

The Role of Extensive and Intensive Margins and Export Growth

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Abstract

We investigate and compare countries based on their extensive and intensive export margins. At the extensive margin we investigate the rate at which countries form new export relationships, while at the intensive margin we investigate countries' ability to maintain and deepen their relationships. We perform counterfactual exercises where we ask how different exports of each country would be had they been able to match the US and South Korean performance on the intensive and extensive margin. We find developing countries would have had higher export growth were they able to maintain their relationships as well as the US and South Korea did. More countries would benefit from having South Korea's deepening rate than the US's, while countries are rather similar in their ability to establish new relationships.

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1 Introduction

While economists have long examined trade patterns at the aggregate level the recent availability of disaggregated data has increased the interest in a more careful accounting of changes in patterns of trade. The result has been a number of papers examining intensive and extensive margins of international trade. The extensive margin refers to the breadth of international trade capturing the number of trade partners a country has. The intensive margin refers to the depth of international trade capturing the value of trade. Our goal is to make a contribution to this literature by examining how countries differ at the intensive and extensive margins and the importance of each margin for the growth of trade. We are particularly interested in examining differences between developed and developing countries.

We examine disaggregated bilateral exports of twenty seven countries between 1975 and 2003. We define the extensive margin similarly to the existing literature – the number of trade relationships a country has. Our definition of the intensive margin presents an innovative element to our analysis. While other researchers defined the intensive margin as the volume of trade involving existing trade partners and examined its price and quantity components, we define it to capture the intensity of existing trade relationships. The intensity of a relationships depends on how long it is maintained, its survival or duration, and its ability to grow or deepen. We decompose the intensive margin into those two components: survival and deepening. To our best knowledge, the intensive margin has not been examined from this angle. We use the information about the extensive and intensive margins at the disaggregated level and

project them onto aggregate exports to evaluate which margin (and its component) is key to achieving a higher growth rate of aggregate exports.

We first characterize the extensive and intensive margin in turn. We find all countries experienced a growth in the extensive margin, but to varying degrees. Since we introduce a new decomposition of the intensive margin into survival and deepening dimensions, we spend more time examining the intensive margin. We show countries differ at the intensive margin as well, but in a different way than at the extensive margin. While developing countries experience a larger growth in the extensive margin of their exports, they lag significantly behind developed countries in the intensive margin performance.

We next examine how important each margin is for the aggregate growth of exports and how differences across countries in the two margins affect their export growth. We decompose exports into the extensive margin and the survival and deepening dimensions of the intensive margin. Decomposition allows us to pose the following counterfactual question: how would a country's exports have grown over the last forty years had it had a different performance at the extensive and intensive margins? This question has three answers as we can in turn apply the counterfactual performance in three areas. On the intensive margin we pose two questions: how would a country's exports differ were it able to maintain (survive) and deepen (grow) its trade relationships at counterfactual rates? On the extensive margin we examine how a country's exports would differ were it able to form new trade relationships at the counterfactual rate. We apply counterfactual values to each dimension in turn, holding each country's actual performance in the other two constant.

Since we are particularly interested in differences between developed and developing countries, we focus primarily on developing countries of Latin America and Asia. We use two sets of counterfactual values, applying the US and the South Korean experience to every other country. The US is a representative developed country with a superior survival dimension of the intensive margin. South Korea is a representative successful developing country which has made great strides in the extensive margin and the deepening dimension of its intensive margin. We find that the key element to achieving higher aggregate export growth are longer relationships and hence higher relationship survival rates.

Our results indicate most countries would have benefited from having the US exports survival rate by having 1%–10% higher annual growth rate of exports. While some countries would benefit from the US deepening rate, most countries would not. Having the US deepening rate would have resulted in 1%–8% lower annual export growth rate for the former. The latter would have had around 2% higher annual export growth rate. Similarly, most countries outperform the US on the extensive margin by creating new relationships at a higher rate. Having the US entry rate would have resulted in at worst a 2% lower and at best a 0.5% higher annual export growth rate.

Replicating the South Korean experience would have resulted in much lower, but still positive, gains from having South Korea's survival, up to 2% higher annual growth rate. South Korea deepens its relationships at a rate higher than the US, resulting in larger gains if other countries can match the South Korean success. The gains are between 3% and 13% of additional annual growth rate. Only India, East Asian

Tigers, and Mexico would not benefit from South Korean deepening. Differences on the extensive margin are even smaller than was the case with the US.

Studies of extensive and intensive margins have been motivated by a variety of reasons. Trade models usually predict larger economies will export more than smaller economies. Hummels and Klenow (2005) examine a number of models and their predictions about how larger economies export more. They identify three dimensions along which these models predict countries' trade differs: intensive, extensive, and quality margins. The intensive margin is emphasized by models assuming Arming-ton's (1969) national differentiation. These models predict larger economies export greater value and volume, but not a greater variety of goods. The extensive margin is emphasized by monopolistically competitive models following Krugman (1981): larger economies export a greater variety of goods proportional to their size advantage. Models of vertical differentiation, such as Flam and Helpman (1987) and Grossman and Helpman (1991), emphasize the quality margin: richer countries produce and export higher-quality goods.

Hummels and Klenow (2005) find the extensive margin accounts for 60 percent of the greater exports of larger economies. The intensive margin can be decomposed into price and quantity dimensions and is dominated by higher quantities rather than higher prices. Richer economies export higher quality goods, while economies with more workers export higher quantities but not at higher prices. Schott (2004) finds similar evidence by examining the intensive margin of U.S. imports — richer countries export at higher prices.

Feenstra (1994) found substantial growth of the extensive margin of U.S. imports

of six manufactured goods between 1964 and 1987. Funke and Ruhwedel (2001) found the extensive margin of both exports and imports of 19 OECD countries to be positively correlated with per capita income.

A number of papers examined the role of extensive and intensive margins in the growth of trade. Evenett and Venables (2002) find a third of the growth of exports of developing countries between 1970 and 1997 can be attributed to the expansion of the extensive margin. Felbermayr and Kohler (2006) argue a proper accounting of the extensive and intensive margins resolves the “distance puzzle” in the gravity equation literature.¹ They find the extensive margin played a larger role in the growth of world trade between 1950 and 1970 and again in the mid 1990s, while the intensive margin was more important in the intervening years. Helpman, Melitz, and Rubinstein (2006) find the majority of the growth of trade between 1970 and 1997 is attributable to the intensive margin rather than the extensive margin. This result confirms the finding of Felbermayr and Kohler, but is at odds with Evenett and Venables (2002).² Using export data for South Korea and Taiwan Kang (2004) shows the extensive margin plays a more important role in export growth than does the intensive margin.

Several papers examine the effects of trade liberalization and regional trade agreements on the extensive and intensive margins. Yi (2003), Kehoe and Ruhl (2003), and Ruhl (2005) show trade liberalization results in an increase of the extensive margin.

¹The “distance puzzle” refers to an increase in elasticity of bilateral trade with respect to distance over time identified by recent studies despite an expectation to the contrary. See a survey by Disdier and Head (2004).

²Helpman, Melitz, and Rubinstein (2006) conjecture the Evenett and Venables (2002) country sample is not representative and that some growth in trade was misclassified by Evenett and Venables to be on the extensive margin.

Using highly disaggregated product-level data Debaere and Mostashari (2006) show trade liberalization increases the extensive margin and preferential tariffs shrink it for excluded countries. However, country and industry specific factors are more important than tariffs in determining changes at the extensive margin. Clausing (2001) and Romalis (2005) both found CUSFTA and NAFTA resulted in a substantial growth of the intensive margin, with substantial increases in trade volumes, but modest effects on prices.

In addition to contributing to the intensive/extensive margin of the trade literature, we make a contribution to the duration of trade literature. Besedeš and Prusa (2006a, b) studied duration of US import relationships at the product level and found it to be very short, only four years at the median. They found differentiated goods tend to be traded in longer relationships than homogeneous goods. Besedeš (2006a) shows a search cost model fits duration data well in that it can explain the preponderance of short and small valued relationships. We now show duration of US exports is short as well and other countries have an even shorter duration than the US.

Our investigation of deepening contributes to the literature on the growth of trade. A number of papers have studied the growth of trade, both recent and historical, including Rose (1991), Krugman (1995), Evenett and Yeung (1996), O'Rourke and Williamson (1999), Baier and Bergstrand (2001), Yi (2003), Besedeš (2006b). These papers examine the growth of trade over different periods of time and attempt to answer different questions pertaining to that growth, but they all have in common their use of country-level trade data. Our analysis of deepening of export relationships uses disaggregated product level data to better understand the growth of trade. To

our knowledge, a careful cross-country study of the growth of export trade at the product level has yet to be undertaken. While we intend to undertake such a study in the future, this paper is among the first to examine how export growth at the product level affects export growth at the aggregate level.

Our results indicate developing countries perform reasonably well when it comes to deepening their relationships and establishing new ones. The problem for developing countries is successfully maintaining their relationships. Longer export relationships are a key to higher aggregate export growth rate. This leads to the main policy suggestion we make. In order to improve their export performance and fuel growth through exports, developing countries should focus on policies which would improve their ability to sustain their export relationships longer. After all, even if they can achieve high growth at the relationship level, unless relationships are long lasting, high growth will have a short term effect. Similarly, even a tremendous ability to establish new relationships will be wasted, unless the new relationships can be maintained for long periods of time. Establishing new relationships is a costly activity. Short relationships require a continuous investment of resources to substitute the failing relationships with new ones.

2 Extensive and Intensive Margin

2.1 Data

Our data come from the UN Commodity Trade Statistics Database (UN Comtrade). The database measures trade in commodities classified using several different classifications. We use data recorded using the Standard Industrial Trade Classification Revision 1, which offers the longest time series of data. We observe trade between 1975 and 2003 for twenty seven countries. While UN Comtrade SITC Revision 1 data are available disaggregated to 5 digits, we use the 4-digit disaggregation due to better consistency. Given that most countries growth strategies focus on manufacturing (not agriculture) we restrict our attention to SITC industries Chemicals (SITC=5), Manufactured Materials (6), Machinery (7), and Miscellaneous Machinery (8). The twenty seven countries export in a total of 380 4-digit manufacturing industry categories to a total of 181 countries. There are 3,930,749 annual export observations providing information on the destination country, and the value and quantity of exports. Table 1 presents the countries and years for which data are available as well as the number of annual observations for each country.

As a part of our analysis we use the annual data and convert them to spells of service for each trade relationship. We define a trade relationship as involving exports of product x from country e to country i . If a country exports the same product to the same country in two (or more) distinct non-overlapping spells of service, for example during 1978–1984 and again 1989–1994, we treat this as two independent relationships. Such transformation of annual data allows us to calculate survival

rates as well as to calculate relationship deepening rates. Besedeš and Prusa (2006a) provide an in-depth discussion of all issues pertaining to applying duration methods to trade data. We have data on 1,000,136 export relationships as shown in Table 1. Given the number of countries we study, we present results by grouping countries in geographical regions – USA, the Caribbean, Central America, South America, Mexico, East Asian Tigers, and India. We chose to leave India separate from other Asian countries (Indonesia, Malaysia, Philippines, Singapore, South Korea, and Thailand) as it is usually not identified with East Asian Tigers. We also chose to separate Mexico from Central America due to its strong trade ties with the US. Country specific results can be found in the appendix.

2.2 Extensive margin

We begin by providing summary statistics about the extensive margin presented in Table 2. The first column in the table shows the growth of exports for each region for reference. At a basic level the extensive margin refers to the number of trading relationships. A country can obtain a new relationship when it exports a product to a country it never exported to before. This is the simplest way to define the extensive margin and is used by Felbermayr and Kohler (2006). Changes in the number of countries exported to in our dataset is presented in the second column of Table 2. The table clearly shows the largest increases were experienced by the developing countries of Latin America. Mexico is the sole exception. At least a part of the changes is due to the new countries created during this period, mostly due to

the breakup of Yugoslavia and the Soviet Union, which we do not control for.³

A country can gain new relationships by exporting products of industries it previously did not export. We examine changes in this measure of the extensive margin in the third column of Table 2. Developing countries again experience the largest increases with Central and South America experiencing the largest gains. Given our analysis is performed at the 4-digit level, it is not very surprising that the US barely registers a gain, as it already exports in most of these industries.

We chose to define the extensive margin measure we use at the most disaggregated level possible as the number of country-product relationships an exporting country has. Since we are interested in mapping changes at disaggregated levels of the extensive and intensive margins into aggregate export growth, we need to use as disaggregated measures as possible. In addition, our approach to intensive margin components, deepening and survival, requires that we use as disaggregate a measure as possible. A change in the extensive margin can then be achieved by exporting to a country that nothing has ever been exported to, by exporting a product that has never been exported anywhere, and by exporting an already exported product to a country the product has not been exported to. We believe this is the best way to capture changes in the extensive margin, as it captures different flavors in which the extensive margin can change. Not surprisingly, once we define the extensive margin in this way, we observe the largest changes. East Asian Tigers experience largest gains, well over 300% between 1975 and 2003. They are followed by India and Central and South America.

³Felbermayr and Kohler (2006) refer to this as the pseudo extensive margin.

The last two columns show all countries still have plenty of room to expand their extensive margin. It has long been established that many bilateral trade relationships are not active. In other words, some countries never trade together or do not trade as many products as they could. Feenstra and Rose (2000), Evenett and Venables (2002), Haveman and Hummels (2004), Anderson and van Wincoop (2004), Helpman, Melitz, and Rubinstein (2006), and Felbermayr and Kohler (2006) all show that a great number of bilateral trade relationships are not utilized, meaning that they involve no trade. Our data show the US utilizes slightly more than a half of all of its possible relationships. Some countries have made tremendous gains in utilization. India increased its utilization from 14% to 41%, East Asian Tigers from 5% to 22%. It is clear that the Latin American countries lag far behind, with only Mexico cracking the two digit barrier.

2.3 Intensive margin

Most existing studies of the intensive margin focus on studying the volume or value of trade and its price and quantity components. We introduce a new approach by studying the intensity of export relationships, which we will eventually define in terms of survival and deepening. Table 3 provides a first look at trade intensity. The first column shows the fraction of the value of trade observed in 1985 embodied in relationships that were observed in 1975. The next two columns provide the same information for the next two decades, while the fourth column provide the fraction of the value of trade observed in 2003 embodied in relationships that were observed in

1975. The next four columns provide the same information, but disregard the value and only count the relationships. The first four columns measure what we refer to as the value intensity and the remaining ones measure relationship intensity.

The US value intensity in 1985 was 94%, meaning that a full 94% of exported value in 1985 was due to relationships that were observed in 1975. This fraction increases in the following decades. For the whole period under study the US value intensity was 93% – 93% of all exported value in 2003 was due to relationships that were observed in 1975. In terms of the relationship intensity, 81% of relationships observed in 1985 were also observed in 1975. For the period 1985 to 1995 relationship intensity declines to 70% before rebounding back to 82%. Over the whole period, 66% of US export relationships observed in 2003 were observed in 1975.

Mexico's value intensity is very similar to the US's, while its relationship intensity is far smaller. East Asian Tigers and South America experience a significant increase in value intensity. It increases from 79% to 97% for East Asian Tigers and from 64% to 90% for South America. In terms of the relationship intensity, they experience gains as well, but lag far behind the US. The intensity of the Caribbean countries increases, while that of Central America stays rather flat. All countries experience a decline in relationship intensity between 1985 and 1995, which is likely due to the change in the way trade are recorded at the product level. Kehoe and Ruhl (2003) discuss the consequences of this shift to using the Harmonized System classification to record trade data. Note this does not happen with the value intensity.

These crude measures of intensity initially leave an impression that trade is rather intensive or persistent. Most countries seem to retain a large fraction of traded value

and relationships over long periods of time. In other words, they seem to have long lasting trade relationships with some new relationships entering over time. However, this measure is biased upward. Since these measures are based on two points in time, they ignore the possibility of a relationship observed in 1975 ending in 1979, reappearing in 1983 and observed again in 1985. We believe such a relationship should be excluded from the measures of trade intensity as it was inactive for some period of time. To correct for this potential bias we recalculate value and relationship intensities focusing on continuously observed relationships. Fractions reported in Table 4 report the share of continuously observed relationships in each period. The picture provided by Table 4 is not as rosy as that of Table 3.

Once we focus on continuously observed relationships value and relationship intensity decline, in some cases dramatically. Rather than the initial 75%, India's value intensity declines to 55% for the whole period, while its relationship intensity declines from 27% to just 7%. Mexico's value intensity declines from 94% to 79%, while its relationship intensity declines from 33% to just 10%. While US's value intensity declines a little from 93% to 88%, its relationship intensity declines much more from 66% to 41%.

Trade intensities reveal the majority of exported value is embodied in long lasting relationships. The fact that 88% of US's exported value in 2003 is embodied in relationships that are observed continuously since 1975 indicate the majority of US trade is embodied in these long lasting relationships. However, the relationship intensity reveals there is a large number of relationships that are created during this period. Only 41% of US's relationships observed in 2003 are continuously observed

since 1975. Hence, the 59% of relationships which were created between these two years account for some 12% of exported value. While these figures do not imply that new relationships do not grow,⁴ they do imply that the success of US exports in terms of the value they provide lies in long lasting relationships.

Differences observed across regions in Table 4 indicate that developing countries are far less successful in maintaining their relationships. For Central America 22% of exported value in 2003 is due to relationships continuously observed since 1975, but these relationships constitute only 4% of all relationships observed in 2003. South America's corresponding figures are 41% and 8%. Mexico has an even larger disparity, 79% of exported value in 2003 is embodied in only 10% of relationships observed in 2003. These results provide a first glimpse at the core difficulty faced by exports of developing countries. They can start new relationships fairly easily. After all, relationship intensities are low at least in part because they can establish new relationships, or at least reactivate dormant ones. Developing countries are woeful at maintaining their relationships. Duration of export relationships is very low, as we will shortly show. A consequence of short duration is a smaller growth rate of aggregate exports, and hence a smaller growth rate of gross domestic product. Before examining how much lower aggregate export growth rates are due to lower duration, we examine duration in greater detail.

⁴It is certainly feasible that new relationships grow, but grow at a lower rate than existing and large relationships.

3 Intensive Margin Reconsidered

Tables 3 and 4 suggest longevity of trade relationships and trade value differs. A far smaller fraction of trade relationships in any year $t + k$ were in place in year t than is the case for trade value. For instance, 81 percent of US trade relationships and 94 percent of trade value in 1985 were present in 1975. The fraction that were continuously active during the same period is smaller (93 and 66 percent, respectively) but also imply there are many low-valued, short-lived relationships.

Before explicitly examining this idea, it is useful to distinguish between calendar time and analysis time. The term calendar time is self-explanatory and simply refers to the year trade took place. In given calendar year, however, export relationships are a variety of different vintages: some trade relationships are quite old (i.e., have been around for many years) while others are quite new. We use the term analysis time to capture the idea that relationships are of different ages. The first year country e exports product x to country i we will say that the relationship is in its first year of service and that its current spell length or analysis time equals one. In the second year of a relationship we will say analysis time equals two, etc. Thus, in any given calendar year, the distribution of analysis times reflects the longevity of active relationships. A high fraction of relationships with small analysis times reflects short relationships.

In Figure 1 we plot the cumulative distribution of trade relationships for selected regions. In the upper chart we plot the distribution for trade relationships and in the lower chart we plot the distribution for the value of trade embodied in those relationships. The graphs report the fraction of relationships or trade value that have

spell length less than or equal to k , where $k = 1, 2, \dots, 9$. In this figure we depict the distribution for calendar year 2000.⁵

Looking first at trade relationships, we see the US has the lowest profile, followed by the East Asian Tigers and Mexico. South America has the highest profile. In 2000, about 10 percent of US trade relationships were in their first year of service. By contrast, more than 30 percent of South American, Central American, and Caribbean export relationships were in their first year of service. For South America, Central America and the Caribbean more than half of all relationships were less than five years old. The figure conveys that short relationships are quite common.

The picture is a bit rosier when we weigh by the value of trade. For all regions examined, the majority of trade is accounted for by export relationships that are at least 10 years old. Nevertheless, persistent differences across regions remain. As in the upper panel, South America, Central America and the Caribbean tend to have the highest fraction of trade in newly formed relationships indicating an inability to maintain their relationships.

In Table 5 we estimate whether differences in profiles in Figure 1 are significant. Let F_{ety} denote the fraction of the value of trade (number of relationships) of length $\leq t$, with $t = 1, 2, \dots, 9$, where e denotes the exporting country, t denote the analysis time, and y denotes calendar year. We estimate OLS regressions of the form

$$F_{ety} = f(t, y, \text{region}).$$

⁵We have calculated this distribution for each year between 1975 and 2003. Other years are qualitatively similar and available on request.

Results are reported in Table 5 with all region results measured relative to the US. We run the regression both in levels and in logs. As shown, differences across regions are statistically significant in all specifications. In three of the four specifications differences are significant both for the intercept and the trend. In other words, the differences depicted in Figure 1 are not noise, but reflect systematic differences across regions.

Taken together, the analysis challenges the notion that the extensive margin — that is, the ability for a country to start new export relationships — is important for exporting success. We say this because the (weighted value) results in Table 3 indicate that most trade in any given year is accounted for by relationships that were present 10 (or more) years earlier. On the other hand, the results in Table 3 also indicate that a far smaller fraction of relationships were present 10 (or more) years earlier. In fact, as seen in Figure 1 in any given year most relationships have only been intact for a few years. Taken together, these results imply that new relationships are almost always short-lived and that most of a country’s trade is due to a small number of winners. Across most countries there appear to be a few winners and many failures.

Formally, the duration of trade relationships is most appropriately summarized by using survival analysis. As discussed in Besedeš and Prusa (2006a, b) and Besedeš (2006a) survival analysis focuses on analysis time rather than calendar time. One complication when thinking about trade data in terms of spells is the problem of censoring. There are some relationships that we are uncertain about either the true starting or ending date (or perhaps both). There is no information on trade relation-

ships for the years before the beginning and after the end of the sample. In particular, for most countries the first year we have trade data is 1963. Any relationship observed in 1963 may be quite new (in its first year or second year) or quite long (e.g., exported for decades). Similarly, the last year we observe trade data is 2003; as a result it is impossible to ascertain how long a spell observed in 2003 ultimately is. Censoring problems are easily handled using standard statistical techniques of survival analysis.

For each country we estimate the Kaplan-Meier survival function and present results pooled to the regional level. The survival function delivers several important messages. First, the typical exporting relationship has a short life expectancy. Export performance is shorter than the prior discussion suggested. In particular, for most regions the median survival time is two years. In other words more than 50 percent of all export relationships fail within the first two years. Second, data indicate good exporting performance means only 3–4 out of 10 relationships last for more than a few years. While most relationships end quickly, there are important differences across regions. Successful export relationships in regions like the US and East Asian Tigers are about twice as likely to survive 10 years as compared with Central America or the Caribbean. Third, relationships continue to experience high hazard through the first 7–10 years. Thereafter, however, there is a fairly small risk of failure. Results indicate the presence of negative duration dependence — the conditional probability of failure decreases with duration. Some type of a threshold effect may be present: once a relationship is established and has survived the first few years it is likely to survive a long time. Fourth, findings make it clear that understanding the intensive margin requires us to take into account analysis time (or spell length). For instance, Figure 1

indicates that a high fraction of total relationships are in their first or second year of service. This suggests the intensive margin plays an important role for a country's exporting success. On the other hand, Figure 2 suggests almost all new starts will quickly fail which suggests the extensive margin plays an less important role for a country's exporting success.

Even with these findings, it is not clear how much differences in survival matter for a country's exporting success. Given that most trade value for most countries is in long-existing relationships, slightly higher survival for relationships in their infancy may not matter. We now turn to answering this question.

4 Decomposing Growth

4.1 Theory

In order to examine how countries would perform had they had a different performance on the intensive and extensive margins, we first need to decompose exports to capture both dimensions. In any year t we can write the value of exports as

$$V_t = n_t v_t$$

where V_t is the value of exports in year t , n_t is the number of export relationships, and v_t is the value per relationship. Export relationships consist of those that survive from $t - 1$ to t , denoted s_t , and new relationships, denoted e_t , so that $n_t = s_t + e_t$.

Export growth from t to $t + 1$ can be written as

$$\begin{aligned}
 (1) \quad V_{t+1} - V_t &= n_{t+1}v_{t+1} - n_tv_t \\
 &= s_{t+1}[v_{t+1} - v_t] - d_tv_t + e_{t+1}v_{t+1}
 \end{aligned}$$

where s_{t+1} is the number of surviving relationships, $(v_{t+1} - v_t)$ is the per relationship growth of surviving relationship, d_t is the number of relationships that end in t with d_tv_t their total value, and e_{t+1} is the number of new relationships with a total value of $e_{t+1}v_{t+1}$. Since the survival of each relationship depends on how old it is (Figure 2) we need to incorporate years of service into the decomposition. We define

$$\begin{aligned}
 s_t &\equiv \{s_t^1, s_t^2, s_t^3, \dots, s_t^i, \dots, s_t^I\}, \\
 d_t &\equiv \{d_t^1, d_t^2, d_t^3, \dots, d_t^i, \dots, d_t^I\}, \\
 v_t &\equiv \{v_t^1, v_t^2, v_t^3, \dots, v_t^i, \dots, v_t^I\}, \\
 h_t &\equiv \{h_t^1, h_t^2, h_t^3, \dots, h_t^i, \dots, h_t^I\},
 \end{aligned}$$

where the superscript i denotes the year of service and h_t denotes the hazard rate of a relationship ending between $t - 1$ and t . Hence, s_t^i denotes the number of surviving relationships between year $t - 1$ and t that are in the i^{th} year of service. For example, s_t^3 is the number of surviving relationships between years $t - 1$ and t that are in their third year of service. By definition, in a relationship's first year of service $s_t^1 \equiv 1$, $d_t^1 \equiv 0$, and $h_t^1 \equiv 0$.

We can now rewrite (??) as

$$(2) \quad V_{t+1} - V_t = \underbrace{\sum_{i=2}^I \underbrace{[(1 - h_{t+1}^i) n_t^i]}_{\text{survival-stayers}} \underbrace{[v_{t+1}^i - v_t^i]}_{\text{deepening}} - \sum_{i=2}^I \underbrace{[(h_{t+1}^i n_t^i) v_t^i]}_{\text{failure}}}_{\text{intensive}} + \underbrace{e_{t+1} v_{t+1}^1}_{\text{extensive}}$$

where I denotes the maximum potential year of service, $(1 - h_{t+1}^i)$ gives the percentage of surviving relationships between t and $t + 1$, $(1 - h_t^i) n_t^i$ gives the total number of surviving relationships between t and $t + 1$ in the i^{th} year of service, $[v_{t+1}^i - v_t^i]$ represents deepening or growth of trade for surviving relationships, $h_{t+1}^i n_t^i$ gives the number of relationships that end in year $t + 1$, $(h_{t+1}^i n_t^i) v_t^i$ gives their total value, and $e_{t+1} v_{t+1}^1$ gives the value of new entrants in year $t + 1$.

Equation (??) is our decomposition of the growth in exports. Higher survival (lower hazard) results in more relationships (more stayers and fewer failures). Trade deepening is just a part of the intensive margin. The final term captures the extensive margin. Note that superscript i controls for the year of service of each relationship. We emphasize that year of service must be accounted for because relationships are more likely to fail in earlier stages. Each summation begins at $i = 2$ because we can only talk about survival and exit in the second or higher year of service of each relationship. For the same reason, the last term pertaining to new relationships only contains $i = 1$ as relationships are new only in their first year of service.

4.2 Results

In order to perform our counterfactual exercises we need to substitute the performance of some alternative exporter in the above decomposition. For instance, we can ask what would have the performance of country e been had it had the US's experience. In order to calculate how each country's exports would change with counterfactual survival we would change equation (??) to

$$\text{Survival: } \sum_{i=2}^I \left[\left(1 - h_{t+1}^{\text{CF},i}\right) n_t^i \right] \left[v_{t+1}^i - v_t^i \right] - \sum_{i=2}^I \left[\left(h_{t+1}^{\text{CF},i} n_t^i \right) v_t^i \right] + e_{t+1} v_{t+1}^1$$

where superscript "CF" denotes the counterfactual values. Similarly, to find the counterfactual deepening and entry effects we calculate:

$$\begin{aligned} \text{Deepening: } & \sum_{i=2}^I \left[\left(1 - h_{t+1}^i\right) n_t^i \right] \left[v_{t+1}^{\text{CF},i} - v_t^{\text{CF},i} \right] - \sum_{i=2}^I \left[\left(h_{t+1}^i n_t^i \right) v_t^i \right] + e_{t+1} v_{t+1}^1 \\ \text{Entry: } & \sum_{i=2}^I \left[\left(1 - h_{t+1}^i\right) n_t^i \right] \left[v_{t+1}^i - v_t^i \right] - \sum_{i=2}^I \left[\left(h_{t+1}^i n_t^i \right) v_t^i \right] + e_{t+1}^{\text{CF}} v_{t+1}^1 \end{aligned}$$

This decomposition allows us to evaluate how different each country's exports would be had it had our chosen counterfactual survival, deepening, and new relationship formation performance.

4.2.1 US Performance

In Table 6 and Figures 3–7 we report the counterfactual results when the US export performance is the benchmark. In the top half of the table the reported growth rates are based on an endpoint to endpoint comparison (i.e., exports in 1975 compared to exports in 2003). In the lower half of the table we report the average annual growth rates over the whole sample. If growth were constant, there would be no difference in the two panels. However, exports grow faster at different times for different countries and as a result the endpoint comparison might misrepresent a country's overall performance. On the other hand, since survival and deepening will have important long-run impacts, the endpoint comparison might be more relevant. We imagine that readers will differ in which results they find most interesting and hence we present both. We note that the results are qualitatively similar in the two panels and all our major conclusions are found in both panels.

With the US as the benchmark, results indicate differences in survival are crucial. For Central America the annual growth of exports would have been 7.5% instead of 2% had it had the US survival experience (lower panel). Central American exports would have also been larger if had it had experienced the US deepening (4.1% instead of 2%). By contrast, Central American exports would have been smaller had it had the US entry (0.9% instead of 2%). Similar results hold for the Caribbean and South America — the main deficiency as compared to the US is not the extensive margin (entry) or trade deepening (a component of the intensive margin). Rather, improved survival, a component of the intensive margin, is the main source of better

performance.

Figures 3–7 visually convey the impact of each component. For example, in Figure 3 we plot Caribbean exports from 1975 to 2000.⁶ Starting in 1975 we can see an immediate and ongoing impact of improved survival. Clearly, the goal of maintaining export relationships is paramount if the Caribbean countries have any hope of improving their export performance.

Figure 4 plots the Central American counterfactuals. As seen, there is only modest improvement under any of the alternative scenarios until the mid-1990s, when US survival experience creates a marked improvement to Central American exports. South American export performance is superior to that of the Caribbean and Central America (Figure 5). Yet, we again see that the most great scope for improvement lies with improving survival.

4.2.2 South Korean Performance

In Table 7 and Figures 8–12 we report the counterfactual results when the South Korean export performance is the benchmark. As we did earlier we report growth rates based on an endpoint to endpoint comparison in the top half of the table and growth rates based on average annual growth rates in the lower half of the table.

As we saw when we used the US as benchmark, the results with South Korea indicate differences in survival are crucial. The key difference is that we find deepening is a more significant factor with South Korea: more countries would benefit from

⁶Due to an anomaly in Jamaican export data, we limit our analysis to 2000. We believe the issue is a reporting problem; we are working to determine the explanation.

having South Korea's deepening rate than the US's. Regardless of whether the US or South Korea is the benchmark, we find little important growth impact due to differences in the ability to establish new relationships.

Replicating the South Korean experience would have resulted in faster export growth. For Central America the annual growth of exports would have been 5.7% instead of 2% had it had the Korean survival experience (lower panel). The impact of South Korean deepening is even more significant: the annual growth of Central American exports would have been 10.9% instead of 2% had it had the South Korean deepening experience.

Qualitatively similar results are found for South America. The annual growth of South American exports would have been 8.6% with the Korean survival experience and 11.2% with the South Korean deepening experience. As a rule, almost all countries in our study would benefit from either the South Korean survival or deepening experience, with deepening having slightly greater impact.

Whether we use the US benchmark or South Korean benchmark, we find little support that differences in the extensive margin — that is, a country's ability to form new relationships — have significant long run growth implications. Introducing new products that fail within a year or two will generate little long run growth.

5 Concluding Comments

In this paper we take a micro-based approach to studying the differences in the growth of aggregate exports for twenty seven mostly developing countries. We use

product level trade data to examine differences in the intensive and extensive margins of exports of these countries. The intensive margin refers to the depth of trade, while the extensive margin refers to its breadth. We define the intensive margin to be composed of two elements: survival and deepening. Intensity of a country's export relationships will depend on how long they last – survival – and how well they grow over time – deepening. The extensive margin in our paper refers to the number of active export relationships a country has.

We investigate both margins of exports and find countries differ in their performance in each margin. All countries experienced an increase in the extensive margin, with developing countries having a larger increase. At the intensive margin, developing countries lag behind developed ones. We find survival of exports of the US and East Asian Tigers (successful developing countries) to be much larger than that of the developing countries of Latin America. Similarly, product level exports of developed countries grow faster.

We decompose the aggregate growth of exports to reflect the three components we isolated: extensive margin and survival and deepening in intensive margin. We use this decomposition to evaluate the consequences of differences across countries in their performance in these three components for their aggregate exports. The decomposition allows us to examine how different a country's aggregate exports growth would have been had it had a different performance at the extensive and intensive margin. We use the US's and South Korean performances as counterfactual values and find survival to be the area where developing countries lag the most. Developing countries would benefit the most from having the US's or South Korean survival.

They would also benefit from having either the US's or South Korean deepening of export relationships. The only dimension where developing countries do not lag behind developed and successful developing countries is the extensive margin. They are able to form new export relationships at an equal or even better rate.

Our results indicate developing countries would benefit the most by first focusing on policies that will make their export relationships remain active longer. This would allow them to benefit more from higher aggregate exports than if they were to focus on attaining higher relationship growth rate or higher rate of formation of new relationships. Both of these would have positive effects, but the largest gains would be obtained by replicating the higher survival of the US and South Korea.

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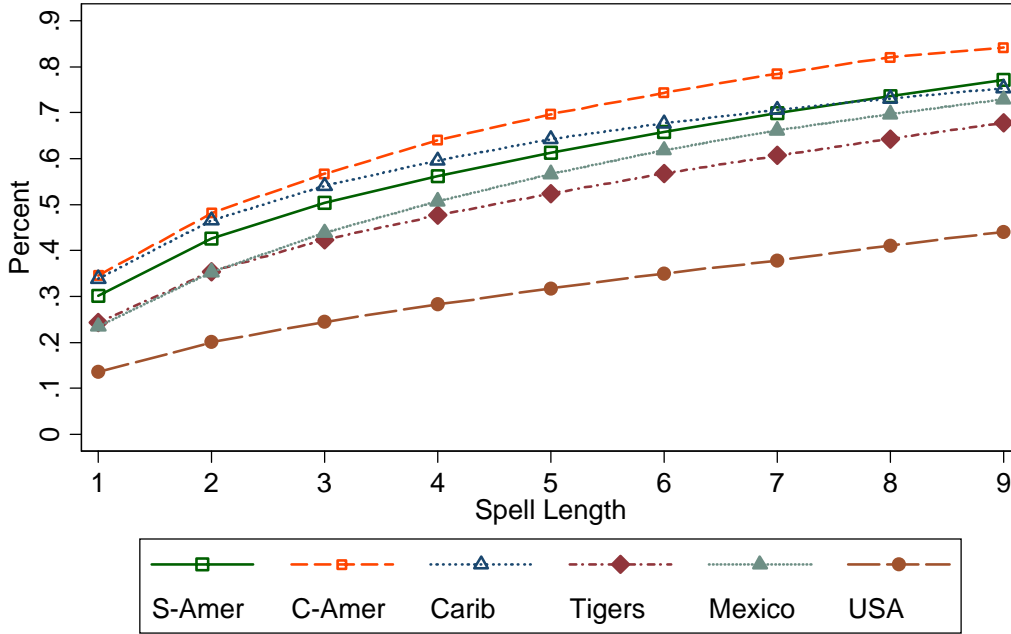
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Figure 1: The Shortness of Relationships

% Trade Relationships \leq k-years length

2000



% Trade Value \leq k-years length

2000

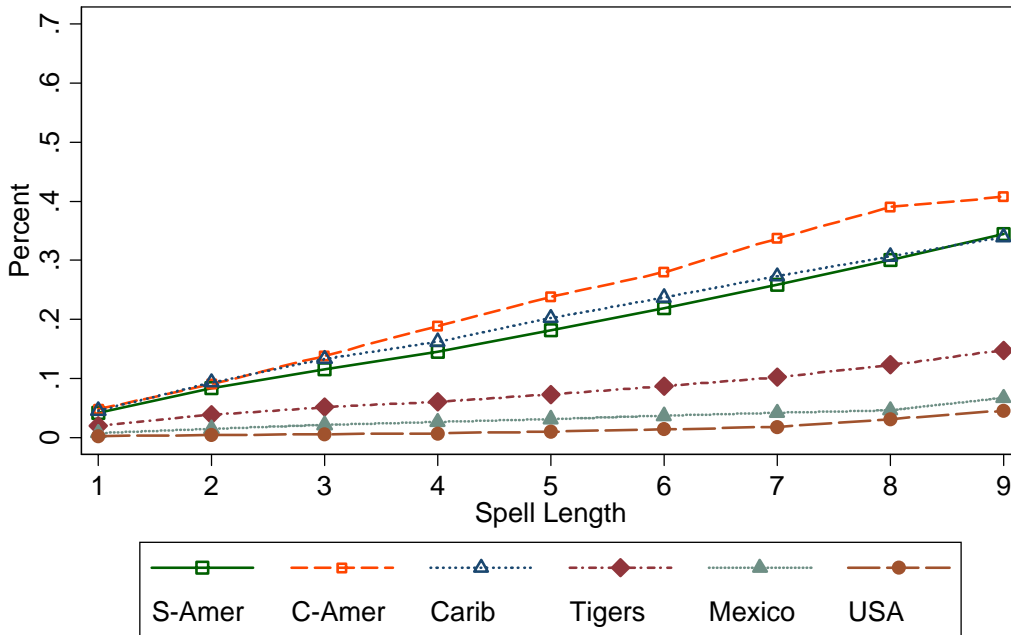


Figure 2: Export Survival
Country level data pooled to regional level

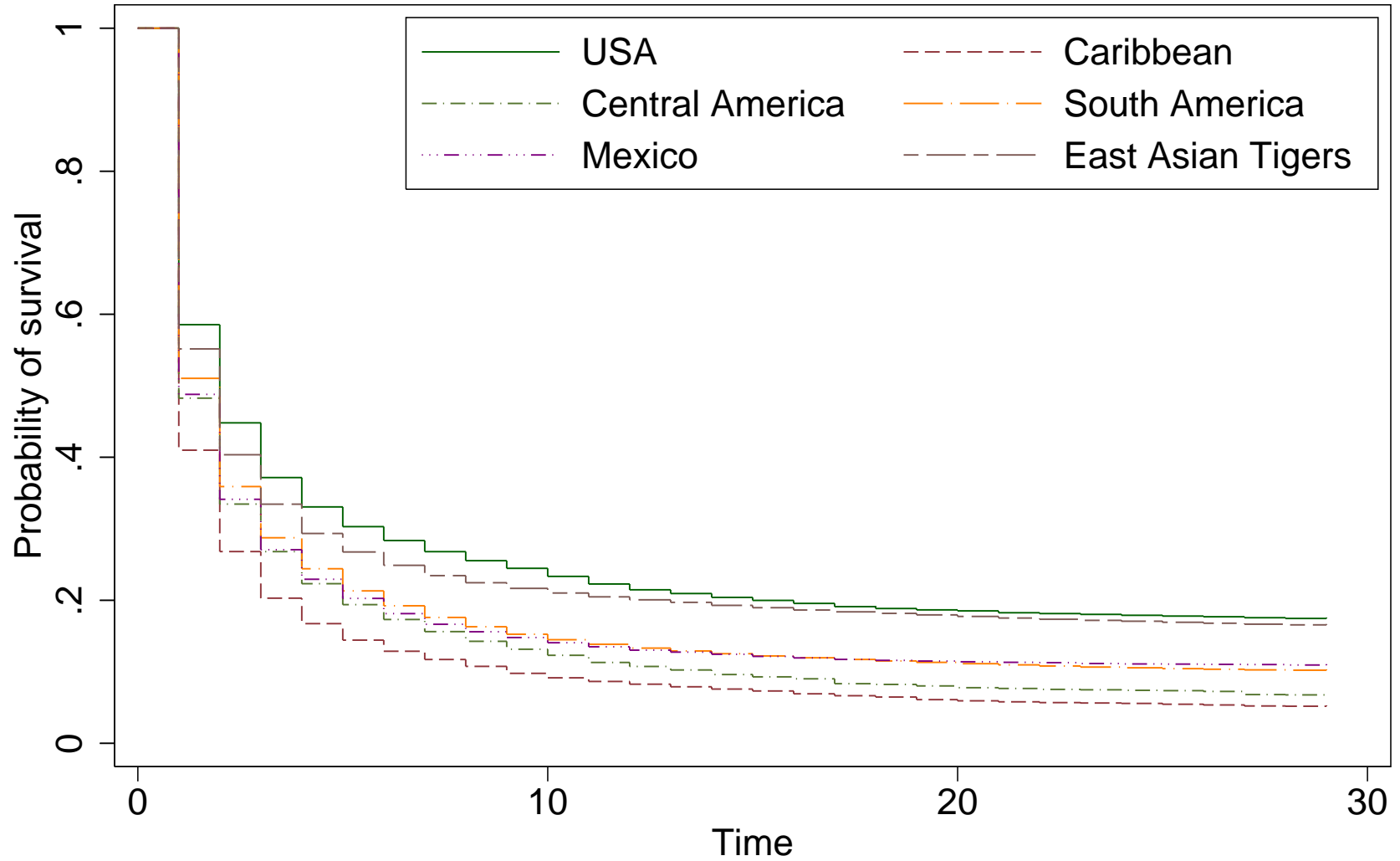
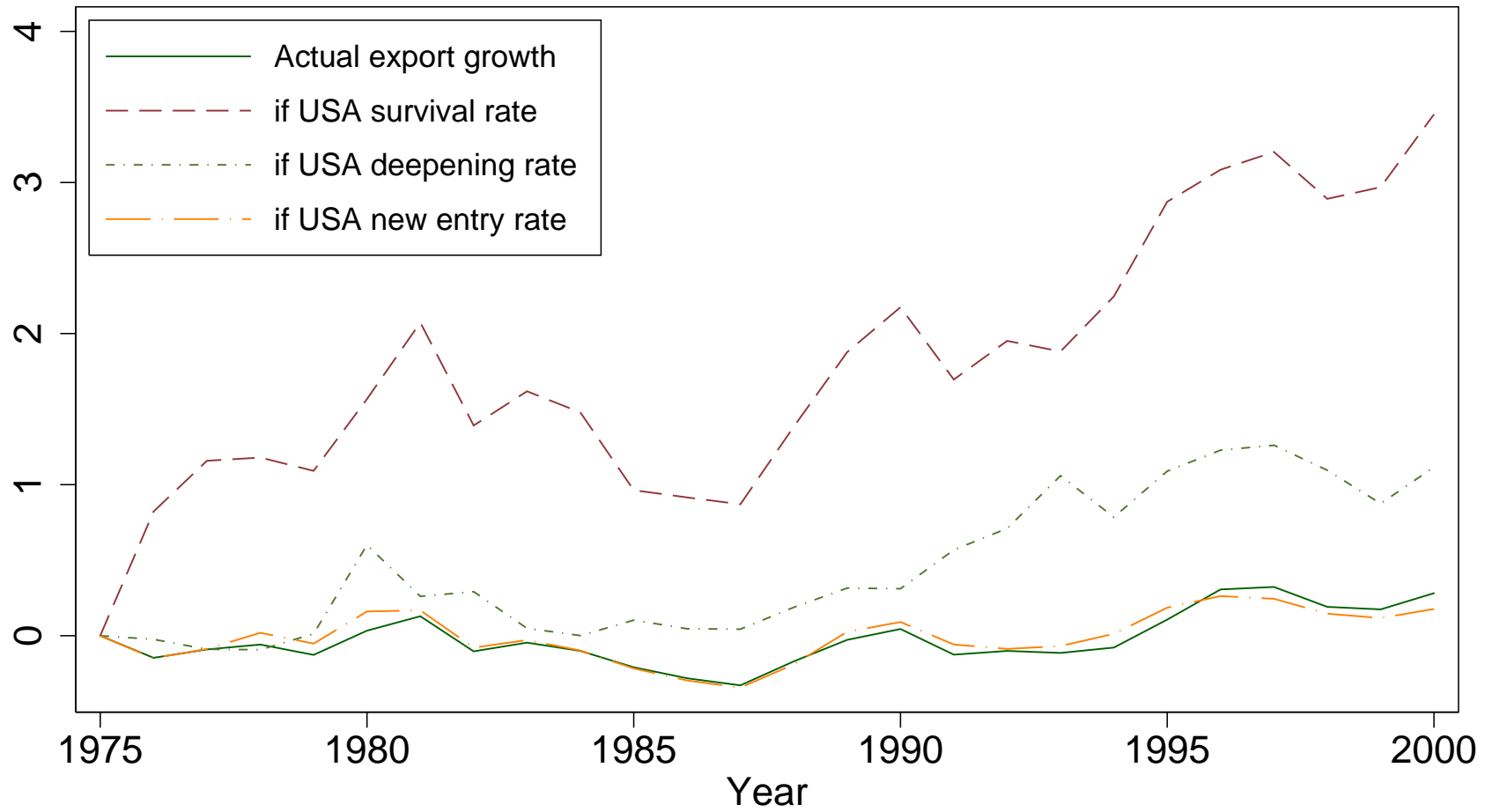
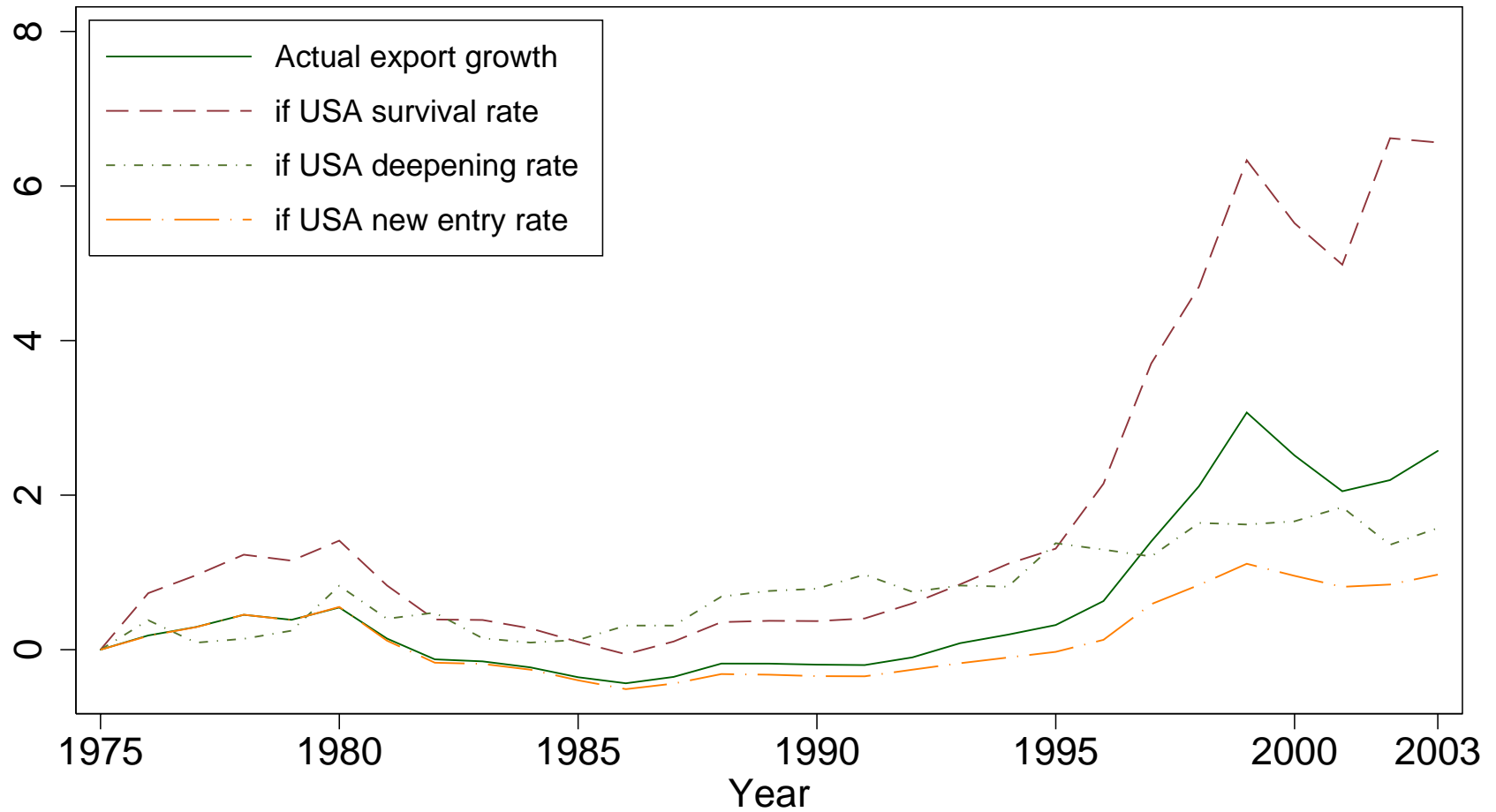


Figure 3: Caribbean
Country level data pooled to regional level



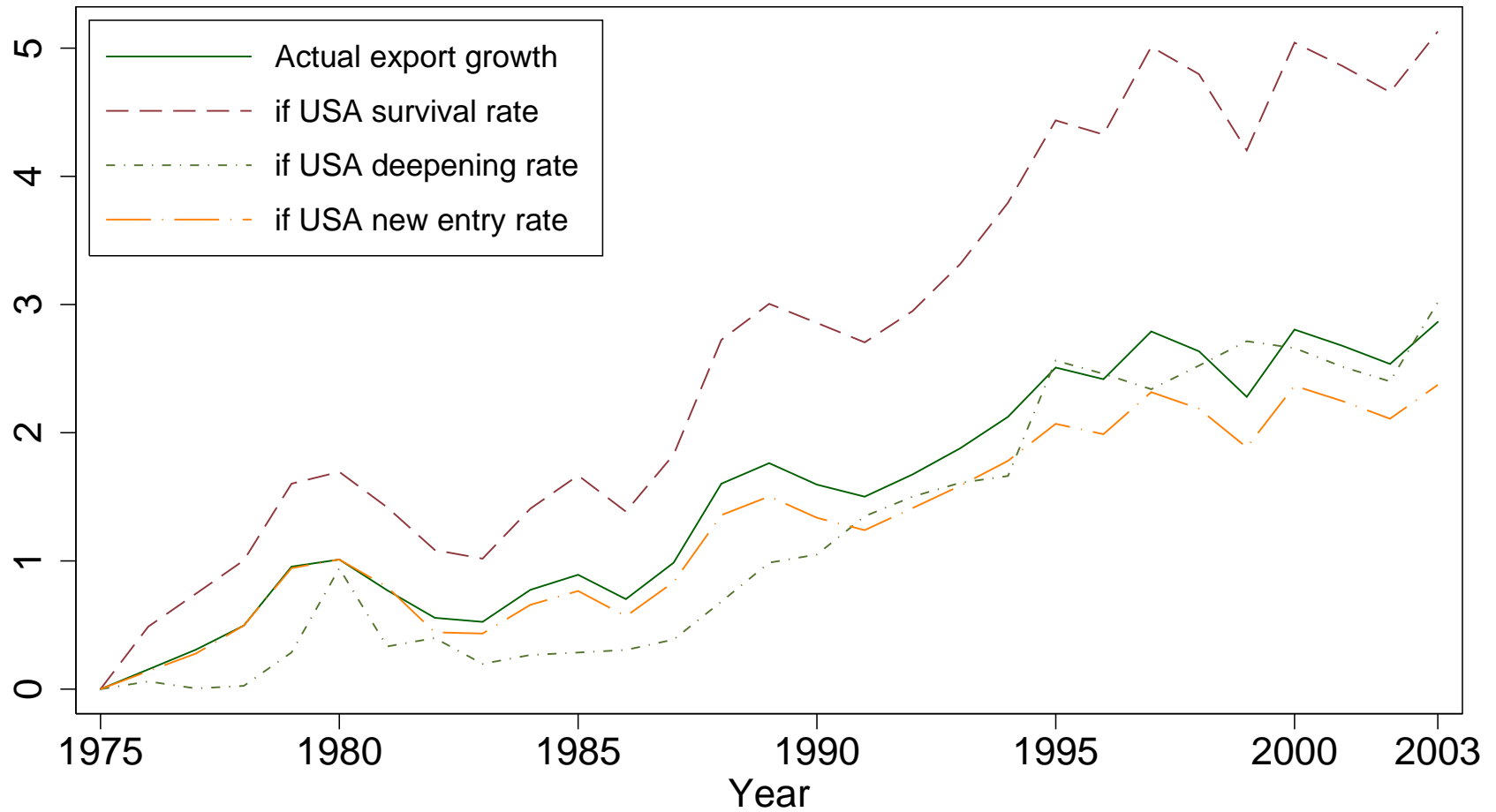
Manufacturing
USA benchmark

Figure 4: Central America
Country level data pooled to regional level



Manufacturing
USA benchmark

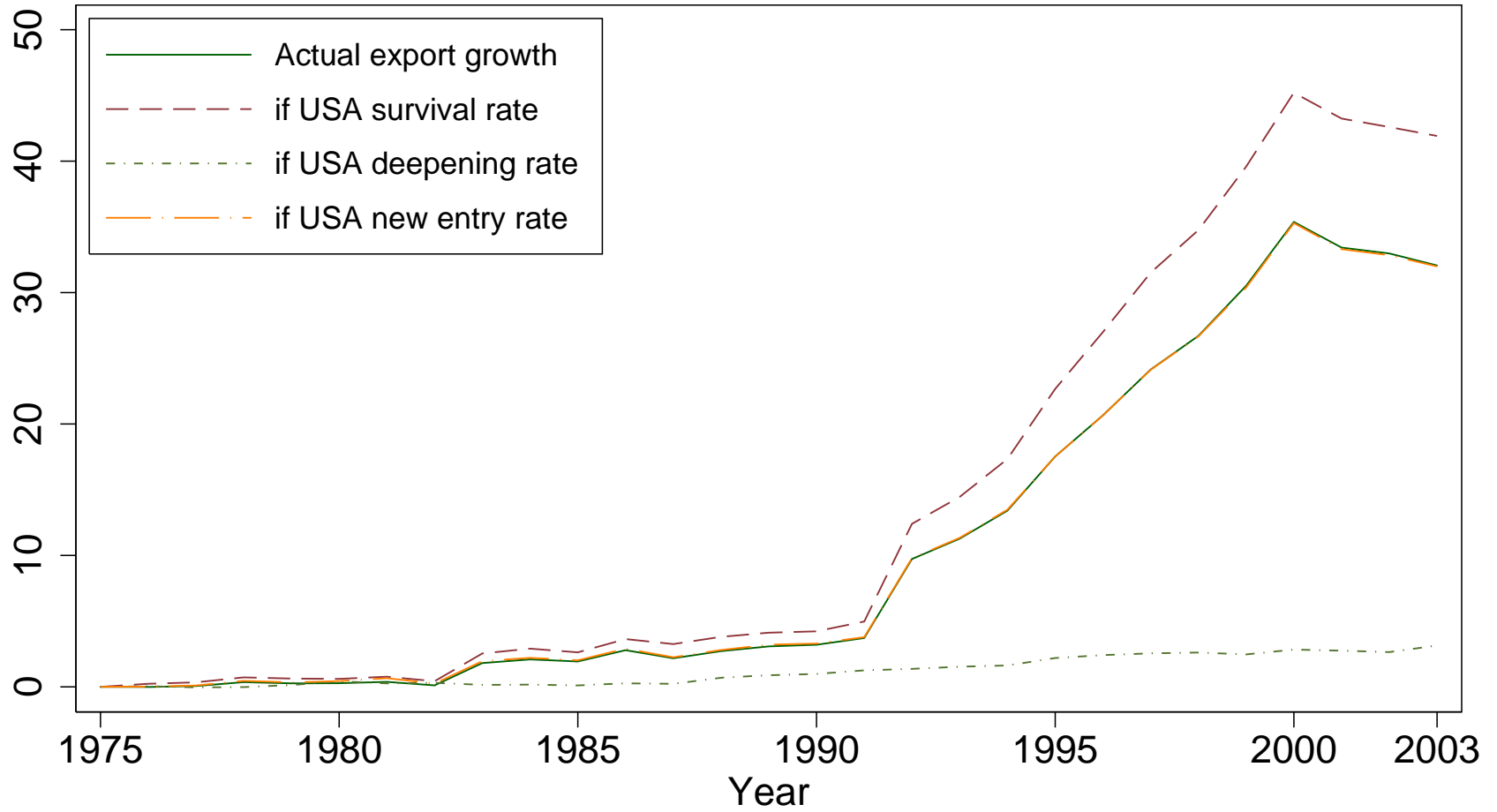
Figure 5: South America
Country level data pooled to regional level



Manufacturing
USA benchmark

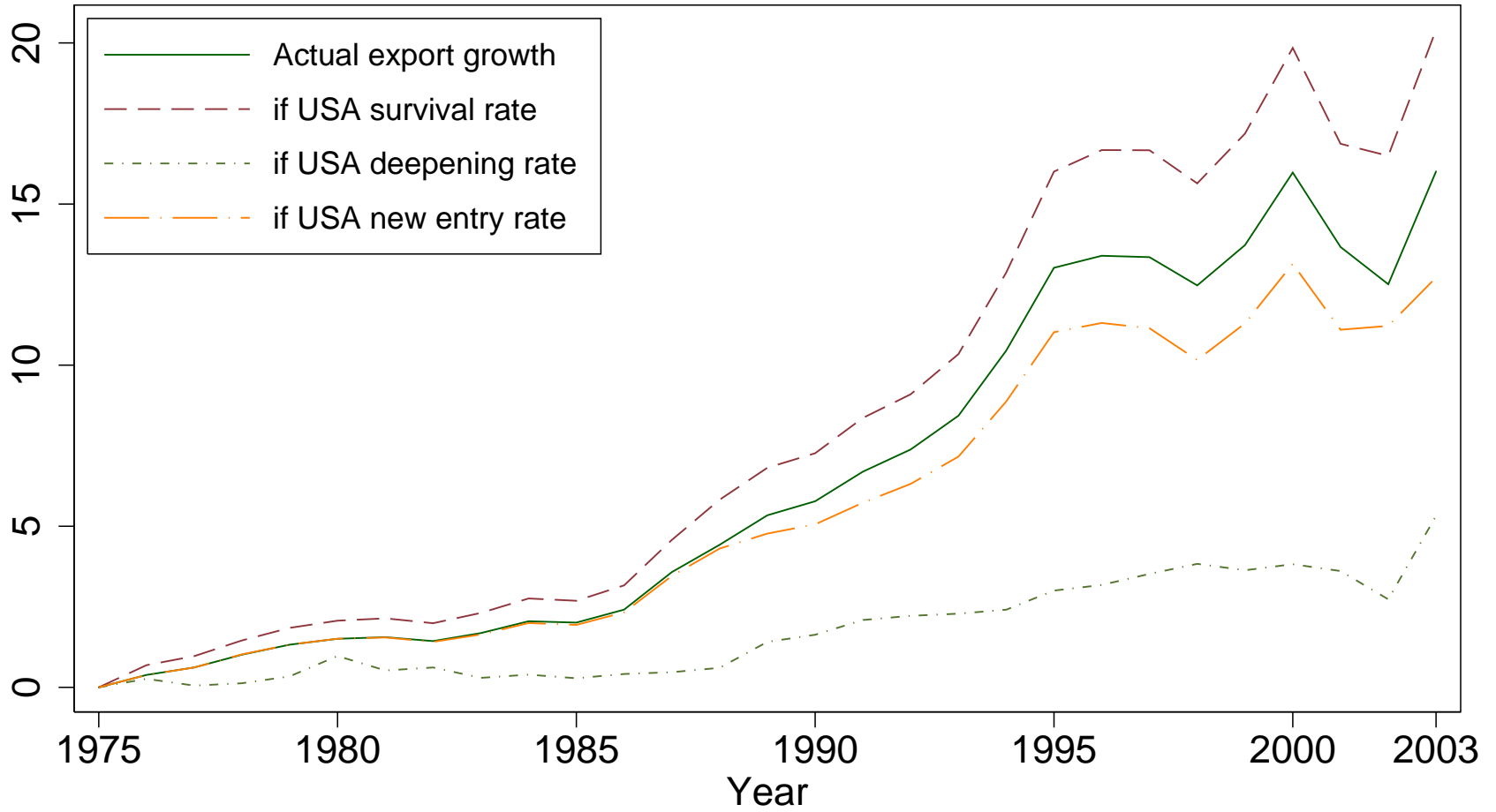
Figure 6: Mexico

Country level data pooled to regional level



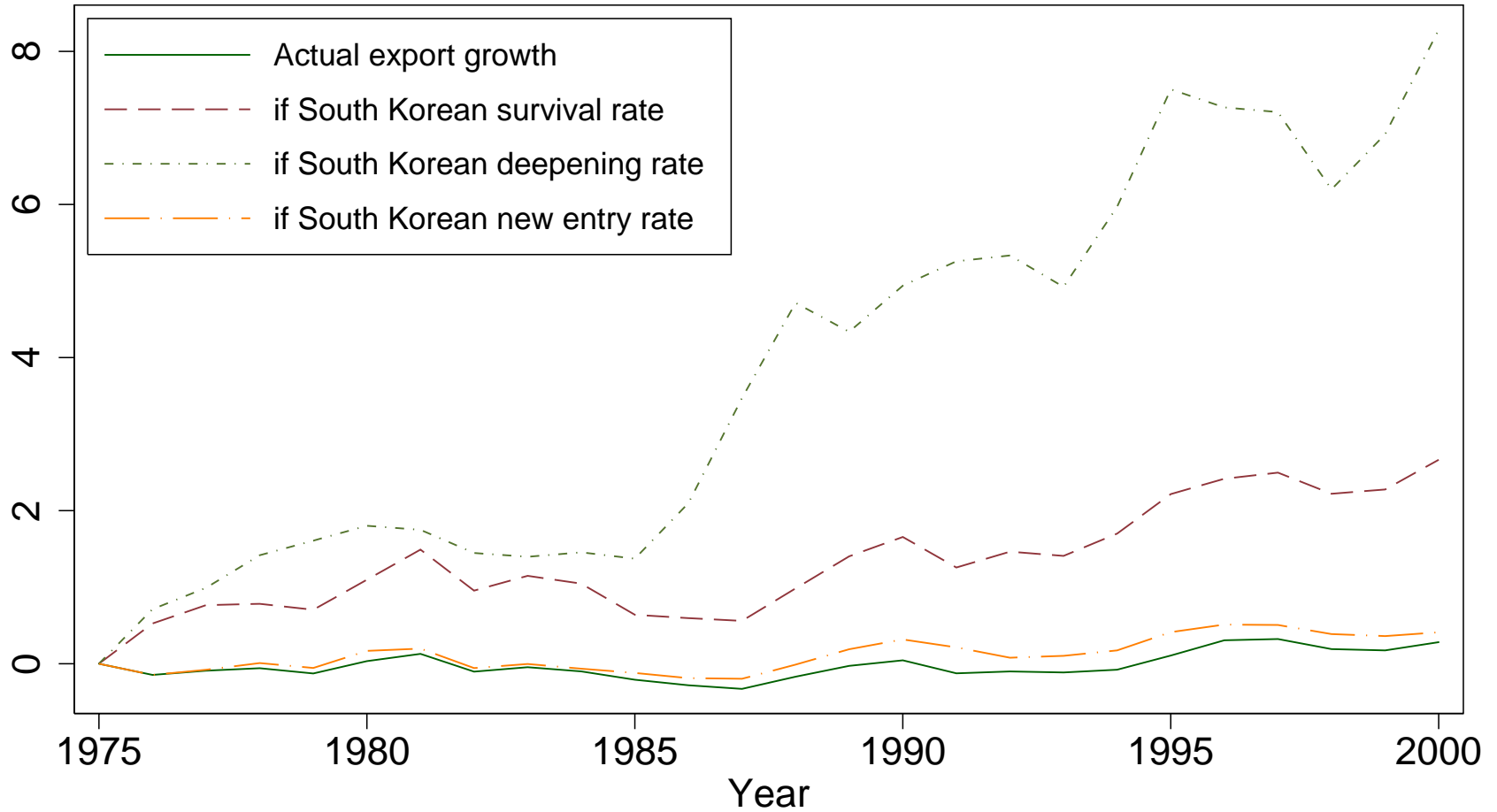
Manufacturing
USA benchmark

Figure 7: East Asia
Country level data pooled to regional level



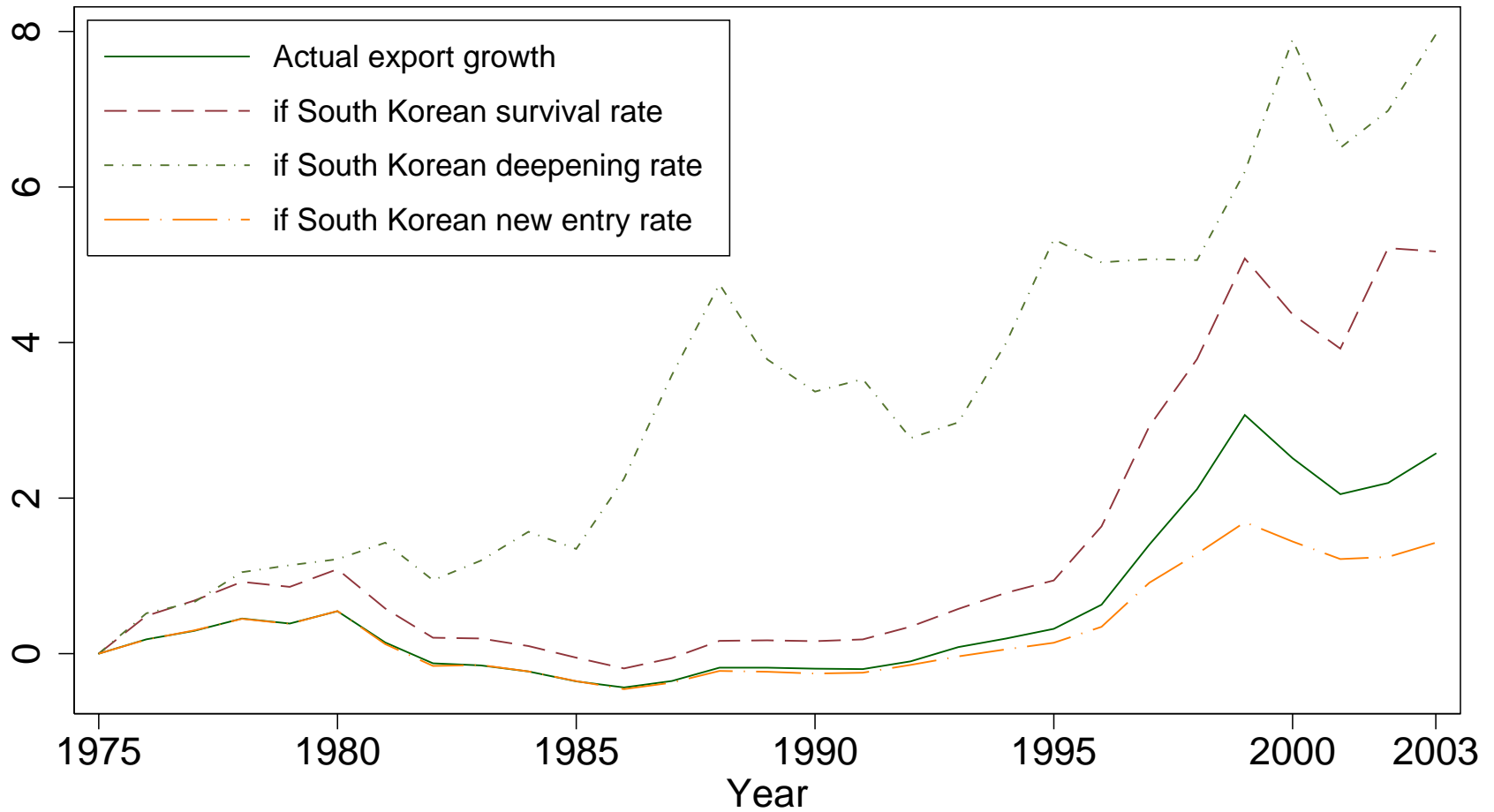
Manufacturing
USA benchmark

Figure 8: Caribbean
Country level data pooled to regional level



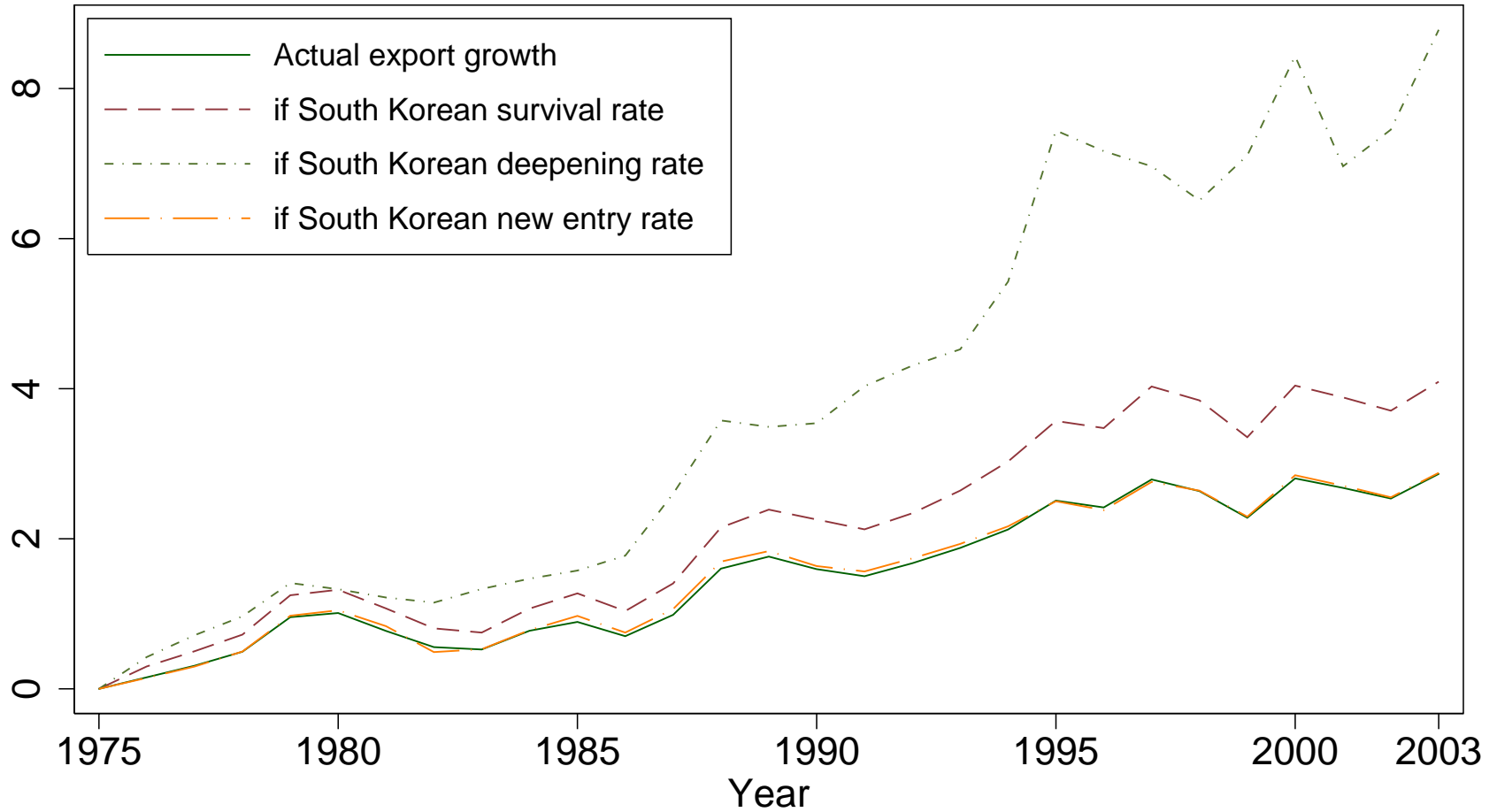
Manufacturing
South Korea benchmark

Figure 9: Central America
Country level data pooled to regional level



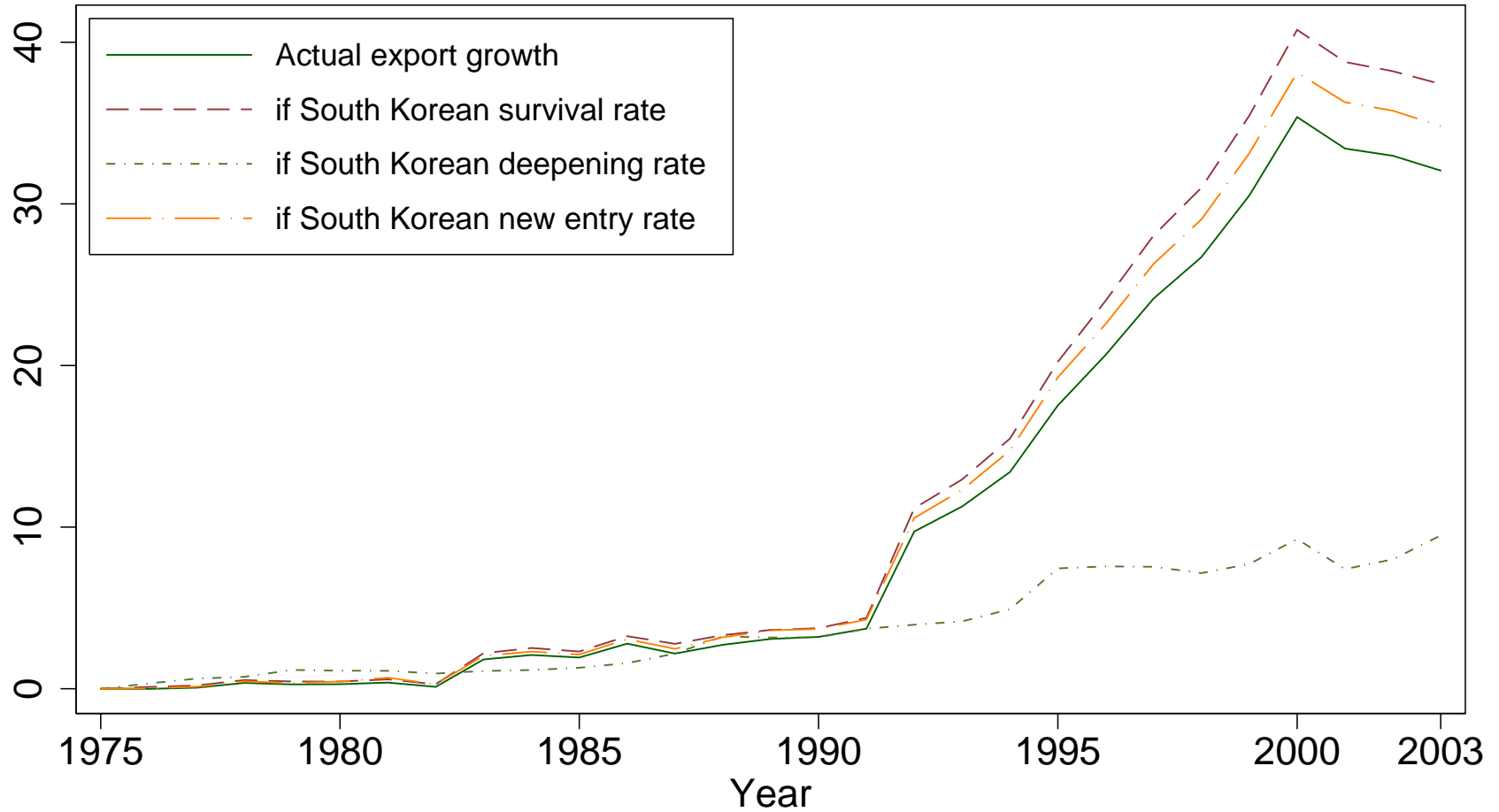
Manufacturing
South Korea benchmark

Figure 10: South America
Country level data pooled to regional level



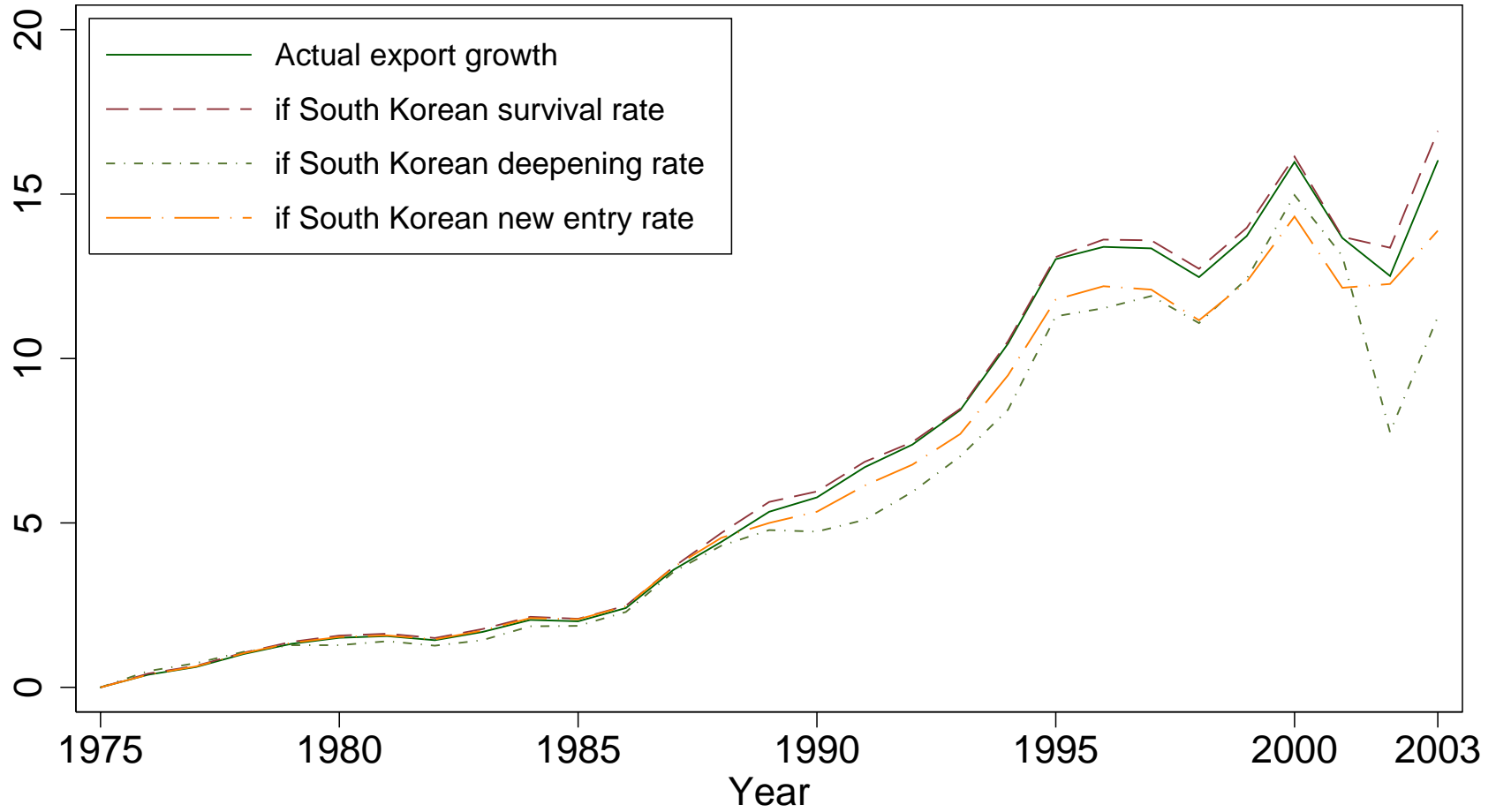
Manufacturing
South Korea benchmark

Figure 11: Mexico
Country level data pooled to regional level



Manufacturing
South Korea benchmark

Figure 12: East Asia
Country level data pooled to regional level



Manufacturing
South Korea benchmark

Table 1 - Countries used

Country	Years covered	Annual observations	Relationships
Argentina	1963-2003	137,992	39,691
Barbados	1968-2003	23,246	8,996
Bolivia	1963-2003	12,076	5,829
Brazil	1963-2003	311,480	73,143
Chile	1963-2003	74,921	25,604
Colombia	1963-2003	91,055	26,462
Costa Rica	1966-2003	41,681	13,197
Ecuador	1963-2003	23,652	9,837
El Salvador	1964-2003	27,412	9,028
Guatemala	1966-2003	41,310	13,379
Honduras	1964-2003	15,484	6,914
India	1963-2003	388,573	107,926
Indonesia	1963, 1968-2003	149,637	46,715
Jamaica	1963-64, 1973-2003	21,485	8,259
Malaysia	1965-2003	192,462	53,771
Mexico	1963-2003	12,456	5,689
Nicaragua	1967-87, 1989-2003	8,261	3,528
Paraguay	1963-2003	60,610	21,522
Peru	1963-81, 1983-2003	101,601	32,079
Philippines	1963-2003	354,752	78,939
Singapore	1963-2003	385,170	87,150
South Korea	1963-2003	206,859	57,055
Thailand	1963-88, 1990-2002	238,572	81,567
Trinidad and Tobago	1969-2003	36,432	13,127
Uruguay	1971-73, 1975-2003	30,311	10,166
USA	1963-2003	879,998	136,519
Venezuela	1963-2003	63,261	24,044
Total		3,930,749	1,000,136

Table 2 - Export and Extensive Margin Growth Rates, Manufacturing Industries, 1975-2003

Region	Growth of Exports	Growth in # Countries Exported to	Growth in # Exported Industries	Growth in # Export Relationships	Realized Potential in 1975 (59,280)	Realized Potential in 2003 (63,858)
USA	154%	12%	1%	17%	49%	53%
India	556%	26%	8%	215%	14%	41%
East Asian Tigers	1601%	74%	24%	369%	5%	22%
Caribbean	313%	85%	18%	88%	1%	2%
Central America	257%	106%	77%	237%	1%	3%
South America	286%	85%	56%	203%	3%	7%
Mexico	3206%	21%	11%	142%	7%	15%

Table 3 - Trade Intensity, Manufacturing Industries, 1975-2003

Country	Value Intensity				Relationship Intensity			
	1975-85	1985-95	1995-03	1975-03	1975-85	1985-95	1995-03	1975-03
USA	0.94	0.95	1.00	0.93	0.81	0.70	0.82	0.66
India	0.88	0.83	0.94	0.73	0.60	0.38	0.55	0.27
East Asian Tigers	0.79	0.87	0.97	0.57	0.41	0.38	0.63	0.18
Caribbean	0.71	0.78	0.49	0.56	0.53	0.40	0.45	0.32
Central America	0.73	0.69	0.70	0.37	0.47	0.29	0.45	0.21
South America	0.64	0.82	0.90	0.61	0.44	0.39	0.55	0.24
Mexico	0.92	0.92	0.99	0.94	0.56	0.37	0.67	0.33

Table 4 - Trade Intensity-Continuous Spells of Service, Manufacturing Industries, 1975-2003

Country	Value Intensity				Relationship Intensity			
	1975-85	1985-95	1995-03	1975-03	1975-85	1985-95	1995-03	1975-03
USA	0.93	0.93	0.99	0.88	0.66	0.53	0.68	0.41
India	0.81	0.72	0.91	0.55	0.33	0.21	0.38	0.07
East Asian Tigers	0.72	0.75	0.85	0.43	0.25	0.22	0.37	0.07
Caribbean	0.49	0.71	0.44	0.32	0.28	0.21	0.31	0.08
Central America	0.66	0.50	0.65	0.22	0.32	0.12	0.26	0.04
South America	0.51	0.73	0.86	0.41	0.24	0.24	0.37	0.08
Mexico	0.89	0.82	0.98	0.79	0.30	0.22	0.48	0.10

Table 5 - OLS Regression, Fraction <= k years spell length

	Value of Trade		Trade Relationships (count)	
	Log-Log	Level	Log-Log	Level
Time	0.965	0.013	0.498	0.036
	[0.039]**	[0.002]**	[0.009]**	[0.002]**
Time x Central America	2.249	0.040	0.883	0.229
	[0.106]**	[0.020]*	[0.030]**	[0.017]**
Time x Central America	2.153	0.039	0.892	0.230
	[0.111]**	[0.021]	[0.031]**	[0.018]**
Time x Caribbean	2.102	0.027	0.888	0.219
	[0.117]**	[0.022]	[0.033]**	[0.019]**
Time x India	1.776	0.020	0.690	0.151
	[0.143]**	[0.027]	[0.040]**	[0.023]**
Time x Asian Tigers	1.165	-0.002	0.668	0.147
	[0.110]**	[0.021]	[0.031]**	[0.018]**
Time x Mexico	1.039	-0.013	0.731	0.167
	[0.143]**	[0.027]	[0.040]**	[0.023]**
South America	-0.100	0.037	-0.093	0.021
	[0.028]**	[0.002]**	[0.006]**	[0.001]**
Central America	-0.207	0.023	-0.108	0.018
	[0.029]**	[0.002]**	[0.007]**	[0.001]**
Caribbean	-0.150	0.029	-0.138	0.014
	[0.031]**	[0.002]**	[0.007]**	[0.001]**
India	-0.159	0.016	-0.062	0.018
	[0.038]**	[0.002]**	[0.008]**	[0.002]**
Asian Tigers	0.018	0.015	-0.041	0.022
	[0.029]	[0.002]**	[0.006]**	[0.001]**
Mexico	0.049	0.023	-0.065	0.020
	[0.038]	[0.002]**	[0.008]**	[0.002]**
Constant	-4.661	0.041	-1.874	0.170
	[0.146]**	[0.028]	[0.041]**	[0.024]**
Observations	6,820	6,820	6,820	6,820
No. of Groups	773	773	773	773
R-Squared	0.70	0.52	0.81	0.72
Year Effects	Yes	Yes	Yes	Yes

Standard errors in brackets

* significant at 5%; ** significant at 1%

Table 6 - Decomposition of Trade Growth -- What if USA Experience

	Annual Growth Rate	What if...			Difference		
	1975 → 2003	Survival	Deepening	Entry	Survival	Deepening	Entry
India	6.7%	7.5%	3.6%	6.1%	0.8%	-3.1%	-0.6%
East Asian Tigers	10.3%	11.1%	6.6%	9.5%	0.9%	-3.7%	-0.8%
Caribbean	0.0%	2.7%	-0.1%	-0.9%	2.7%	-0.1%	-0.9%
Central America	4.5%	7.2%	3.3%	2.4%	2.7%	-1.2%	-2.1%
South America	4.8%	6.5%	4.9%	4.3%	1.7%	0.1%	-0.5%
Mexico	12.8%	13.8%	5.0%	12.8%	1.0%	-7.8%	0.0%

	Avg Annual Growth Rate	What if...			Difference		
	Over Entire Sample	Survival	Deepening	Entry	Survival	Deepening	Entry
India	5.7%	7.8%	3.0%	5.2%	2.2%	-2.6%	-0.5%
East Asian Tigers	13.0%	15.6%	5.8%	12.6%	2.5%	-7.3%	-0.5%
Caribbean	-0.7%	10.0%	1.9%	-0.5%	10.7%	2.6%	0.2%
Central America	2.0%	7.5%	4.1%	0.9%	5.5%	2.1%	-1.2%
South America	6.6%	10.4%	4.3%	6.1%	3.8%	-2.3%	-0.6%
Mexico	10.4%	13.1%	3.7%	10.9%	2.7%	-6.7%	0.5%

Table 7 - Decomposition of Trade Growth -- What if South Korean Experience

	Avg Annual Growth Rate 1975 → 2003	What if...			Difference		
		Survival	Deepening	Entry	Survival	Deepening	Entry
India	6.7%	6.8%	6.4%	6.6%	0.1%	-0.3%	-0.1%
East Asian Tigers	10.3%	10.5%	9.0%	9.8%	0.2%	-1.2%	-0.5%
Caribbean	0.0%	2.1%	5.1%	-0.3%	2.1%	5.1%	-0.2%
Central America	4.5%	6.5%	7.9%	3.1%	2.0%	3.4%	-1.4%
South America	4.8%	5.8%	8.2%	4.8%	1.0%	3.4%	0.0%
Mexico	12.8%	13.4%	8.4%	13.1%	0.6%	-4.4%	0.3%

	Avg Annual Growth Rate Over Entire Sample	What if...			Difference		
		Survival	Deepening	Entry	Survival	Deepening	Entry
India	5.7%	6.2%	8.6%	5.7%	0.5%	2.9%	0.0%
East Asian Tigers	13.0%	13.3%	12.6%	12.9%	0.3%	-0.4%	-0.1%
Caribbean	-0.7%	7.7%	12.7%	0.2%	8.4%	13.4%	0.9%
Central America	2.0%	5.7%	10.9%	1.5%	3.6%	8.8%	-0.6%
South America	6.6%	8.6%	11.2%	6.7%	2.0%	4.5%	0.1%
Mexico	10.4%	11.9%	10.4%	11.3%	1.5%	0.0%	0.9%