supply and quality of human capital; deficiencies in physical infrastructure; and absence of similar countries in the region.

Lack of local linkages and local industry development

While MNCs shifting into service activities may be taken as a positive move (providing higher paid employment), there are some concerns that this shift to services may be partly a reflection of lack of expandability in manufacturing activities. If so, should Costa Rica be content with this situation, especially considering the fact that service industries tends to have much less linkages with other firms (i.e. much less scope for backwards linkages with domestic industries)? If the goal is to encourage the development of indigenous firms, especially in manufacturing activities, shift of MNCs activities too much into services directions may not be desirable.

This (potential) lack of expandability in manufacturing (especially from the viewpoint of MNCs) stems from still too thin industrialization in Costa Rica. From the discussion, development of local support industries is not forthcoming. While some local firms have emerged as suppliers to MNCs, many others have not. It seems that the level of industrialization is still too thin for local linkages to form organically. While the attention to attract medical device industries to Costa Rica seems to be success and more firms in this particular sector seems to be agglomerating in Costa Rica, this has not translated into emergence of local industries. This may be because this industry tends to have smaller volumes and sometimes have more specialized input needs. This is making it more difficult for indigenous firms to develop as suppliers because 1) the technological and managerial capabilities are far removed from the requirements of MNCs; and/or 2) the required investment in equipment (or changes in business practices) is larger relative to the potential pool of customers.

Future supply and quality of human capital

While many MNCs praised the current availability of human capital, many also voiced concerns regarding future availability of necessary skills. This partly reflects the success by Costa Rica to attract more FDI into the country. However, a continual increase in the presence of FDI firms is leading to competition for workers at all levels: operators, technicians, engineers, and management. Since the availability of qualified personnel has been the key attractiveness of Costa Rica, educational institutes, government, and private sector need to work with each other to ensure that supply of human capital does not become a bottleneck to attracting more FDI. Such steady flow of human capital would also to some extent lessen the pressures on wages so that Costa Rica can enjoy the cost advantage relative to other countries for a little longer.

While ensuring enough supply of human capital is an important issue, Costa Rica needs to start paying more attention to quality of education. Currently the quality of lower level education (including technical education) seems to be adequate. However, looking into future, the most valuable asset of Costa Rica would be high quality human capital. Raising quality of tertiary education, especially of research would typically require a long gestation period. Initiating actions right now seems to be fruitful, although such efforts needs to be highly selective and focused on only a university or even a handful of departments.

Many MNCs expressed their desires to embark on more R&D related activities in Costa Rica. However, they have not done so yet because of the lack of human capital, especially with tertiary and above degrees in statistics, materials and biomedical sciences, and good understanding on GMP. This is reflected in still low level of innovation outputs in Costa Rica (more on the innovation capability will be discussed in a later section). Further emphasis on this area as well as improving the availability and quality of human capital in Costa Rica would need to be pursued as a nucleus of long-term growth strategy. By doing so, Costa Rica can improve its position as an attractive location for investment even when wages are rising.

Deficiencies in physical infrastructure

Interviews with firms pointed out some deficiencies in the provision of infrastructure. The quality of road transport and utility (the price of electricity) seem to be high on the minds of business firms. If Costa Rica is to pursue an export-oriented strategy (especially manufactured goods), then transportation and logistics infrastructure needs to be in good conditions. This is especially so for the seaport facilities. Currently the deficiency in this is glaring and it needs to be revamped significantly to stay competitive.

These problems are all addressed in a plan to build new container terminal by APM Terminals. Definitely Costa Rica needs to upgrade its port facilities and the new plan by APM Terminals is suitable to do so. It will provide a manmade shield to ensure the safety of ships under most weather conditions, will provide deeper ports for larger ships to be able to dock, will provide electrical outlets for refrigerated containers, and will provide expanded container yards, and will be equipped with more cranes. All of these are in place to address the current shortcomings. It is also commendable that the new port will be developed on reclaimed land so as to minimize the environmental impacts of new port development.

If the plan moves smoothly, the new terminal will be successful mainly because it will be a replacement of Port of Limon for container handling despite the rather high handling fee. Even if the seaports are expanded through the APM terminal project,[7] other complementary investment in infrastructure is necessary to take full advantage of this expansion. Especially of importance are the improvements in road and railroad infrastructure. Currently the main conduit connecting San Jose and Limon is Route 32. However, the capacity of the road is rather limited. Expansion of this route is needed. In addition, rehabilitation of railroad for freight use could be also explored. By doing so, it would be able to alleviate some of the congestions experienced on Route 32.

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[7] Another project, the AMEGA project focuses on the transshipment business, which is expected to generate 1,000 employment when in operation. If this project proceeds and is successful, then this will create additional need to develop transportation infrastructure linking APM terminal and AMEGA project along the coast lines of Moin. If such situation develops, care need to be paid to environmental impacts as well as devising the most cost effective way to transport containers between these two terminals.

Given that in many other countries, new port developments are almost always combined with development of an industrial estate near the port, Costa Rica should also explore the possible establishment of export-oriented industrial zones near the new container terminal. This will significantly reduce costs associated with logistics, especially given the current limitation on the road capacity. Furthermore, this would lead to employment generation. That should assist a smoother transition from Limon port to the APM terminal, which would employ only about 700 people when in operation.

In addition to the improvements in seaport capacity, the airport capacity also needs to be expanded in future. Given that the current location does not offer any opportunity for further expansion, a new location needs to be identified. Expansion of the airport should be also complemented by the effort to increase direct flights to major markets so as to offer opportunities to expand the direct cargoes in the belly.

These investments in above-mentioned hard infrastructure need to be complemented by continuing investments in soft infrastructure. These include improvements in the system used by the Custom agency and also the number of agricultural inspectors. From the interview, it is apparent that many have appreciated the new system introduced by the General Directorate of Customs. However, there have been many complaints about instability of the system, especially during the weekend. Since many exporters prepare their documents and arrange for shipping during the weekends, the system needs to improve its stability so that it will be continuously available during the weekends.

In addition, some concerns on the lack of the number of agricultural inspectors were voiced. Given that agriculture and horticulture exports are important to Costa Rica, alleviating this bottleneck is needed if the expectation is to increase the exports of these commodities.

Likewise, energy policy is an important element of industrial policy and increasingly environmental policy. How to manage the increase in energy demand commensurate with rising income will likely to influence future course of development in Costa Rica. With the growth of an economy and with expansion of seaports and export activities, the demand for energy, especially of electricity will only increase.

To increase the electricity supply, continuous investments in electricity generation is needed.   Costa Rica should be mindful of maintaining its green image and such expansion of electricity capacity should be met mainly from renewable sources.   In addition, if Costa Rica's government is considering this opportunity as a way in which to develop local capabilities in renewable energy sector, more attention could be paid to the development of ocean energy.   The technology for ocean energy is not yet firmly established and because of this, there is still room for domestic firms to enter this sector, relative to other renewable sources such as solar and wind where the industry is already entrenched by incumbent MNCs.

From discussions with these key stakeholders, it is apparent that Costa Rica would need to invest significantly on physical infrastructure in order to maintain and to improve its export competitiveness.   However, at the same time, Costa Rica needs to be rather careful in choosing the right partners so as not to tarnish her reputation as environmentally friendly and conscious country.   By far, this is the most competitive asset that Costa Rica possesses.   The need to invest in infrastructure has to be balanced with considerations regarding sustainability and environmental impact.   This may result in investment being more expensive upfront compared to alternatives.   However, if such infrastructure project lead to significant negative environmental impacts, it could significantly tarnish the reputation of Costa Rica as a green country and regaining the good reputation would be hard if not impossible.   If Costa Rica loses its reputation as an eco-friendly and conscious country, it will be just another small "brown" country and lose its distinctiveness.   This will have large negative impacts on tourism and also on the attractiveness of Costa Rica for foreign direct investment (FDI).   Therefore, it is advisable for Costa Rica to choose reputable and environmentally conscious partners for infrastructure development projects.

Absence of similar countries in the region

Even though Costa Rica enjoys an advantage conferred from its geographical location, one missing element is an absence of suitable partner countries in the region. Because of this, it will be quite difficult for Costa Rica to make significant inroads into more established high-volume production networks such as electronics (broadly defined,

including semiconductors). There are two reasons for this assessment. First, the supply chain associated with electronics is well-developed and much of this is located in East Asia. As a diversification strategy of MNCs, they may decide to locate some of the production facility to Costa Rica or other countries in Latin America. However, such flow would be small. Secondly, Costa Rica is currently relatively isolated in terms of geographical location. While in terms of pure geographical terms, Costa Rica is well situated, in terms of regional production networks, Costa Rica is, at least currently, a lone player, dealing directly with major markets (the U.S. and EU) in both imports of necessary inputs and exports of (semi-)finished goods. There are no other countries in vicinity that are taking part of the production network that Costa Rica belongs to, with perhaps Mexico as an exception in some cases. This is a stark contrast to the shape of production networks in East Asia where many countries in the region tend to participate in some stages of production.

What can be done?

Costa Rica will need to fully utilize its potential to export based on the locational advantage and attractiveness to foreign direct investment as well as improvements in innovation capabilities. One way to improve her trade performance is to use free trade agreements effectively. In fact, Costa Rica has embarked on adopting free trade agreements in recent years and the next section examines their impacts.

IV. The impact of free trade agreement implemented by Costa Rica

Costa Rica is a small open middle-income economy that largely depends on exports for its growth. To promote exports, the Costa Rican government negotiated a number of FTAs with its main trade partners. The first free trade agreement (FTA) signed in 1963 with the countries of Central America and the two of the most recent FTAs are the Dominican Republic-Central America FTA (DR-CAFTA)[8] and the FTA with China, signed in 2009 in 2011 respectively. Table 7 lists the FTA partners and the dates of agreements.

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[8] On DR-CAFTA, see Jaramillo and Lederman (2006).

Table 7: A list of free trade agreement implemented by Costa Rica

Name of FTA	Year of FTA	Date of FTA	Country name
Central America	1963		Costa Rica
Central America	1963		El Salvador
Central America	1963		Nicaragua
Central America	1963		Guatemala
Central America	1963		Honduras
Mexico	1995		Mexico
Canada	2002		Canada
Chile	2002		Chile
Dominican Republic	2002		Dominican Republic
Caricom	2005		Antigua and Barbuda
Caricom	2005		Barbados
Caricom	2005		St. Kitts and Nevis
Caricom	2005		Trinidad and Tobago
Caricom	2005		Belize
Caricom	2005		St. Lucia
Caricom	2005		Grenada
Caricom	2005		Dominica
Caricom	2005		Guyana
Caricom	2005		Jamaica
Caricom	2005		St. Vincent and the Grenadines
Caricom	2005		Suriname
Panama	2008		Panama
DR-CAFTA	2009	Jan. 1st	Costa Rica
DR-CAFTA	2009	Jan. 1st	El Salvador
DR-CAFTA	2009	Jan. 1st	Nicaragua
DR-CAFTA	2009	Jan. 1st	Guatemala
DR-CAFTA	2009	Jan. 1st	Honduras
DR-CAFTA	2009	Jan. 1st	Dominican Republic
DR-CAFTA	2009	Jan. 1st	United States
China	2011	Aug. 1st	China

This section attempts to quantify the effects of these two most recent FTAs on the export patterns of Costa Rican firms. We use the export data at the firm-destination-product level over the period of 2008-2012 obtained from PROCOMER, the export promotion agency of Costa Rica, to test whether Costa Rica's *(i)* export flows to the Dominican Republic and Central America increased after the implementation of the DR-CAFTA in 2009; *(ii)* export flows to China increased after the implementation of FTA with China in 2011; *(iii)* firms or industries experience heterogeneous effects from these two FTAs.

We employ the difference-in-difference estimation strategy to the traditional gravity model of international trade to be able to compare Costa Rican export flows to its FTA

partners pre- and post- FTA implementation with the export flows to other countries pre- and post- FTA implementation. We use two different underlying estimators under the difference-in-difference framework, the traditional OLS estimator and the Poisson pseudo-maximum-likelihood (PPML) estimator, to be able to control for zero export flows.

Our main empirical result suggests that the implementation of DR-CAFTA in 2009 increased export volume to the partner countries only for relatively large Costa Rican exporters (with larger than the median value of employment size), while the FTA with China in 2011 did not seem to benefit Costa Rican exporters, at least within a year after its implementation.

Our empirical results are based on a relatively short panel of export data, the years of 2008-2012, which makes it empirically hard to capture the full effects of these two most recent FTAs. To estimate the longer term effects of DR-CAFTA and the FTA with China and to evaluate the effects of the earlier FTAs the panel needs to be extended to include the previous years as well as the latest years of trade data. Also, within the analyzed period, the Costa Rican economy experienced the repercussions of the global financial crisis of 2008 as most of the world economies. The export flows by Costa Rican firms contracted by more than 2% in 2008 and more than 6% in 2009, resulting in the 1% decline of GDP growth rate in 2009 (see Table 8 for the exports and GDP values of Costa Rica in real terms), which makes it even harder to capture the effects of the two most recent FTAs within the analyzed period, despite attempts to control for the crisis.

The next section describes the data used in this study, followed by the discussion on our analysis and concluding remarks.

Table 8: Real export and real GDP values

Year	Export in constant 2005 bil. USD	Export growth in constant 2005 USD	GDP in constant 2005 bil. USD	GDP growth in constant 2005 USD
2008	11.50	-2.01%	24.08	2.73%
2009	10.81	-6.02%	23.84	-1.02%
2010	11.41	5.54%	25.02	4.95%
2011	12.10	6.07%	26.13	4.43%
2012	13.13	8.49%	27.47	5.13%

Source: the World Bank's WDI database.

Data

The data for this study is provided by PROCOMER, the export promotion agency of Costa Rica, which support the work of the Ministry of Foreign Trade. The original firm-level dataset includes export flows from Costa Rican firms over the period of 2008-2012, differentiated by a destination country and the 8-digit Harmonized System (HS) codes for the export products. We choose to structure our data at the firm-destination-product level to be able to utilize the number of firm-specific characteristics included in the original PROCOMER's dataset. We will include such firm-specific characteristics as the level of a firm's employment and the number of business years in our empirical gravity model to account for the firm's size and age. Firms that are larger or more mature may choose different export strategies compared to smaller or younger firms.

Table 3 shows our main variable, the export flows by Costa Rican firms, aggregated by year. This table also compares PROCOMER's export flows with the publicly available BoP's annual export of goods and services (in current USD dollars) from the World Bank's WDI database. Given that the data from PROCOMER includes only the firms from the special economic zones in Costa Rica, we expect the aggregated export flows from PROCOMER to be smaller than the WB's export values. Indeed, the annual export values in PROCOMER's dataset are smaller by approximately 10% on average compared to the World Bank's WDI annual export values, but notably the annual changes in the export flows follow the same dynamics[9].

Table 9: Nominal export values

Year	Export in current bil. USD (PROCOMER)	Export in current bil. USD (WDI)
2008	9.57	10.17
2009	8.62	9.67
2010	9.47	10.60
2011	10.38	11.58

[9] For the detailed description of PROCOMER's export data see Lederman, Rodriguez-Clare and Xu (2010).

| 2012 | 11.35 | 12.73 |
| Total | 49.39 | 54.74 |

Source: PROCOMER's data and the World Bank's WDI database.

Table 10 presents the export values by Costa Rican industries in 2008-2012. The *Manufacturing* industry as a whole exported almost 29 billion USD of products within this period, or approximately 60% of the total value of exports by Costa Rican firms over the period of 2008-2012. The other two largest exporting industries are *Agriculture, forestry and fishing* with 13% of total export value and *Wholesale and retail* with 9% of total export value within 2008-2012.

Table 10: Export by Industry for 2008-2012

Industry	Export in bil. USD	Share of total export
Manufacturing	28.87	58.44%
Agriculture, forestry and fishing	6.40	12.97%
Wholesale and retail trade; repair of motor vehicles and motorcycles	4.47	9.06%
Professional, scientific and technical activities	0.57	1.15%
Water supply; sewerage, waste management and remediation activities	0.13	0.26%
Other service activities	0.13	0.26%
Construction	0.09	0.19%
Administrative and support service activities	0.07	0.14%
Information and communication	0.06	0.12%
Transportation and storage	0.04	0.09%
Financial and insurance activities	0.03	0.05%
Human health and social work activities	0.01	0.02%
Mining and quarrying	0.01	0.02%
Education	0.01	0.01%
Real estate activities	0.00	0.00%
Accommodation and food service activities	0.00	0.00%
Electricity, gas, steam and air conditioning supply	0.00	0.00%
Arts, entertainment and recreation	0.00	0.00%
Public administration and defense; compulsory social security	0.00	0.00%
Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use	0.00	0.00%
Activities of extraterritorial organizations and bodies	0.00	0.00%

Source: PROCOMER's data

Table 11 further shows the shares of exporting industries within the *Manufacturing* industry as a whole. *Manufacture of computer, electronic and optical products* is the

biggest exporting industry in Costa Rica in 2008-2012 with almost 15% of total export value within 2008-2012.

Table 11: Export by Manufacturing Industry for 2008-2012

Industry	Export in bil. USD	
Manufacture of computer, electronic and optical products	7.20	14.57%
Other manufacturing	5.66	11.46%
Manufacture of food products	5.30	10.74%
Manufacture of rubber and plastics products	1.90	3.84%
Manufacture of electrical equipment	1.86	3.76%
Manufacture of wearing apparel	0.90	1.82%
Manufacture of chemicals and chemical products	0.90	1.81%
Manufacture of paper and paper products	0.82	1.65%
Manufacture of basic pharmaceutical products and pharmaceutical preparations	0.69	1.40%
Manufacture of fabricated metal products, except machinery and equipment	0.68	1.37%
Manufacture of other non-metallic mineral products	0.65	1.31%
Manufacture of basic metals	0.56	1.13%
Manufacture of beverages	0.29	0.58%
Manufacture of textiles	0.26	0.53%
Manufacture of leather and related products	0.23	0.47%
Manufacture of motor vehicles, trailers and semi-trailers	0.18	0.36%
Printing and reproduction of recorded media	0.12	0.24%
Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	0.08	0.16%
Manufacture of furniture	0.06	0.13%
Manufacture of machinery and equipment n.e.c.	0.05	0.10%
Manufacture of other transport equipment	0.01	0.03%
Manufacture of tobacco products	0.00	0.01%
Manufacture of coke and refined petroleum products	0.00	0.00%

Source: PROCOMER's data

To evaluate the impact of the FTAs on the export flows by Costa Rican firms, we constructed two dummy variables, for the DR-CAFTA partners and for the FTA with China based on the information in Table 1. Since our main variable, the export flows by Costa Rican firms, is available only within the period of 2008-2012, we cannot estimate the effects of the FTAs ratified before the year of 2008. Nevertheless, to analyze whether these countries as a group receive higher export volumes in 2008-2012 compared to the rest of the export destination countries, we also construct the dummy variable for the FTA partners before 2008 and include it in our gravity model.

Table 12 and Table 13 provide additional information about the export patterns of the FTA partners of Costa Rica. The DR-CAFTA partner countries as a group received the largest volume of exports from Costa Rica in 2008-2012, while export to China has been undertaken by the largest firms in our sample. The average export volume to China by Costa Rican companies is almost 4 million USD a year, while the average export volume to other FTA partners is approximately 0.5 million USD a year[10].

Table 12: Export to FTA partners for 2008-2012

FTA	Year in effect	Export in bil. USD by Year					
		2008	2009	2010	2011	2012	Total
China	2011	0.68	0.77	0.29	0.20	0.33	2.26
DR-CAFTA	2009	4.91	4.25	5.08	5.54	6.07	25.85
Panama	2008	0.41	0.44	0.45	0.58	0.58	2.45
Caricom	2005	0.14	0.13	0.15	0.11	0.12	0.65
Dominican Republic	2002	0.23	0.19	0.24	0.16	0.20	1.02
Chile	2002	0.02	0.02	0.04	0.02	0.03	0.13
Canada	2002	0.05	0.05	0.08	0.09	0.07	0.35
Mexico	1995	0.24	0.20	0.25	0.32	0.32	1.33
Central America	1963	1.31	1.14	1.36	1.50	1.59	6.90

Source: PROCOMER's data

Table 13: Average Export Volume at the Firm level by FTA partners for 2008-2012

FTA	Year in effect	Export in mil. USD by Year					
		2008	2009	2010	2011	2012	Total
China	2011	6.30	8.34	2.38	1.58	2.47	3.91
DR-CAFTA	2009	1.11	1.00	0.99	1.08	1.16	1.07
Panama	2008	0.49	0.48	0.39	0.45	0.47	0.45
Caricom	2005	0.34	0.32	0.33	0.30	0.31	0.32
Dominican Republic	2002	0.82	0.68	0.76	0.53	0.63	0.68
Chile	2002	0.20	0.18	0.28	0.16	0.18	0.20
Canada	2002	0.27	0.21	0.34	0.36	0.26	0.29
Mexico	1995	0.91	0.76	0.72	0.97	0.95	0.86
Central America	1963	0.47	0.43	0.44	0.49	0.51	0.47

Source: PROCOMER's data

To build our final panel dataset we combine the firm-level data from PROCOMER with the dummy variables for the FTA partners as well as the country-level characteristics

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[10] See Table 1 of the Appendix for the export volumes to all trade partners of Costa Rica. The FTA partners are marked in grey.

about GDP, population, distance, and continuity. The traditional gravity control variables are obtained from the CEPII dataset.[11]

Empirical Analysis

The purpose of the empirical analysis is to test whether Costa Rica's *(i)* export flows to the Dominican Republic and Central America increased after the implementation of the DR-CAFTA in 2009; *(ii)* export flows to China increased after the implementation of the FTA with China in 2011; *(iii)* firms or industries experience heterogeneous effects from these two FTAs.

We adopt the difference-in-differences approach and combine it with the standard gravity model to test our hypotheses. Applied to the issue of FTA effect on export pattern, difference-in-difference approach suggests that one compares the export pattern among FTA partner countries pre- and post- FTA implementation with the export pattern among control countries pre- and post- FTA implementation. The role of FTA is identified as the estimated difference in difference of trade volumes pre- and post- FTA implementation between the two groups of countries.

Based on the standard gravity model (1), the value of exports from Costa Rica to country i in year t, denoted by $E_{i,t}^{CR}$ is proportional to the product of the two countries' GDPs, denoted by $Y_{i,t}$ and Y_{t}^{CR} and is inversely proportional to $D_{i,t}$, the distance between the CR and the other country:

(1) $$E_{i,t}^{CR} = e^{\alpha} \times (Y_{i,t})^{\alpha_1} \times (Y_{t}^{CR})^{\alpha_2} \times (D_{i,t})^{\alpha_3} \times e^{\eta_{i,t}^{CR}},$$

where α, α_1, α_2 and α_3 are unknown parameters, and $n_{i,t}^{CR}$ is an error term. We apply the difference-in-difference method to the gravity model (1) by including the dummy variable for the FTA treatment group, $FTAtreat_i$, the dummy variable for the post- FTA years, $Post_t$, as well as the interaction of these two dummies,

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[11] The CEPII dataset can be accessed via:
http://www.cepii.fr/CEPII/en/bdd_modele/presentation.asp?id=8

$(FTAtreat \times Post)_{i,t}$. We also include the vector of firm-specific characteristics (the age of a firm and its employment level), $\lambda X_{j,t}$, to obtain our baseline estimation equation:

(2)
$$E_{i,j,t}^{CR} = \exp\left(\alpha + \beta\, FTAtreat_i + \gamma Post_t + \delta(FTAtreat \times Post)_{i,t} + \lambda X_{j,t}\right) \times$$
$$(Y_{i,t})^{\alpha_1} \times (Y_t^{CR})^{\alpha_2} \times (D_{i,t})^{\alpha_3} \times \exp\left(\eta_{i,j,t}^{CR}\right)$$

,

Provided $E_{i,j,t}^{CR}$ is strictly positive, we can log-linearize the above equation to obtain our main specification, the linear gravity equation for the firm-level panel data:

(3) $\mathrm{Ln}\, E_{i,j,t}^{CR} =$

$$\alpha + \beta\, FTAtreat_i + \gamma Post_t + \delta(FTAtreat \times Post)_{i,t} + \lambda X_{j,t} + \alpha_1 \ln Y_{i,t} +$$
$$\alpha_2 \ln Y_t^{CR} + \alpha_3 \ln D_{i,t} + \eta_{i,j,t}^{CR}$$

.

Our coefficient of interest is δ and it measures the impact of the FTA (either DR-CAFTA or the FTA with China) on the log of the value of exports by Costa Rican firms to its FTA partners. If δ is positive and significant, the export volume from Costa Rica to its FTA partners increase after the implementation of the FTA .

Given that equation (3) can only be used to estimate regressions with strictly positive non-zero exports, we also use the Poisson pseudo-maximum-likelihood estimator (PPML) proposed by Santos Silva and Tenreyro (2006) to estimate the equation (2), so that zero exports can also be included in our analysis.

While the PPML estimates are consistent even in the presence of heteroscedasticity, if certain exports are incorrectly reported as zeros, the PPML estimates may be biased. Moreover, the interpretation of the coefficients on the interaction terms in the PPML model is not straightforward. Thus, we report both OLS and PPML estimates. To be able to compare the estimation results based on these two methods we need to keep the number of observations equal in both OLS and PPML samples. We choose to transform

the OLS sample to include zeros as well by adding one to the export volumes before taking the log.

Firm- and industry-level heterogeneity of the treatment effect of DR-CAFTA

Table 14 presents the OLS and the PPML estimation results for the DR-CAFTA implemented in 2009. Firstly, we report the OLS and PPML estimates in Column (1) and Column (4) without including any firm-specific characteristics or other gravity control variables to compare the performance of these two estimators on the largest possible sample with all the zero export values included. Given that the coefficients on the interaction terms in the PPML model cannot be interpreted literally, we further focus on interpreting the OLS estimates, but include the PPML results as a robustness check.

In Column (2) we estimate our main linear gravity equation (3) and include the firm-level characteristics (the log of employment and the years of business) as well as the standard gravity control variables (GDP, population, distance, contiguity and the language). The number of observations drops significantly, from more than 3 million observations in the OLS regression in Column (1) to approximately 1.4 million observations in the regression in Column (2). This is because there are a lot of missing values in the $Log\ of\ employment$ variable.

Our coefficient of interest on the interaction term, $Post \times CAFTA\ partners$, is negative and statistically significant, which implies that the implementation of DR-CAFTA decreased the export volume of the average Costa Rican firm to the DR-CAFTA partner countries since 2009. Another way to interpret this finding is that while some exporting firms increased their exports following DR-CAFTA, other firms decreased their export volume, such that the total effect is negative. The PPML estimates in Column (5) support this finding.

To test for this heterogeneous response by exporting firms to the implementation of DR-CAFTA we analyze whether the treatment effect of DR-CAFTA differs depending on a firm's size (measured as the log of employment). We thus include the triple interaction term, $Post \times CAFTA\ partners \times Log\ of\ employment$ in our main

specification (3). The results of the extended model are presented in Column (3) of Table 14.

Table 14: Difference-in-Difference Estimate for CAFTA

Dependent variable: log of export for OLS and Export for PPML

Variable	OLS (1)	OLS (2)	OLS (3)	PPML (4)	PPML (5)	PPML (6)
Years after CAFTA	-0.010***	-0.0012	-0.0082	-0.19*	0.29	0.29
	(0.0026)	(0.0056)	(0.0054)	(0.074)	(0.16)	(0.16)
CAFTA	1.94***	1.81***	1.81***	4.30***	1.72***	1.72***
	(0.038)	(0.059)	(0.059)	(0.23)	(0.21)	(0.21)
Post × CAFTA	-0.29***	-0.26***	-2.16***	0.025	-0.19	-0.75**
	(0.027)	(0.047)	(0.15)	(0.079)	(0.12)	(0.28)
FTA partners before 2008	0.093***	-0.0098	-0.0096	-1.71***	0.43*	0.43*
	(0.0098)	(0.012)	(0.012)	(0.30)	(0.20)	(0.20)
Log of employment	-	0.095***	0.073***	-	0.93***	0.88***
	-	(0.0068)	(0.0061)	-	(0.078)	(0.086)
Years of business	-	0.00022	0.00022	-	-0.0079	-0.0080
	-	(0.00049)	(0.00049)		(0.0056)	(0.0056)
Log of GDP	-	0.095***	0.095***	-	1.02***	1.02***
	-	(0.0039)	(0.0039)	-	(0.079)	(0.079)
Log of population	-	-0.0058**	-0.0058**	-	-0.50**	-0.50**
	-	(0.0019)	(0.0019)	-	(0.089)	(0.089)
Log of distance	-	-0.22***	-0.22***	-	-0.95***	-0.95***
	-	(0.0080)	(0.0080)	-	(0.18)	(0.18)
Contiguity	-	1.86***	1.86***	-	0.85***	0.85***
	-	(0.057)	(0.057)	-	(0.23)	(0.23)
Spanish language	-	-0.12***	-0.12***	-	0.30	0.30
	-	(0.015)	(0.015)	-	(0.18)	(0.18)
Post × CAFTA × Log of employment	-	-	0.52***	-	-	0.092
	-	-	(0.037)	-	-	(0.053)
Constant	0.11***	-0.47***	-0.39***	9.19***	-5.54***	-5.26**
	(0.0038)	(0.079)	(0.080)	(0.37)	(1.66)	(1.71)
Number of observations	3210420	1399665	1399665	3210420	1399665	1399665
R-squared	0.063	0.12	0.13	-	-	-

Standard errors in parentheses

* p<0.05   ** p<0.01   *** p<0.001"

Importantly, both interaction terms are significant in the extended specification which signifies a good addition to the model. To interpret the coefficient on the triple interaction

term and see if the size of a firm matters in realizing the beneficial effects of DR-CAFTA we calculate the derivative of the underlying equation in Column (3) with respect to the DR-CAFTA treatment and evaluate it at the post- FTA implementation years (i.e., $Post = 1$). Thus, we get the following equation:

$$\frac{d\,Ln E_{i,j,t}^{CR}}{d\,CAFTA\;partners} = -2.16 + 0.52 \times Log\;of\;employment.$$ Using the information

on the distribution of the $Log\;of\;employment$ variable from Table 15, we then calculate the treatment effect of DR-CAFTA at different employment levels to check the sign and the magnitude of the derivative.

Table 15: The distribution of the Log of employment

	Percentiles	Smallest		
1%	0	0		
5%	1.386	0		
10%	1.946	0	Obs.	40422
25%	3.045	0	Sum of Wgt..	40422
50%	4.263		Mean	4.215
		Largest	Std. Dev.	1.755
75%	5.525	9.146		
90%	6.479	9.146	Variance	3.082
95%	6.921	9.146	Skewness	-0.150
99%	8.007	9.146	Kurtosis	2.667

Source: PROCOMER's data

Based on this exercise, the firms with the log of employment larger than 4.263 (i.e., the 50th percentile of the Log of Employment distribution) increased their export flows following the implementation of the DR-CAFTA in 2009. While interpretation of the coefficients on the interaction terms is not straightforward in PPML, the estimates are qualitatively similar, and therefore support the finding that larger firms benefited from the implementation of DR-CAFTA, while smaller firms decrease their export flows.

Table 16 further explores the heterogeneous effects from the DR-CAFTA between the exporting industries. To construct this table we estimate our preferred linear gravity equation (3), but we do it separately for all the exporting Costa Rican industries. We then

report only the industries that have the significant coefficient, δ, on the interaction term, $(FTAtreat \times Post)_{i,t}$. As Table 16 shows, some exporting industries expanded after the DR-CAFTA, while other industries that are export to the DR-CAFTA partners contracted significantly after 2009.

Table 16: Difference-in-Difference Estimate for CAFTA

Sector description	Coefficient estimate	Standard error
Other professional, scientific and technical activities	4.101	1.148
Scientific research and development	2.624	1.204
Real estate activities	2.070	0.883
Education	1.864	0.943
Programming and broadcasting activities	1.732	0.651
Manufacture of beverages	1.644	0.585
Manufacture of computer, electronic and optical products	1.142	0.480
Retail trade, except of motor vehicles and motorcycles	0.797	0.331
Wholesale trade, except of motor vehicles and motorcycles	-0.354	0.142
Warehousing and support activities for transportation	-1.645	0.575
Construction of buildings	-2.431	0.917
Information service activities	-2.534	0.095
Employment activities	-2.765	1.030
Other personal service activities	-4.038	1.838
Air transport	-4.538	0.821

Note: The table includes the sectors which show statistically significant estimates after the OLS regressions.

The FTA with China did not affect the majority of Costa Rican exporters to China

Similarly to the previous table for the DR-CAFTA treatment, Table 17 presents the OLS and the PPML estimates for the FTA with China implemented in 2011. The coefficient on the interaction term, $Post \times China\ partners$, in Column (2) is positive, but not significant. We interpret it that the average Costa Rican firm that exports to China does not benefit from this FTA implementation. This finding is robust to the alternative PPML estimation strategy, presented in Column (5).

Table 17: Difference-in-Difference Estimate for China FTA

Dependent variable: log of export for OLS and Export for PPML

Variable	OLS (1)	OLS (2)	OLS (3)	PPML (4)	PPML (5)	PPML (6)
Years after China FTA	-0.019**	0.017**	0.017**	-0.021	0.24	0.24

	(1)	(2)	(3)	(4)	(5)	(6)
	*					
	(0.0024)	(0.0052)	(0.0052)	(0.040)	(0.13)	(0.13)
China	0.16***	-0.28***	-0.28***	2.44***	-0.21	-0.21
	(0.022)	(0.034)	(0.034)	(0.71)	(0.39)	(0.39)
Post× China	0.023	0.024	-0.074	-0.96***	1.16	-1.44
	(0.020)	(0.034)	(0.11)	(0.21)	(0.65)	(1.07)
FTA partners before 2008	0.48***	0.17***	0.17***	0.82**	0.23	0.23
	(0.014)	(0.014)	(0.014)	(0.28)	(0.18)	(0.18)
Log of employment	-	0.096***	0.096***	-	0.93***	0.93***
	-	(0.0069)	(0.0068)	-	(0.079)	(0.077)
Years of business	-	0.00019	0.00019	-	-0.0083	-0.0083
	-	(0.00049)	(0.00049)	-	(0.0058)	(0.0058)
Log of GDP	-	0.092***	0.092***	-	0.98***	0.98***
	-	(0.0039)	(0.0039)	-	(0.069)	(0.069)
Log of population	-	0.044***	0.044***	-	-0.28***	-0.28***
	-	(0.0023)	(0.0023)	-	(0.081)	(0.081)
Log of distance	-	-0.37***	-0.37***	-	-1.91***	-1.91***
	-	(0.0096)	(0.0096)	-	(0.14)	(0.14)
Contiguity	-	1.97***	1.97***	-	0.023	0.023
	-	(0.058)	(0.058)	-	(0.21)	(0.21)
Spanish language	-	-0.063***	-0.063***	-	-0.80***	-0.80***
	-	(0.015)	(0.015)	-	(0.20)	(0.20)
Post × China × Log of employment	-	-	0.028	-	-	0.40
	-	-	(0.029)	-	-	(0.22)
Constant	0.12***	0.17*	0.17*	9.45***	0.85	0.88
	(0.0034)	(0.081)	(0.081)	(0.25)	(1.45)	(1.44)
Number of observations	3210420	1399665	1399665	3210420	1399665	1399665
R-squared	0.015	0.093	0.093	-	-	-

Standard errors in parentheses

* p<0.05   ** p<0.01   *** p<0.001

We also check whether the treatment effect of the FTA with China depends on a firm's size as measured by its employment. In Column (3) we include the triple interaction term, $Post \times China\ partners \times Log\ of\ employment$, to estimate the effect of a firm's size on export flows to China after the FTA in 2011. However, unlike for DR-CAFTA, we did not find that a firm's size affects the treatment effect of the FTA with China. The coefficients on both interaction terms are not significant in the extended model. This result is robust to the alternative PPML specification.

Conclusion

We employ the difference-in-difference estimation framework for the traditional gravity model of trade to quantify empirically the effects of the two most recent FTA between Costa Rica and its trading partners, the Dominican Republic-Central America FTA (DR-CAFTA) in 2009 and the FTA with China in 2011.

Our main empirical result suggests that the implementation of DR-CAFTA in 2009 increased export volume to the partner countries only for relatively large Costa Rican exporters (with larger than the median value of employment size). This result is fairly consistent with similar studies looking at the effects of FTAs or the utilization of FTAs. The results from these studies point to the need to increase the awareness and dissemination on the FTAs to small and medium enterprises. The FTA with China in 2011 did not seem to benefit Costa Rican exporters, at least within a year after its implementation. This may be because of the short period of time since the implementation of the FTA with China, we cannot detect any changes in export behavior of firms mainly due to the data limitations.

V. Innovation Capabilities in Costa Rica

Building up of an innovation capability is thought as a way to escape from the middle-income trap. In this regard, Costa Rica still has a long way to go. Often research and development (R&D) spending as a share of GDP is used to measure the inputs that are used for innovation. In this metric, Costa Rica is spending only about 0.5% of GDP on R&D, which is much lower than that of Korea which has joined high income status in 1995 (see Figure 3).[12] It is even lower compared to Malaysia which is also in the same income category as Costa Rica.

Figure 3: R&D spending as a share of GDP in Korea, Malaysia, and Costa Rica, 1996-2011

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[12] Korea, Hong Kong, Singapore, and Taiwan are the forerunners of star performers in East Asia. They all made it to high income status, riding on the electronics and semiconductor boom. On their growth experience, see for instance, Mathews and Cho (2000), Amsden (1989), and Amsden and Chu (2003).
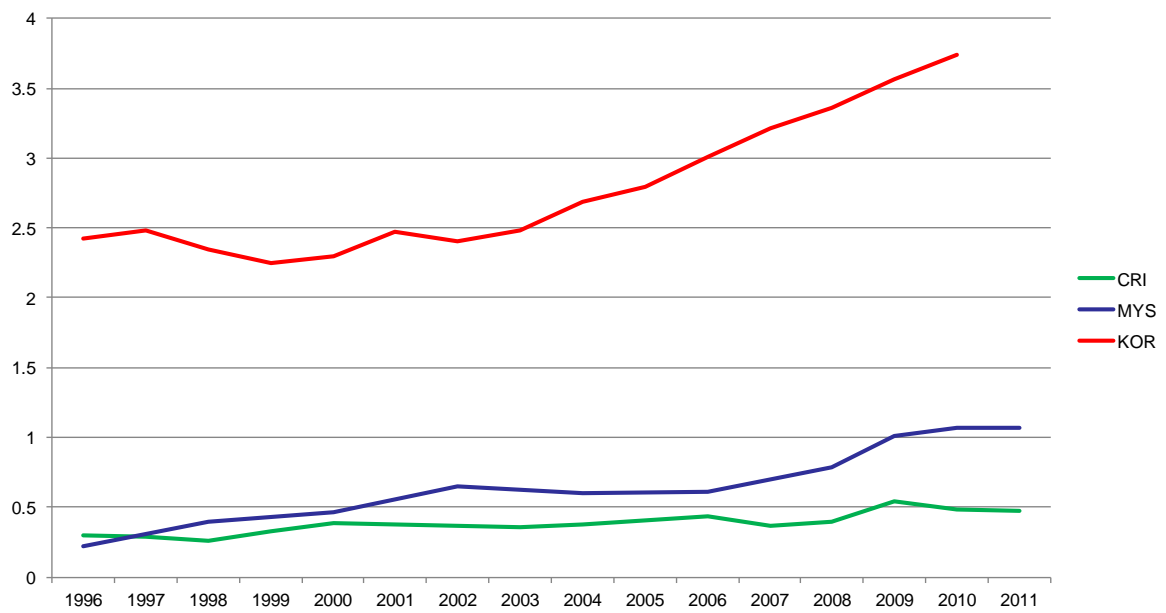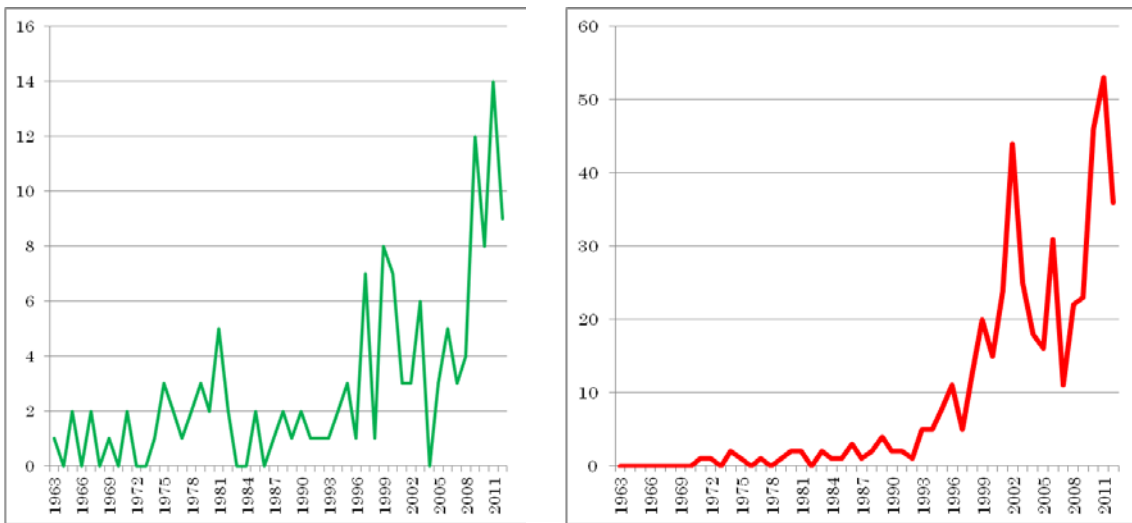
Source: Created by the author using data from World Development Indicators

R&D spending is a measure of input and because of this, R&D spending may not accurately reflect the innovation outcomes. A number of patents granted are a much better measure to actually assess the innovation outcome. However, since there exist differences among patent offices in different countries, here we utilize the data from the US Patent and Trademark Office (USPTO) so as to control for the differences in patent examination. Using this measure, one can see that patenting activities by Costa Rica is still rather low, even compared to Thailand (see Figure 4).

Figure 4: Comparison of a number of patents granted at USPTO between Costa Rica and Thailand, 1963-2011

Costa Rica   Thailand

Source: Created by the author using data from the US Patent and Trademark Office.

The patenting at USPTO can be used as a leading indicator to assess whether a country will be stuck in a middle-income trap. For instance, Korea and Taiwan made their transition to high income category in 1995 and 1993, respectively. Prior to their transition in to high income category, patenting activities have increased significantly (see Figure 5). Unfortunately, this kind of take off in innovation output is not seen yet in Costa Rica.

Figure 5: Comparison of a number of patents granted at USPTO between Korea and Taiwan, 1963-2011
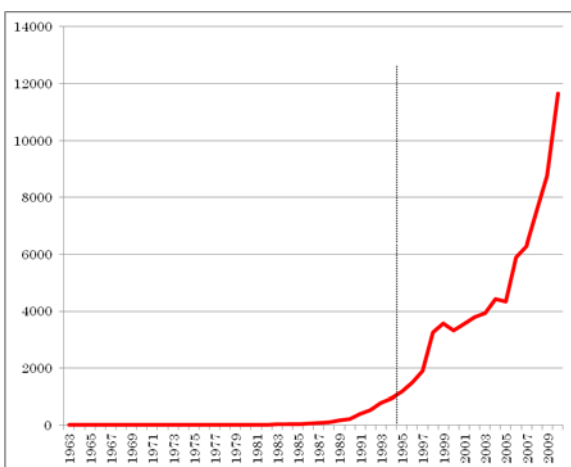
Korea   Taiwan
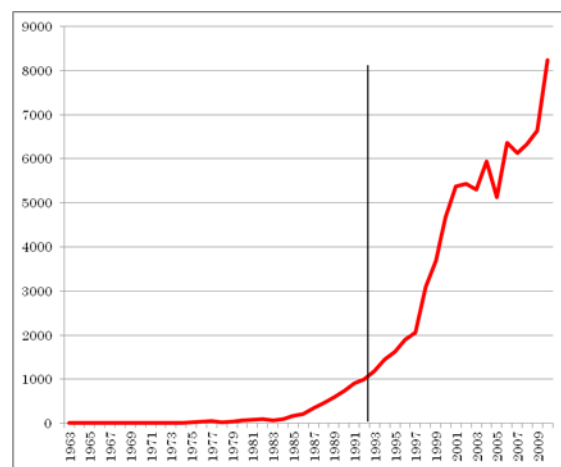
Source: Created by the author using data from the US Patent and Trademark Office.
Note: The vertical bar indicate the year when these countries were classified as high income.

Future dictions:

Given the current conditions facing Costa Rica, what should Costa Rica do? Table 18 lists suggested policy focus areas differentiated by the time horizon.   In the short-run, continuing efforts to expand FTA and attraction to FDI will be important. In order to do so, Costa Rica needs to maintain the existing strengths that were responsible for the success in attracting FDI: political and macroeconomic stability, and availability of human capital.   Political and macroeconomic stability is the most important pre-conditions for economic growth.   In terms of macroeconomic management, fiscal conditions needs to be in order.   In many countries, macroeconomic management is faltering because of the global economic slowdown.

Costa Rica has been actively seeking FTAs.   However, currently only large firms seems to benefit from FTAs. A better understanding of the lack of utilization by smaller firms is needed and policy support and assistance needs to be provided.

Table 18: Policy focus areas

Short-run	▪ Continuing efforts to expand FTA
	▪ Continuing attraction of FDI
Medium-run	▪ Development of local industries that are attached to global supply chain
	▪ Improvements in investment climate, logistics
Long-run	▪ Further development of human capital

Continuing attraction of potential MNCs producing relatively higher value-added goods that are less exposed to the previous waves of globalization such as medical devices are good options for Costa Rica.   However, this effort to attract FDI needs to be complemented by broadening exporting activities by domestic firms to deepen industrialization and to assist development of support industries.

To some extent, Costa Rica should consider better coordination among various development projects.   A more coordinated approach will bring higher payoffs than pursuing these individually.   This is especially so for logistics infrastructure since the key to modern logistics is the development of multimodal transport.   The attention to seaports needs to be complemented by improvements in road and rail infrastructure.

In addition, to better utilize the expanded capacity of the port facility, development of an industrial estate near the new port should be explored.

By far the most important and most durable source of growth for Costa Rica would be continuing emphasis on human capital development. The fact that emigration rates are relatively low, Costa Rica being an attractive location and continuous inflow of tourists all suggest that investment in human capital will be beneficial since Costa Rica would face less likelihood of brain drain. However, given the small size of Costa Rica, investment in human capital also needs to be focused and efficient. This means that communication and sharing of information among government, business, and education sectors needs to be frequent and well-coordinated. For instance, information about labor requirements can be collected systematically from MNCs and make projections (one year ahead, 5 years, 10 years ahead) of labor demand.[13] For this projection to work, coordination with educational institutes is needed. In addition, having regular forums in which government, universities, and private sectors (including MNCs) can exchange their views on future labor requirement will be beneficial. These three bodies need to work together to ensure that Costa Rica can supply necessary and qualified human capital when needed.

Improving the quality of tertiary education and above in science and engineering fields, especially in labs (a number of firms expressed the lack of hands-on experience as one key shortcomings of new hire) as well as statistics, materials and biomedical sciences, and good understanding on GMP.

In pursuing its development goals, Costa Rica should be mindful of its reputation as an environmentally friendly place. In the short-term, attention to this may raise the costs of investment. However, if looking at long-term competitiveness and the distinctiveness of Costa Rica, the country needs to adhere to the sustainability orientation. Otherwise, Costa Rica would run the risk of becoming like other small "brown" countries, vying for FDI without much to distinguish itself. Costa Rica can show to the other countries that even focusing on sustainable development, a country can post high growth rates and achieve high levels of income.

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[13] See Rasiah (2002) for the experience of Malaysia and Mori, Nguyen and Pham (2009) on Vietnam.

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Appendix

Table 1. Export by Destination Market for 2008-2012

Market	Export in bil. USD
United States	17.934
Netherlands	3.357
Panama	2.454
China	2.262
Hong Kong	2.229
Nicaragua	2.075
Guatemala	1.910
Honduras	1.559
Belgium	1.507
El Salvador	1.360
Mexico	1.330
Dominican Republic	1.016
United Kingdom	0.957
Malaysia	0.860
Puerto Rico	0.826
Germany	0.763
Italy	0.709
France	0.416
Japan	0.415
Taiwan	0.371
Canada	0.352
Spain	0.313
Republic of Korea	0.288
Trinidad and Tobago	0.270
Colombia	0.270
Bolivarian Republic	0.255
Singapore	0.196
Ireland	0.195
Portugal	0.193
Jamaica	0.191
Ecuador	0.170
Australia	0.169
Sweden	0.165
Brazil	0.162
Russian Federation	0.158
India	0.134
Chile	0.132
Peru	0.107
Cuba	0.103
Netherlands Anti	0.083
Argentina	0.071
Viet Nam	0.069
unknown	0.067
Bahamas	0.063
Turkey	0.061

Barbados	0.061
Democratic Peopl	0.061
Haiti	0.060
Philippines	0.051
Belize	0.043
Suriname	0.040
Greece	0.034
Israel	0.034
Thailand	0.032
Saudi Arabia	0.030
Aruba	0.029
Cameroon	0.028
Norway	0.024
Indonesia	0.023
Finland	0.020
United Arab Emir	0.020
Switzerland	0.018
Guyana	0.015
Islamic Republic	0.013
Martinique	0.011
Guadeloupe	0.010
Denmark	0.010
Poland	0.010
Bermuda	0.010
South Africa	0.010
Uruguay	0.009
Saint Lucia	0.009
Cayman Island	0.008
Bolivia	0.007
Hungary	0.007
Mozambique	0.006
New Zealand	0.006
Antigua & Barbuda	0.005
Romania	0.005
Morocco	0.005
Austria	0.004
Libya	0.004
Dominica	0.004
Tunisia	0.003
Ukraine	0.003
Saint Kitts and Nevis	0.003
Lebanon	0.003
Bulgaria	0.003
Grenada	0.003
Malawi	0.003
Paraguay	0.002
Egypt	0.002
French Guiana	0.002
Saint Vincent and the Grenadines	0.002
Ghana	0.002
Cote dlvorire	0.002

Slovenia	0.002
Sri Lanka	0.002
Virgin Islands,	0.002
Oman	0.001
Pakistan	0.001
Gabon	0.001
Latvia	0.001
Eritrea	0.001
Nigeria	0.001
Cambodia	0.001
Yemen	0.001
Qatar	0.001
Andorra	0.001
Reunion	0.001
Slovakia	0.001
Angola	0.001
Zambia	0.001
Lithuania	0.001
Bosnia and Herze	0.001
Tanzania	0.001
Afghanistan	0.001
Myanmar	0.001
Kenya	0.000
French Polynesia	0.000
New Caledonia	0.000
Bangladesh	0.000
Syrian Arab Repu	0.000
Albania	0.000
Congo	0.000
Curacao	0.000
Czech Republic	0.000
Iceland	0.000
Ethiopia	0.000
Georgia	0.000
Jordan	0.000
Cyprus	0.000
Kuwait	0.000
Papua New Guinea	0.000
Armenia	0.000
Turks and Caicos	0.000
Malta	0.000
Luxembourg	0.000
Mongolia	0.000
Gibraltar	0.000
Guam	0.000
Holy See	0.000
Virgin Islands	0.000
Uganda	0.000
Pitcairn	0.000
United States Mi	0.000
Senegal	0.000

Sao Tome and Pri	0.000
Algeria	0.000
Sierra Leone	0.000
The Democratic R	0.000
Togo	0.000
Iraq	0.000
Croatia	0.000
Federal States o	0.000
Burundi	0.000
Saint Pierre and	0.000
Mayotte	0.000
Macao	0.000
Bahrain	0.000
Benin	0.000
Monaco	0.000
Anguilla	0.000
Saint Helena, As	0.000
Mauritania	0.000
Macedonia	0.000
Liberia	0.000
Mauritius	0.000
Heard Island and	0.000
Palau	0.000
Equatorial Guine	0.000
Fiji	0.000
Liechtenstein	0.000
Mali	0.000
Zimbabwe	0.000
Maldives	0.000
Uzbekistan	0.000
Kazakhstan	0.000
Belarus	0.000
Yugoslavia	0.000
Niue	0.000
Vanuatu	0.000
Burkina Faso	0.000
Tajikistan	0.000
Central African	0.000
Swaziland	0.000
Rwanda	0.000
Samoa	0.000

Source: PROCOMER's data