ESSAYS IN EMPIRICAL INTERNATIONAL TRADE

by

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ABSTRACT OF THE DISSERTATION

Essays in Empirical International Trade

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This dissertation brings together three empirical studies of international trade issues covering trade policy reforms, trade patterns and the duration of trade relationships in Latin American countries. In the first essay, we review export activities in Brazil since the 1990s, describing changes in export basket composition and diversification of destination markets. Using highly disaggregated trade data, we decompose export growth into the extensive margin (exports of new goods) and the intensive margin (more exports of established goods). We then estimate a probabilistic model of export decisions to investigate whether previous export experience in proximate markets contributes to the shipment of new goods to a trade partner. We find that prior export experience in neighboring countries has a small, positive effect on the probability of exporting in the future. As far as export promotion is concerned, this suggests that new trade relationships should be formed with countries within regions where previous export experience exists. After describing, in the first essay, what products and to what countries Brazil exports, in the second essay we study how long trade relationships last. We characterize the duration of trade relationships by investigating the length of time until Brazil stops exporting a good to a country and whether exports of particular products or to particular markets last longer than others. Our results indicate that trade relationships have a very short life, with

a median duration of only 2 years. We add to the list of trade policy recommendations on export promotion by suggesting that instead of encouraging new relationships it might be better to prevent the existing ones from ending too soon. In the last essay, we study trade issues in another Latin American country. We perform a quantitative analysis of the impact of various trade policies on international trade patterns, domestic prices and poverty in Bolivia. With a unique dataset combining trade data with survey data at the household level, we simulate the magnitude of a variety of trade shocks using a partial-equilibrium model, feed these shocks into price and quantity changes, and finally feed these price and quantity changes into household incomes and expenditures.

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1 Introduction

Export performance has always concerned policy makers and researchers in Brazil. However, the focus of the attention has changed over the last two decades. While in 1980s and 1990s the concern was over the low and erratic export growth, nowadays it is the sustained double-digit growth rates that receive most of the attention. In the 1980s, the lack of an "exporting culture" as well as the lack of government policies entirely devoted to promote exports resulted in mediocre export performance throughout the decade. Brazilian exports grew, on average, 5.6 percent yearly from 1980 to 1990. The trade reform carried out in the early 1990s was marked, on the export side, by a combination of government policies that reduced exports taxation and regulation and the creation of government agencies dedicated to foster export growth. Yet, exports were slow to respond and the annual export growth rate was still at a low 6 percent, on average. The effects of the trade reform were probably offset by low public savings and international pressure following the Uruguay round of negotiations which prevented the government from subsidizing exports as it had been doing in previous years.

It was not until a few years ago that a new pattern of export growth began to emerge. Following the Asian Crisis in 1997 and the capital outflow resulting from the Russian debt moratorium a year later, the Brazilian government was forced to devalue the *real*, the Brazilian currency, in 1999, and adopted a flexible exchange rate regime. A confidence crisis related to the presidential election in 2002 resulted in another (and even stronger) wave of depreciation of the *real* vis-à-vis the currencies of most of Brazil's trade partners and exports finally began to experience rapid and sustained growth.

The combination of a decrease in domestic demand and an increase in commodity prices, associated with the international economy strong growth also gave exports a big push. Despite the appreciation of the real exchange rate the country has been facing for the past couple of years, exports in Brazil reached the record mark of US$ 137.5 billion in 2006, an increase of 16.3 percent from the previous year. Unlike the stagnated export performance of the 80's and 90's, this excellent export growth in recent years, which represents a remarkable change from the scenario of 20 years ago, is what policy makers and researchers discuss these days.

The purpose of this study is twofold. First, we want find out how much of this recent export growth can be owed to exports of new goods. More specifically, we investigate the extensive margin growth of exports between the periods 1997/98 and 2003/04, roughly before and after the exchange rate shocks. Second, we investigate to what extent previous export experience in related markets and tariff shocks contribute to the new goods trade. We work with highly disaggregated trade data classified according to the 6-digit Harmonized System (HS) and the 8-digit “Nomenclatura Comum do Mercosul” (NCM), which is an extension of the HS used by MERCOSUR countries to classify their products. We find that about 30 (11) percent of the total export growth between 1997/98 and 2003/04 can be explained by the trade of new goods disaggregated at the 8-digit (6-digit) level. The results vary considerably with exports at the country level. We find that for some less traditional trade partners new goods trade is responsible for more than 50 percent of export growth. Moreover, the results indicate that new Brazilian products (those not exported in the first period) are sent first to more traditional markets, with whom it has been trading for a longer time and which have a larger share of total exports (e.g., US, EU, Argentina). We then proceed to the estimation of a probabilistic model of Brazil's export decisions controlling for previous export status and for changes in tariff rates imposed by importing markets, as well as country- and industry-specific effects. We find that initial export status plays a significant role in determining the probability of exporting in the second period. Our results also suggest that previous export experience in related countries has a significant effect on the probability of exporting in the second period however, this effect is quite small. Controlling for previous exports to destination market *c* and changes in the tariffs imposed on Brazilian products by that trade partner, having exported to a neighboring country in period 1 increases the probability of exporting to *c* by less up to 8 percentage points, depending on the trade criteria used.

The rest of the paper is organized as follows. The next section describes the performance of Brazilian exports in the last 15 years to motivate the study of new goods trade. Section 3 decomposes recent export growth into the extensive margin (exports of new goods) and the intensive margin (more exports of established goods). Section 4 describes the econometric methodology and presents the estimation results. Section 5 concludes.

2 Export performance in Brazil

In this section we provide a review of the export activities in Brazil since the 1990s, with particular emphasis on the spectacular growth experienced in recent years. We use bilateral trade data classified according to the 6-digit Harmonized System (HS), obtained from the UN Comtrade Database. After an assessment of the overall export performance, we characterize exports in terms of changes in the destination markets and the export basket composition.

2.1 Overall exports

With an average export growth around 6 percent in the 1990s, Brazil's export performance was below the average for the world during most of those years. However, a different scenario emerged during the early years of the current decade. Table 1.1 shows annual growth rates for Brazilian and world exports. Export growth has increased substantially since 2000, in most part due to a more competitive exchange rate but also as a result of stronger international demand conditions. Between 2002 and 2003 alone exports grew by an exceptional 21.1 percent. The double-digit growth rates sustained in the past few years resulted in an average annual growth rate of 19 percent since 2003.

2.2 Geographical distribution of exports

The structure of the distribution of Brazilian exports among its main destination markets has not changed considerably during the past 15 years. The shares of exports to Brazil's most important trade partners in total exports are displayed in Table 1.2 for selected years. The United States, Argentina, European countries and Japan maintained their status of main destination markets for exports from Brazil with their imports accounting for more than 50 percent of Brazilian exports throughout the sample period, even though most of the top importers experienced small decreases in their market shares over the years. Brazilian exporters have become progressively less reliant on the Japanese market and exports to Japan accounted for about 3 percent of total exports in 2006, a gradual decrease from 8.3 percent 15 years earlier. In contrast, exports to China have increased by a remarkable 300 percent in five years. The country, which was ranked the 10th largest importer of Brazilian products in 1996, jumped to 6th place five years later and was in 3rd place in 2006 importing 6.2 percent of Brazilian exports.

Even though the group of main importers of Brazilian products has remained reasonably intact, there has been some diversification in export destinations. The reduction in the share of foreign sales to Brazil's top ten importers, who together accounted for about 63 percent of total exports in the early 1990s and 56 percent in 2006 (Table 1.2), is a sign of this process of geographical diversification. Also, as shown in Table 1.3, exports to less traditional countries, i.e., countries responsible for a small share in the total amount exported by Brazil, experienced significant growth in recent years. Countries such as Iraq, Israel, Ghana, Azerbaijan and Ukraine are among those who significantly increased their shares of Brazilian foreign sales, especially after the last round of exchange rate devaluations in 2002. This regional diversification in exports can also be observed when we compare the combined share in total exports of the 20 countries with the lowest exports shares in 2001 with the share of this same group of countries in 2006. In only 5 years, these countries increased their participation in total exports from Brazil from 0.002 percent to almost 0.06 percent, a remarkable increase of more than 2,000 percent.

Table 1.4 provides further evidence that the rise in exports has been accompanied by geographical diversification. First, the total number of destination markets increased from 173 in the beginning of the sample to 204 in 2006. Second, while in 1989 each product was shipped to an average of 11 countries; in 2006 the average number of destination markets by product almost doubled and Brazil exported each of its products to 20 markets, on average.

To get a better understanding of how the degree of concentration of exports by destination markets evolved over the years, we computed the normalized Hirschman-Herfindahl Index (HHI) over all importers of Brazilian products. The HHI is defined as follows

$$HHI_t = \frac{\sqrt{\sum_{j=1}^{n} x_{jt}^{\ 2}} - \sqrt{\frac{1}{n_t}}}{1 - \sqrt{\frac{1}{n_t}}},$$

where, for each year t, x_{jt} is the share of country j in total exports from Brazil and n_t is the total number of importers. This normalized version of the HHI ranges from 0 to 1 and the more geographically concentrated exports are, the greater the index will be. The results indicate that there seems to be no relevant geographical diversification process at place, except for the most recent years. Despite a slight oscillation in the index over the years, its value remains around 0.20 throughout the sample period with a consistent reduction since 2002 to 0.18 in 2006.

A comparison of the shares of export destinations for country regions[1], presented in Table 1.5, reveals some notable developments which reinforce the pattern seen in the analysis with individual countries. While the shares of the USA and the EU declined considerably, there are higher proportions of exports destined to less traditional markets, with African

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[1] We group exports to individual countries to study exports to the following regions: Africa, Aladi, Asia, EU15, Middle East and Other. Given the size of its market, the USA is treated as a region on its own.

countries increasing their share of Brazilian exports by more than 60 percent from 2001 to 2006. Asian markets are also figuring more prominently in recent years, mostly due to the surge in exports to China and in spite of the significant loss of export share experienced by Japan. Although comparatively more muted, there has also been a significant increase in the share of exports to the Middle East over the period.

2.3 Export basket composition

Table 1.6 shows the export basket with product categories corresponding to the Standard International Trade Classification (SITC), Revision 2. The industry composition remained relatively stable over the years, with machinery and transport equipment at the top of the list in 2006 accounting for almost 25 percent of total exports. Despite the significant reduction in its share of total exports over the years, manufactured goods classified by material still account for almost 19 percent of total foreign sales, in most part due to the exports of iron and steel which have been recuperating from the decrease in export values experienced during the 1990s. Most notable is the increasing share of mineral fuels, which accounted for less than 1 percent of total exports in the early 1990s but increased their participation to almost 8 percent in 2006. A slight reduction in the degree of concentration of industry exports can be confirmed by verifying that the HHI for industry exports decreased from 0.18 in the beginning of the sample period to 0.14 in 2006.

Further analysis of the export basket composition is performed by aggregating product codes into two broad product groups: primary commodities, comprising the agribusiness, fuels, ores and metals; and manufactured goods, which are further disaggregated on the basis of the degree of technological intensity. This product classification was created as a combination of UNCTAD's classification into primary commodities and manufacturing, and the classification according to the technology level which comes from the OECD's STAN Indicators. As displayed in Table 1.7, a comparison of the structure of Brazilian exports between 1991 and 2006 does not show any dramatic change in the export basket sector composition, with both primary commodities and manufactures responsible for about half of the total export value in 2006. It is worth mentioning the remarkable increase in the exports of fuels in recent years, as already seen in the previous analysis with the SITC categories. This surge in fuels exports is almost entirely explained by the increase in exports of petroleum and petroleum products, whose participation in total exports increased by almost 60 percent since 2002. Led by the increase in fuel exports, the participation of commodities in total exports increased from about 44 percent in the early 1990s to almost 49 percent 15 years later. Manufactures, on the other hand, lost some participation in total exports due to the decrease in export share of about 30 percent experienced by both products with low and medium-low technology levels.

The analysis with the SITC data might not be the most appropriate for our purposes of describing the export basket diversification since the level of aggregation is not fine enough. Moreover, the SITC focuses more on the economic functions of products at various stages of development rather than the precise breakdown of the products' individual categories. We finalize the export performance description by looking at the export basket composition with the HS data disaggregated at the 6-digit level.

Even at these finer product classifications the level of concentration of exports remains stable throughout the sample period. The HHI remains around 0.10 in all years. To investigate the changes in the export basket composition in more detail, we rank the products according to their shares in total exports in 1991, 1996, 2001 and 2006. Six products make the top 15 list in all four years and, as can be seen from Table 1.8, some of them experienced dramatic changes in their rank positions. While coffee was the second most important product in the early 1990s it has been losing participation in total exports over the years and its position went down to 8th place, responding for 2.2 percent of total exports in 2006. Soya beans, on the other hand, have been gaining importance, having increased from the 11th position in 1991 to a remarkable 3rd place 15 years later.

3 Intensive and extensive margins of trade

3.1 Definition

A country can experience exports growth by increasing the volume of sales on its existing trade relationships or by forming new trade relationships. According to the literature on intensive and extensive margins of trade, trade growth along the intensive margin is defined as an increase on the volume of trade involved in existing trade relationships, while growth on the extensive margin means an increase on the number of trade relationships a country has.

When it comes to the study of trade growth reflecting a wider set of trade relationships, or extensive margin growth, different approaches have been taken in the literature. In their study of the geographical spread of trade, Evenett and Venables (2002) interpret extensive margin as the trade attributed to the acquisition of new trade partners. With bilateral trade data for 23 countries they find that one third of the export growth between 1970 and 1997 can be accounted for by the supply of existing products to new destination markets. Kehoe and Ruhl (2002) take a completely different approach as they refer to changes along the extensive margin when studying the diversification of the export basket of 18 countries which experienced significant trade liberalizations. They find that the share of trade accounted for by goods which were traded the least before the trade liberalization increases significantly after the liberalization. In related work, Debaere and Mostashari (2005) consider how changes in tariffs and tariff preferences affect the range of goods that the US imports from its trade partners. Even though they also interpret trade along the extensive margin as trade of new varieties, their measure of extensive margin growth is different from Kehoe and Ruhl. Debaere and Mostashari split their sample in two periods and compare the goods that were traded in 1989-1991 with goods that were traded in 1998-2000. Their results indicate significant changes in the extensive margin of US imports between the beginning and the end of their sample but they find that these changes can only be in part accounted for by tariff reductions and tariff preferences.

We adapt from Debaere and Mostashari's approach when studying the changes in the extensive margin of Brazilian exports. We consider two two-year periods to capture the changes induced by the exchange rate shock: 1997/98 and 2003/04[2]. As previously mentioned, the Brazilian exchange rate policy went through a dramatic change in January 1999 and a major devaluation took place. Such devaluation, of a considerable amount, usually makes a country more competitive in the export market and is thus chosen as the break point in our sample. Figure 1.1 reveals a clear change of pattern and an

[2] We choose to work with a two-year window to reduce idiosyncrasies that may occur in any single year.

unequivocal upward movement of the real exchange rate[3] in the few years following the change in the exchange rate system.

According to our definition of extensive and intensive margins, Brazilian export performance can be split into the performance of three product categories: new products, deleted products and permanent products. New products are those that were not shipped anywhere in the first period but were exported to some trade partner in the second period. Deleted products are those that were exported somewhere in the first period but were not exported anywhere in second period. Lastly, permanent products are those that were exported in both periods[4]. We define a good to be traded if it is exported in at least one of the two years of the period[5] and we require that the average export value in the two-year period be higher than a predefined threshold. To test the sensitivity of our results to the criteria of what constitutes a traded good, we define three cutoff values for exports: 0, 500 and 1,000 constant 1987 dollars[6].

We start our investigation of changes at the extensive margin by looking at total Brazilian exports regardless of destination market and we then proceed to a country-level analysis by looking at exports of established products to countries the products had not yet been exported to.

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[3] Nominal exchange rates obtained from the Central Bank of Brazil were deflated using the Broad National Consumer Price Index (IPCA).

[4] But not necessarily in the years between both periods.

[5] We also computed statistics requiring that the product be exported in both years in order to be considered traded but the results did not change considerably.

[6] We adjust the data on current US dollars by the US CPI to create a constant 1987 dollar series.

3.2 Data

We work with two highly disaggregated sets of bilateral trade data. The data classified at the 6-digit Harmonized System (HS) is obtained from the UN Comtrade Database and the 8-digit data classified according to the "Nomenclatura Comum do Mercosul" (NCM), an extension of the HS used by MERCOSUR countries to classify their products, is obtained from the Brazilian Ministry of Development, Industry and Foreign Trade (MDIC). According to the 6-digit classification, a total of 3,985 product codes were exported in the 1997/98 period (including permanent and deleted products) and 4,294 in the 2003/04 period (including permanent and new products). These numbers increase to 7,285 and 7,856, respectively, with the 8-digit disaggregation.

Unfortunately, there are problems with both classifications. On one hand, the aggregation at the 6-digit level may not be fine enough to observe new goods trade and, on the other hand, the more disaggregated 8-digit data suffer from more frequent and untraceable reclassifications of product codes, which may result in overstating the extensive margin[7]. To understand the different conclusions regarding extensive margin growth that may result from these product classifications, consider the following example in which the 6-digit product category is exported in both periods but the 8-digit product category is only exported in the second period. Product code "260300 - Copper ores and concentrates" is

[7] These reclassifications entail not only splitting a single code into multiple codes but also combining multiple codes into a fewer number of new codes. Since it is not possible to keep track of all these reclassifications, we cannot know for sure whether a new code that appears in our sample really represents exports of a new product or simply exports of an already existent product under a reclassified code.

composed of two 8-digit product codes: “260300.10 - Copper ores and concentrates, copper content” and “260300.90 - Copper ores and concentrates, other metal content”. While the 6-digit category “260300” was exported in both periods and, hence, is a permanent product under the 6-digit classification, product code “260300.90” was only exported in the second period and is considered a new product under the 8-digit classification.

3.3 Results

3.3.1 Overall exports

Table 1.9 shows the number of new, deleted and permanent goods in 1997/98 and 2003/04 as well as their shares in the total number of products exported in the periods considered, for both the 6-digit and the 8-digit product classifications. All Brazilian trade relationships are recorded in our databases regardless of export value. To test the sensitivity of our results to the criteria of what constitutes a traded good, we also present the intensive and extensive margins of exports under different cutoff values: 0, 500 and 1,000 constant 1987 dollars. The first thing we notice is that the different cutoffs used to define a product as traded do not alter the results in any meaningful way. According to the 8-digit (6-digit) classification, using the US$0 cutoff value, 1,557 (500) products were exported for the first time in the second period, 986 (191) products were exported only in the first period and 6,299 (3,794) products were exported in both periods. While at the 8-digit level 21.6 percent of the products exported in the second period had not been exported in the first period, at the 6-digit level this number decreases to 11.6 percent.

The disparities between the two product classifications become even more pronounced when we consider the extensive and intensive margins of export values instead of number of products, as show in Table 1.10. In this table we present the share of export value in both periods as well as the share of export growth between the two periods accounted for by each product category. Once again the different cutoff points do not seem to matter and we discuss the results based on the US$0 criteria. At the 6-digit level, only a very small fraction of the export value in 1997/98 is owed to products which are not exported in the second period: 0.6 percent of the export value corresponds to deleted products and 99.4 to permanent products. Although the share of deleted products is higher with the 8-digit level data, it is still low at 7.0 percent.

The result we are most interested in is the extent to what the new goods trade contributes to the export growth between both periods. With the US$0 cutoff value, we find that, at the 6-digit level, only 11.4 percent of the export growth between 1997/98 and 2003/04 are owed to exports of new products. As expected, at the 8-digit level the growth at the extensive margin is considerably larger, with the export of new goods responsible for almost 30 percent of the export growth. As previously mentioned, there is a simple explanation for the observed disparities. One on hand, the 6-digit data are probably not detailed enough to observe the exports of new products and the results may understate the true extensive margin. On the other hand, the results with the 8-digit data may overstate the true extensive margin since at this level of disaggregation product code reclassifications become much more frequent. We choose to take advantage of the more disaggregated dataset, keeping in mind that this might lead to an overestimation of the true extensive margin of exports.

3.3.2 Exports at the country-level

We start the analysis with bilateral trade data by looking at the extensive margin in terms of the number of new products exported to Brazil's trade partners. Table 1.11 presents the top destination markets for new Brazilian products classified at the 8-digit level. The second column of the table shows the total number of products shipped to selected markets for the first time in the 2003/04 period. As can be seen from the table, the US, Latin American countries and the EU are the main destination for new exportables. The third and fourth columns decompose the total number of new products exported to each country into those that had already been exported by Brazil to some other trade partner in 1997/98[8] and those which had never been exported anywhere in the first period. Taking the US market as an example, out of the 4,888 products that were exported to the US in 2003/04, a total of 1,906 products (39%) had not been exported to the country before. Moreover, out of this 1,906 new products, 1,277 (67%) had already been exported somewhere else in the 1997/98 period while 629 (33%) were being exported by Brazil for the first time.

The last column of the table shows the share of new Brazilian products that were being exported to the selected countries for the first time in the 2003/04 period in the total number of new Brazilian products. These shares indicate that new Brazilian products are sent first to the Brazil's more traditional destination markets, such as the US and Latin

[8] This classifies them as new products at the destination market level but permanent products for Brazil.

American countries, especially its MERCOSUR partners, and the EU. Figures 1.2 and 1.3 seem to confirm this finding. In both figures, we plot the share of products exported to the trade partners for the first time in the second period (new products at the country level) in the total number of new Brazilian products (from Table 1.11) against the trade partners' shares in Brazilian exports in the first period. Excluding the outlier observations of the US and Argentina, Figure 1.3 suggests that, in general, countries with larger shares of Brazilian exports in 1997/98 are those who receive the greater number of new products in 2003/04. It is worth mentioning that Angola stands out in the list of top destination markets for new Brazilian products, with 24 percent of the new Brazilian products being shipped to the country for the first time in 2003/04 despite its small share of total Brazilian exports in 1997/98. Together with the other PALOP countries[9], Angola has become one of the top priorities in Brazil's political and economic diplomacy in recent years. The destruction of almost all of its towns and cities during the struggle for independence from Portugal between 1961 and 1974 and the 1975-2002 civil war turned it into a vast field of business opportunities. Trade relations with this West African country started to grow in 2000 but since President Lula took office, in January 2003, Brazilian investment in the country has soared.

We also investigate whether Brazil exported more new products to larger countries. In Figures 1.4 and 1.5 we plot the share of products shipped to the trade partners for the first

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[9] PALOP, the group of Portuguese-Speaking African Countries, consists of Angola, Cape Verde, Guinea-Bissau, Mozambique and Sao Tomé and Príncipe.

time in 2003/04 in the total number of new Brazilian products against the destination markets' GDPs in 1997/98[10]. Despite the relatively high share of European countries, even after excluding the outliers in Figure 1.5 it is still not clear how important market size is for Brazil's export decisions given the large number of new products shipped to smaller markets in Latin America. The export basket diversification seems to be influenced both by the proximity and the size of the destination markets and this heterogeneity will be controlled for in our econometric specification.

We now turn to the share of export value at the country level that can be attributed to the extensive margin. As can be seen from the first two columns of Table 1.12, for some selected markets the extensive margin accounts for a significant share of the total exports in the second period and, in some cases, for more than 50 percent of the export growth experienced between the two periods. Of the total exports to the US market in 2003/04, 15 percent corresponded to shipments of new products and almost 40 percent of the export growth between periods is accounted for by the extensive margin. More impressive is the case of India, with 46.3 percent of Brazilian exports to the country in 2003/04 and 66 percent of the export growth between both periods consisting of goods Brazil had not shipped there before.

In order to control for the issue of product code reclassifications, we also present the results at the country level for a set of Brazilian permanent goods, i.e., goods which had

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[10] GDPs were obtained from the World Bank's World Development Indicators (WDI).

already been exported somewhere by Brazil in 1997/98 but were new to the country in question. The last two columns of Table 1.12 suggest that reclassification might matter at the 8-digit level since the new goods share of exports in 2003/04 and of export growth between 1997/98 and 2003/04 decreases for most of our selected countries when we restrict ourselves to the set of permanent Brazilian products. A case worth mentioning is the US, whose extensive margin share in 2003/04 exports drops 12.3 percentage points, to 2.7 percent, and whose extensive margin share in export growth drops by 30.1 percentage points, to 7.2. This could be an indication that most of the products shipped to the US for the first time in 2003/04 were in fact products that Brazil had not exported anywhere before, which reinforces the idea that Brazil tends to try its new products in more traditional (and larger) markets, where it is probably easier to find demand for new products. However, these results should be interpreted with care. As pointed out by Amiti and Freund (2007), working with a set of permanent products may actually result in an understated extensive margin at the country level if exports of new products occur based on new product classifications.

4 Econometric approach

4.1 Model specification

To study the changing extensive margin taking into consideration previous export experience and trade costs, we follow Debaere and Mostashari's method and estimate a probabilistic model of Brazil's export decisions. More specifically, we estimate the probability of good i being exported to country c in the 2003/04 period controlling for whether or not it was exported in the 1997/98 period (either to country c or to a related market) and for changes in tariff rates imposed by importing markets.

Taking previous export status into account is important since it allows us to control for the fixed costs associated with starting a trade relationship. The costs of exporting depend on knowledge that has been gained about the importing markets and we extend Debaere and Mostashari's approach by allowing this knowledge to come from two sources. Previous knowledge in a specific market *c* is controlled for by DC_{ic}, a dummy variable that is 1 if good *i* was exported to country *c* in the first period and 0 otherwise. To allow for spillovers from experience obtained in neighboring markets we create DR_{ic}, a dummy variable that is 1 if the good was not exported to country *c* in the first period but was exported to other countries in the same geographical region as country *c*. It seems reasonable to hypothesize that having previous export experience in France, for example, would potentially facilitate, in terms of knowledge of similar markets and reduction of search costs, the start of trade relationships with other European countries. In a set of alternative specifications, we split the region spillover variable to allow for effects of belonging not only to the same region but also to a Customs Union (CU)[11]. In doing so, we create two new variables: (i) $DRCU_{ic}$, which is 1 if the good was not exported to country *c* in the first period but was exported to other countries in the same geographical region as country *c* which are in a CU with *c*, and (ii) $DRNCU_{ic}$, which is 1 if the good was not exported to country *c* in the first period but was exported to other countries in the same geographical region as country *c* but not in a customs union with *c*. The reason for

[11] Under a customs union, a group of countries pursues free trade internally while maintaining a common external tariff with the rest of the world.

doing this is that one might expect the knowledge gained by exporting to a country that belongs to a Customs Union to be directly applicable to other members of the CU (in terms of, among other things, regulations, tax laws, quality control), hence significantly reducing the cost of starting a new trade relationship and reinforcing the effects of the regional spillover.

We include tariff changes as a proxy for trade costs to capture the fact that, conditioning on the exporting status in the first period, Brazil is more likely to export good *i* to country *c* if its costs relative to country *c*'s production costs decrease. The inclusion of country and industry dummies in our estimation controls for country-specific macroeconomic conditions and market size as well as technological innovations in production which could potentially affect the probability of exporting.

For each product *i* and destination market *c*, let Y_{ic} be the binary indicator variable that takes on the value 1 if product *i* is exported to country *c* in the second period and 0 otherwise. Y_{ic} is derived from an underlying latent variable as follows:

$$Y_{ic} = 1 \quad if\ Y_{ic}^{*} > 0,$$
$$Y_{ic} = 0 \quad otherwise;$$

where

$$Y_{ic}^{*} = \alpha + \beta DC_{ic} + \delta DR_{ic} + \gamma cht_{ic} + \rho Z + \theta W + \varepsilon_{ic}.$$

DC_{ic} and DR_{ic} are the initial export status variables as previously described[12], cht_{ic} is defined as the log change in the tariff rate imposed by country *c* on good *i* between both periods, and *Z* and *W* are country and industry dummies[13], respectively, to account for unobserved heterogeneity. Under the normality assumption we estimate our model with a probit controlling for potential heteroscedasticity and within-region correlation.

4.2 Results

In this section we investigate whether and by how much previous export experience in neighboring markets and tariff changes affect the probability of exporting in the second period, controlling for initial export status. Therefore, we present not only the estimated probit coefficients, whose signs indicate whether the covariates have a positive or negative effect, but also, and more importantly, the marginal effects, which indicate the magnitude of the effect on the probability of exporting a good. Table 1.13 presents the results for the benchmark estimation in which the product is considered traded if it is exported in at least one the two years of the period and the region spillover is measured by the DR_{ic} variable[14]. Table 1.14 presents the results with the regional spillover variable split into $DRCU_{ic}$ and $DRNCU_{ic}$ to control for the effects of customs union membership.

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[12] Autocorrelation should not be an issue here given the large gap between what we call first and second periods.

[13] Industry dummies for each category of the International Standard Industrial Classification (ISIC), Revision 3.

[14] We also obtained results with an alternative sample specification according to which, for each two-year period, the product must be exported in both years of the period to be considered traded. Since the results were very similar to the benchmark estimation we choose not to present them here for simplicity.

As one notices from Table 1.13, the different cutoff values do not seem to alter the results dramatically. There is no evidence of any significant effects of tariff changes on the probability of exporting in the second period, regardless of trade criteria, and the estimated coefficients for the spillover dummy, *DR*, are only significantly different from zero with the estimation under the two highest cutoff values. The marginal effects of the *DR* variable estimated under the 500 and 1,000 1987 dollars cutoffs are very similar and slightly larger than those obtained with the 0 dollar threshold. While these results indicate that previous export experience in the region has a significant effect on the probability of exporting in the second period, this effect is relatively small. Marginal effects for the binary variable are obtained by computing the difference between Prob ($Y_{ic} = 1|DR_{ic} = 1$) and Prob ($Y_{ic} = 1|DR_{ic} = 0$) using the estimated coefficients and setting the other covariates at their average values. Controlling for previous exports to destination market *c* and changes in the tariffs imposed on Brazilian products by that trade partner, having exported to a neighboring country in period 1 only increases the probability of exporting to *c* by less than 5 percentage points.

The last row of the table shows the percentage of correct predictions by the model as an indicator of the model predictive ability. Model predictions of the number of goods exported in the second period are compared to the actual number of zeros and ones by setting the model prediction to 1 if the predicted probability is greater than 0.5 and 0 otherwise. As can be seen from the table, a total of 63 to 70 percent of the model's predictions are correct, depending on the export threshold. Moreover, while under the 0 threshold the model predicts correctly more 1's than 0's, the opposite is true for the other two higher thresholds[15]. While these results do not seem to suggest good predictive ability, as Greene (2002) points out, not too much emphasis should be placed on this measure of goodness of fit, especially when the sample is relatively unbalanced, i.e., when there are many more ones than zeros or vice-versa[16].

Since our goal is to investigate the effect of previous experience with neighboring countries on the extensive margin of exports, we also compute the marginal effects for the *DR* variable, i.e., the difference in response probabilities calculated at the two values of *DR*, on a sample of new products only. Given the relatively small coefficients on *DC*, setting *DC* equal to 0 instead of its mean value when calculating predicted probabilities does not result in any significant changes in the marginal effects associated with *DR*.

The results in Table 1.14 indicate that membership to a Customs Union reinforces the effects of the regional spillover. Although the marginal effects for both regional dummies are still relatively small, $DRCU_{ic}$ has an effect on the probability of exporting in period 2 which is statistically different from zero under all thresholds and is stronger than the effect of simply belonging to the same region obtained with DR_{ic} in the benchmark specification. Previous export experience in a neighboring country that is in a customs

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[15] A constant-only model is unable to predict 0's under the lowest cutoff value and it cannot predict 1's under the two highest cutoff values.

[16] Two-thirds of the observations are zeros and one-third are ones under the 0 threshold. The opposite holds under the 500 and 1,000 1987 dollars cutoff value.

union with country *c* increases the probability of exporting to *c* by up to 8 percentage points.

5 Concluding remarks

This paper contributes to the research on exports from Brazil by examining the remarkable export performance in recent years and investigating to what extent this recent boom is owed to exports of new goods entering the exporting basket.

The first part of the paper reviews Brazilian export activities since the 1990s, with particular emphasis on the spectacular growth experienced since 2002. With much disaggregated bilateral trade data, we characterize export performance in terms diversification of trade partners and export basket composition. We find that the structure of the distribution of Brazilian exports among its main destination markets has not changed considerably during the past 15 years. The United States, Argentina, European countries and Japan maintained their status of main destinations for exports from Brazil, with their imports accounting for more than 50 percent of Brazilian exports throughout the sample period. Nevertheless, the reduction in the share of foreign sales to Brazil's top ten importers, who together accounted for about 63 percent of total exports in the early 1990s and 56 percent in 2006, is an indication of geographical diversification of exports. There is also no dramatic change in the export basket sector composition. Primary commodities and manufactures were each responsible for about half of the total export value throughout the sample period. Among exports of manufactures there is a small change in pattern with the share of high and medium-high technology manufactures increasing in detriment of the shares of medium-low and low technology manufactures.

In the second part of the paper we study the extensive margin growth of exports between the periods 1997/98 and 2003/04, roughly before and after the exchange rate shocks which led to a series of devaluations of the real, the Brazilian currency. We decompose the aggregate growth of exports into the intensive and extensive margins and we find that about 30 (11) percent of the total export growth between 1997/98 and 2003/04 can be explained by the trade of new goods classified at the 8-digit (6-digit) level. The results vary considerably with exports at the country level. We find that for some less traditional trade partners, new goods trade is responsible for more than 50 percent of the export growth. Moreover, the results indicate that new products are sent first to those more traditional markets with whom Brazil has been trading for a longer time and which have a larger share of total exports (e.g., US, EU, Argentina). We then proceed to the estimation of a probabilistic model of Brazil's export decisions controlling for initial export status and for changes in tariff rates imposed by importing markets, as well as country- and industry-specific effects. We find that initial export status plays a substantial role in determining the probability of exporting in the second period. We also find evidence that previous export experience in neighboring countries, especially those members of the same customs union, has a significant effect on the probability of exporting in the second period however, this effect is relatively small. Controlling for previous exports to destination market c and changes in the tariffs imposed on Brazilian products by that trade partner, having exported to a neighboring country in period 1 only increases the probability of exporting to c less than 5 percentage points (up to 8 percentage points if both countries belong to a customs union). As far as export promotion is concerned, this suggests that new trade relationships should be formed with countries within regions where previous export experience exists.

Chapter 2 How long to trade relationships last?

1 Introduction

For a long time the performance of exports has been the focus of trade research in Brazil. However, most of the empirical studies on Brazilian export activity have dealt with the same topics: investigating the determinants of export trade relationships, explaining the reasons behind export performance over the years in terms of values, prices and quantum and providing recommendations on how to promote export growth. Trade relationships are usually characterized based on export basket composition and the geographical distribution of foreign sales and it is often suggested that export promotion should involve diversification of the export basket and the destination markets. In this study we take a different route as we do not investigate whether or why a trading relationship is formed, but rather, once it is formed, how long it lasts.

As pointed out by Van den Berg (2000), survival analysis has been widely used in areas such as labor economics, to study unemployment and strike durations, as well as in population economics where authors study, among other things, marriage durations and duration until death. Other applications of survival analysis include the study of the duration of wars by political economists, the duration until purchase of a product in consumer economics and the duration of a patent in the industrial organization field. A new approach to duration methods pioneered by Besedeš and Prusa (2006a) provides new insights into international trade relationships. The authors apply survival analysis to study the duration of US imports and their results indicate highly dynamic trade patterns, with the median duration of importing from a foreign supplier of just 1 year.

Following Besedeš and Prusa's work, we apply survival analysis to trade data at the product level to study how long Brazilian products survive in exporting markets. We characterize the duration of trade relationships in which Brazilian exports are involved by investigating not only how long it takes until Brazil stops exporting good *x* to country *c* but also whether exports of specific products and/or to specific markets last longer than others. We also add to the list of recommendations on how to promote export growth by suggesting that instead of encouraging new relationships to be formed it might be better to prevent the existing relationships from ending too soon. We find that Brazilian export trade relationships have a very short life, with the median duration of exporting a product of just 2 years. Our results also indicate that trade relationships are at the greatest risk of being dissolved in the early years of their existence since the probability of failure decreases over time. Moreover, duration time is highly sensitive to the aggregation level of product classification and aggregation from products to industries increases estimated survival time considerably. Trade relationships starting with large initial trade values are shown to survive longer than those with small starting values.

The structure of the paper is as follows. Section 2 describes the data and discusses the issues that will have to be dealt with in the estimation procedure. Section 3 presents our methodology and the following section presents the main econometric results. The final section concludes.

2 Data

For each year between 1989 and 2006 we have information on every product exported by Brazil to each of its trade partners. The exports of 4,917 products to a total of 228 trade partners over the 18 years covered by the sample are classified according to the 6-digit Harmonized System (HS). These highly disaggregated data, henceforth called the benchmark data, will be the standard against which alternative treatments of the data, to be discussed later in this section, will be compared. For the purpose of robustness checks performed later on, we also have data on product categories corresponding to the Standard International Trade Classification (SITC), Revision 2 ranging from the 1-digit to the 5-digit level. Both datasets were obtained from the United Nations Comtrade database.

Episodes of servicing the foreign market are usually referred to as "spells". The data are organized in duration (or spell) format according to which there is one record for each spell of a trade relationship. In this format, for each product-country pair we have a record documenting the start and ending dates of the relationship, the length of the spell in years and information on whether failure or censoring occurred at the end of the period[17]. Our study has a fixed (calendar) starting date related to data availability but as what matters is analysis time, i.e., the duration of the relationship existence, trade relationships are allowed to start and enter the sample at different calendar times. Table

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[17] "Failure" and "censoring" are typical terms used in survival analysis. Definitions can be found later in the text.

2.1 provides an example of the data collected for a representative product, Brazil nuts, and illustrates the level of product detail. The "x's" indicate the years in which Brazil nuts were exported to some of Brazil's partners. As can be seen from the table, countries such as the US, Spain and Italy imported Brazil nuts continuously in every year covered by the sample. This results in a unique spell lasting 18 years. Other countries had their trade relationships involving Brazil nuts interrupted for a few years, as is the case of Bolivia, who imported Brazil nuts between 1997 and 1999 and then again between 2003 and 2006. This pattern results in 2 spells, the first lasting 3 years and the second 4 years.

Both the number of products and the number of trade partners have increased over the years, as can be seen from Table 2.2. The table also shows the total number of (non-zero) trade relationships, the average number of products sold to each trade partner and the average number of importers of each product by year. The numbers in the table indicate that not only has Brazil been expanding its export basket over the years, it has been doing so at the country level. While almost 250 products were being exported on average to each trade partner in 1989, this number increased considerably to more than 420 products by 2006. Brazil has also been diversifying the markets to which its exports are sold, with each product being sold, on average, to almost twice as many countries in 2006 than 15 years before that.

It is worth mentioning the remarkable changes experienced between 2002 and 2003. Even though the total number of partners remained stable, the number of Brazilian export relationships increased by more than 20,000, a partner imported on average 100 products more than in 2002 and more than 200 new products were exported in 2003. There are many potential explanations which together could account for these findings. First, and most important, a confidence crisis related to the presidential election in 2002 led to a strong depreciation of the *real* vis-à-vis the currencies of most of Brazil's trade partners and exports experienced rapid growth. Between 2002 and 2003 total exports grew more than 20 percent, 17 percentage points higher than the growth experienced in the previous year. The combination of a decrease in domestic demand and an increase in commodity prices, associated with the international economy strong growth also gave exports a big push. Second, at the destination market level, there was a surge in exports to China, which increased by almost 76 percent during between these two years. The number of products exported to the country increased from 851 in 2002 to 1,055 a year later. The reclassification of the Harmonized System could also help explain, even if to a less extent, the increase in the number of trade relationships as 27 new product codes were first exported by Brazil in 2003.

Table 2.3 provides some summary statistics both for our benchmark data and for the alternative treatments of the data to be explained next. The benchmark dataset consists of 320,934 spells[18], with an average spell length of 3.1 years and a median spell length of 1 year. The observed distribution of the duration of relationship spells for the benchmark data can be seen in Figure 2.1, which shows the percentage of observations whose observed spell is greater than a given spell length. More than half the spells last just 1 year and about 85 percent are observed for less than 5 years. Moreover, as an indication

[18] A product-country pair can have more than one relationship spell, as seen in Table 1. We discuss multiple spells in more detail later in the text.

of how the majority of export relationships are short-lived, a little over 7 percent of the spells last longer than 10 years and only about 3 percent of trade relationships span the entire sample period.

Further analysis of the observed distribution of spell lengths with the benchmark data was performed by computing spells lengths broken down by country regions, as it would be interesting to verify whether relationships with traditional partners, such as the US and ALADI members[19], last longer than those with less-traditional partners in the Middle East and Africa. The results can also be seen in Table 2.3. Export relationships with ALADI members, the US and European countries not only involve a higher number of products but they also have longer spells than others. Spells last, on average, 7.5, 4.8 and 4.7 years, respectively, for relationships with countries in these regions. Also, relationships with countries in Asia, Africa and the Middle East are, on average, half as long as those with ALADI members. Proximity to Latin American countries and the size of the US and European markets could explain these results.

2.1 Data aggregation

If instead of calculating spell lengths for each product-country pair we aggregate spells by exports to regions[20] and exports to the whole world (or total exports), the number of spells is reduced considerably and, as expected, the spells last much longer. There are a

[19] ALADI, the Latin-American Integration Association (also know by the English acronym LAIA), has twelve members: Argentina, Bolivia, Brazil, Chile, Colombia, Cuba, Ecuador, Mexico, Paraguay, Peru, Uruguay and Venezuela.

[20] We group exports to individual countries to study exports to the following regions: Africa, Aladi, Asia, EU15, Middle East and Other. Given the size of its market, the USA is treated as a region on its own.

total of 57,207 spells for product-region pairs and 8,293 for product-world pairs. The aggregations result in mean (median) spell lengths of 4.7 (2) and 9.1 (6) years for region and world aggregations, respectively. It should be noted that analyzing the duration of exports to the world is equivalent to studying the duration of trade of each product regardless of destination market. Since the majority of the products are not destination-specific[21] and therefore will be frequently exported to at least some trade partners, one should expect longer duration spells than those obtained with either country data or region data.

The longer spells obtained with region and world data can also be observed from Figure 2.1. While for the benchmark data 47 percent of the observations last longer than 1 year, for data on product-region and product-world relationship pairs these numbers are considerably higher, with 58 percent and 74 percent of observations lasting more than 1 year, respectively. Moreover, while in the benchmark case only about 7 percent of spells last longer than 10 years, this number increases to 16 percent with the region aggregation and almost 43 percent with exports to the world.

Summary statistics for the observed spell lengths with data aggregated at the industry level based on the SITC ranging from 1-digit to 5-digit are also shown in Table 2.3. The higher the aggregation level, the less we observe the formation and dissolution of trade relationships and, consequently, the fewer and the longer the spells. While there are

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[21] Only 103 of the 4,917 distinct hs codes in the sample had a unique destination market.

155,835 spells with 5-digit SITC data, there are only 56,943 with 3-digit and 3,800 with 1-digit data. The mean (median) spell length increases from 3.3 (1) years with 5-digit data, to 4.7 (2) with 3-digit and 7.5 (3) with 1-digit data. Thus, while in terms of spell lengths the SITC 5-digit data produces results very similar to the benchmark case[22], higher aggregation levels result in spells up to 4 years longer on average. Figure 2.2 provides more details on the observed spell lengths for the SITC data[23]. For all SITC aggregations more than half the spells last longer than 1 year, except for data aggregated at the 5-digit level where 53 percent of the spells end in the first year. For more disaggregated data at SITC 4 and 5 digits, similarly to the benchmark case, only a very small percentage of the spells last longer than 10 years.

2.2 Censoring

Censoring is a common feature of survival studies in which the length of time is pre-specified. Since our study covers the period 1989-2006, the exact beginning date of a trading relationship that appears in the first year of our sample is not observed, and we cannot determined the exact duration of a trading relationship that is still active in the last year of the sample either. If we observe a product being exported in 1989, we cannot know with certainty whether this trading relationship started in 1989 or sometime before that. Take the exports of Brazil nuts to Japan as an example. As displayed in Table 2.1,

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[22] This should be expected since, at its most detailed level, the majority of SITC 5-digit concord with 6-digit HS codes.

[23] SITC Rev.2 data is available since 1983 which explains spells lengths of more than 18 years as is the case with the HS data used in our benchmark analysis.

Brazil nuts were exported to Japan from 1989 to 1992, which gives a spell of 4 years. However, since this trading relationship could have started in some year prior to 1989 we treat it as censored and because the exact spell length is unknown, we interpret it as a spell lasting at least 4 years. Similarly, Brazil nuts were exported to Israel for 6 years until 2006 but all we can say is that this trading relationship lasted for at least 6 years because we cannot be sure when the relationship ended. Since by the time the study ended the product was still being exported (i.e., no failure had been experienced) trade relationships like this one are considered censored. In summary, because of the fixed time of data collection, the observed spell lengths might be shorter than the true length of the spells.

As discussed by Besedeš and Prusa (2006a), another type of censoring present in our study arises from the fact that product classifications are often revised, resulting in the deletion of some codes and the introduction of new ones. These reclassifications entail not only splitting a single code into multiple codes but also combining multiple codes into a fewer number of new codes. Since it is not possible to keep track of all these reclassifications, we cannot know for sure whether a new code that appears in our sample really represents the start of a new trade relationship or simply the continuation of an already existent relationship under a reclassified code formerly included under other codes. Similarly, when a product disappears from our sample we can either interpret this as Brazil no longer exporting that product or the result of a code reclassification under which the relationship continues to be active but under a new, untraceable code.

We understand that making assumptions about what happened as a result of these reclassifications distorts the distribution of export duration. By assuming that those products which disappear and those that emerge after a reclassification are real deaths and births, we might end up underestimating the duration of the trade relationships while the opposite happens when we assume the relationships involving these products are censored. However, this might turn out not to be a significant issue in our study. Table 2.4 shows the number of product codes that appear and disappear from the sample in every year. Regardless of how we decide to deal with reclassifications, most of the censoring will definitely occur in the first and last years of the sample since only a small number of products are created and deleted each year. In the benchmark analysis, we choose to follow the conservative approach taken by Besedeš and Prusa to deal with reclassifications and we interpret spells beginning with the emergency of a new product code and spells ending when an existing product code disappears as being censored[24]. The estimation procedures we undertake allow for censored data.

2.3 Alternative treatments of the data

2.3.1 Multi-spell data

Another issue we have to deal with is the fact that some trade relationships have multiple spells. There are many cases in which we observe a product *x* which is initially exported to a country *c*, ceases to be exported to this country, and then after a while it is exported again. For example, Brazil began exporting Brazil nuts to Denmark in 1996, stopped

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[24] We alternatively classify spells with new and deleted product codes as births and deaths but the results do not change significantly. For simplicity, later in the text we only show the results with the benchmark data.

doing so in 1998 and started exporting again between 2000 and 2002, when the relationship was last observed in our data. In this case, the 5-year relationship with Denmark is split into two spells. In the benchmark dataset we have 179,960 distinct product-country pairs, out of which only 54 percent have one single spell. The number of spells for each product-country pair ranges from 1 to 8 and among those relationships with multiple spells about 54 percent of them have 2 spells, 28 percent have 3 spells and 18 percent have 4 or more spells.

In the analysis based on our benchmark dataset we use all spells per country-product pair and we assume they are independently distributed. That is, if, after being dissolved, a trading relationship is formed again, we assume this spell is completely independent of previous ones[25]. In any case, in order to check the robustness of our results under the assumption of independence among spells, we consider three alternative samples: (i) consisting of trade relationships which have only a single spell; (ii) consisting of the first spell of each trading relationship (which includes relationships with just a single spell and the first spell of multi-spell relationships); and (iii) combining one-year gaps between spells to form longer spells under the assumption that small gaps have been misreported (longer gaps are assumed to be correct and are not adjusted for).

Similarly to what was done with the benchmark data, we also analyzed the distribution of observed spells lengths for these alternative ways of dealing with multiple spells. Though

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[25] Without the presence of any covariates at this stage, multiple spells are independent if there is no unobserved heterogeneity (Van den Berg (2001)).

merely suggestive, this gives us an idea of the sensitiveness of our results to these different approaches. As can be seen from Table 2.3, when we limit our sample to include only first spells of relationships we are left with 179,960 spells, whose mean and median lengths are 3.4 years and 1 year, respectively. When compared to the mean and median lengths obtained with the benchmark data we see that not much has changed. While the median spell length is exactly the same in both cases, the benchmark mean spell length is only slightly shorter. Moreover, as shown in Figure 2.3, in both cases more than half of the relationship spells are just 1 year long.

Limiting ourselves to the study of single spells reduces the sample even more and we are left with 96,956 spells. Even though the median spell length is still the same as in the benchmark case, the mean is now a little over a year longer. The observed distribution of spells does not seem to be highly sensitive to this approach except in the late years of the relationships. While only about 7 percent of the spells in the benchmark dataset last longer than 10 years, with single spells only this number increases to 15 percent. Focusing on single-spell relationships leaves us with a sample with a greater proportion of longer spells that in the benchmark data.

The one-year gap adjustment results in 260,559 spells which last, on average, 1 year longer than with the benchmark data. While a higher proportion of spells last through their first year with the gap adjustment than in the benchmark case (55 percent with gap adjustment against 47 in the benchmark case), as the spell length becomes longer the two distributions become more similar.

2.3.2 Trade weights

Finally, we investigate whether putting more weight on higher valued trade relationships modifies our results. Besedeš and Prusa (2006a) pointed out that if short spells involve small trade values and long spells involve large trade values, then by giving the same weight to both types of relationships we might end up with a distribution which understates the duration of the spells. We proceed by weighing each observation by the value of trade in the first year of the relationship spell and the resulting distribution of spells under this alternative formulation can be seen in Table 2.3 and Figure 2.3. The observed distribution of spells is highly sensitive to this approach, as indicated by the increase in the mean and median spell lengths which are 3 years and 1 year longer than in the benchmark case, respectively. The proportion of relationships which survive beyond the first year is 15 percentage points higher with weighted data than with non-weighted data. Moreover, larger initial values seem to increase the probability of survival. While in the benchmark case only about 3 percent of the spells survive through the entire sample period, with the trade weighted data this proportion jumps to almost 12 percent.

3 Duration Analysis

3.1 Modeling

This study is about modeling time-to-event data. We focus on the case with only two states: a product is either being exported or not; in other words, a trading relationship either exists or not. All products start in the initial state with positive exports, and each product either ceases to be exported and exits the initial state or is censored before exiting. In survival analysis, this transition from the initial stage to the next is usually referred to as "failure" or "exit". In this study, the end of a trade relationship or the fact that a product ceases to be exported will be used interchangeably to mean failure or exit.

To model duration data, let *T* be a non-negative random variable denoting the time to a failure event, in our case, the time elapsed until a product ceases to be exported by Brazil. Spell lengths are observed in annual intervals hence, duration time *T* is assumed to be a discrete random variable with probability density function (p.d.f.)

$$f(t_j) = P(T = t_j),$$

where $j=1,2,...,n$. The survivor function, representing the probability of surviving beyond some point t_j, is defined as the reverse cumulative distribution of *T*

$$S(t_j) = 1 - F(t_j) = \Pr(T > t_j) = \sum_{k>j} f(t_k),$$

where $S(t_0) = 1$ (all spells survive initially).

The hazard function, which is the probability of failure occurring at t_j, given that it has not occurred until the period immediately before t_j, is defined as

$$h(t_j) = \Pr(T = t_j \mid T \geq t_j) = \frac{f(t_j)}{S(t_{j-1})}.$$

From the equation for the survivor function, we can get the following expression

$$f(t_j) = S(t_{j-1}) - S(t_j),$$

which, when substituted into the equation for the hazard function, gives

$$h(t_j) = 1 - \frac{S(t_j)}{S(t_{j-1})}.$$

Since surviving beyond t_j requires survival through all periods before (and including) t_j, the survivor function may be written as the product of conditional survival probabilities

$$S(t_j) = \prod_{k \le j} \frac{S(t_k)}{S(t_{k-1})}$$

and, as a result, the following relationship between the hazard and survivor functions arises

$$S(t_j) = \prod_{k \le j} \left[1 - h(t_k)\right].$$

3.2 Estimation

To proceed with the non-parametric estimation of the hazard and survivor functions, assume we have n independent observations denoted $(t_j; c_j)$, where $j=1,2,\ldots,n$, t_j is the survival time, and c_j is the censoring indicator variable C taking a value of 1 if failure occurred, and 0 otherwise. Assume also that there are $m \le n$ completed durations observed in the data. The survival times are arranged in order of magnitude as $t_1 < t_2 < \ldots < t_m$. Let n_j denote the number of spells neither completed nor censored before t_j, i.e., the number of subjects at risk of failing at t_j, and define d_j as the number of failures observed at t_j. Under the assumption of independent censoring[26], the survivor function can be estimated consistently by the Kaplan-Meier estimator, also known as the product-limit estimator, which is defined as

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[26] Censoring is assumed to be independent of the occurrence of the failure event. If this is not the case, then censored relationships might differ from those who remain at risk of experiencing failure and the generalization of the behavior of relationships from the risk set back to the entire sample might be incorrect, which leads to inconsistent estimation results.

$$\hat{S}(t_j) = \prod_{k \le j} (\frac{n_k - d_k}{n_k}).$$

It is important to note that the Kaplan-Meier estimator is not well defined for time points beyond the largest survival time, t_m, and it can only be obtained at exit times. As a result, $S(t_j)$ is a step function with jumps at the observed failure times, with the height of the jumps depending on the survival estimates[27] and the width of the steps depending on the times at which failures occurred.

The variance of the Kaplan-Meier estimator is estimated by Greenwood's formula

$$\hat{V}[\hat{S}(t_j)] = \hat{S}^2(t_j) \sum_{k \le j} \frac{d_k}{n_k(n_k - d_k)}.$$

However, since Greenwood's estimator tends to underestimate the true variance of $S(t_j)$ in small samples (Klein and Moeschberger (1997)), the asymptotic variance of $\ln\{-\ln S(t_j)\}$ is used in the calculation of confidence intervals:

$$\sigma^2(t_j) = \frac{\sum_{k \le j} \frac{d_k}{n_k(n_k - d_k)}}{[\sum_{k \le j} \ln(\frac{n_k - d_k}{d_k})]^2}.$$

The hazard function can be estimated (at the observed failure times only) by

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[27] Conventionally, $S(t_j) = 1$ if *j<1*.

$$\hat{h}(t_j) = \frac{d_j}{n_j}.$$

Alternatively, a kernel smoothing technique can be used to obtain a smoothed (and aesthetically improved) estimate of the hazard function[28]. This convolution type hazard estimator is obtained by smoothing the steps of the Nelson-Aalen estimator of the cumulative hazard function at each failure time t_j (which themselves provide crude estimates of the hazard) with a kernel function. In other words, we weigh the increments of the cumulative hazard estimate over event times close to t_j using a kernel function to compute the weights[29]. The cumulative hazard function is defined as

$$H(t_j) = \sum_{k \le j} h(t_k)$$

and the Nelson-Aalen non-parametric estimator of $H(t_j)$, $\hat{H}(t_j)$, is given by

$$\hat{H}(t_j) = \sum_{k \le j} \frac{d_k}{n_k}.$$

Since the estimated cumulative hazard is a step function with jumps at failure times it cannot be directly differentiated to provide an estimate of the hazard function. However, if for each observed failure time t_j we define the magnitude of the jump to be

[28] The kernel hazard estimator has been widely studied in the literature. See Wand and Jones (1995) for an extensive list of references on this topic.
[29] Another approach would be to smooth the cumulative hazard first and then differentiate it to obtain an estimate of the hazard. See Wand and Jones (1995) for the appealing features of the estimator that results from the approach chosen here.

$$\Delta\hat{H}(t_j) = \hat{H}(t_j) - \hat{H}(t_{j-1}),$$

then we can obtain a smoothed estimator of the hazard function, $\hat{h}_s(t_j)$, with

$$\hat{h}_s(t_j) = \frac{1}{b}\sum_{j=1}^{m} K(\frac{t-t_j}{b})\Delta\hat{H}(t_j)$$

for some kernel function $K(\ )$ and bandwidth *b* (also known as the smoothing parameter or window width); and the summation is over the *m* times at which failure occurs. The choice of kernel determines the weights given to points at a certain distance from t_j, while the bandwidth determines how close to t_j event times have to be in order to be included in the weighted average. Choosing the optimal bandwidth is crucial for the kernel smoothing process since when adjusting the smoothing parameter one is faced with the trade-off between the bias and the variance of the resulting estimator[30].

We choose to work with a Gaussian kernel and following Silverman (1986) we define the optimal bandwidth as follows:

$$b = 1.06\sigma N^{-1/5},$$

where σ is the standard deviation of the data and *N* is the sample size.

4 Results

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[30] Silverman (1986) and Wand and Jones (1995) provide a full discussion of the strategy for choosing the optimal bandwidth.

Figure 2.4 presents estimated survivor functions for the benchmark data indicating the proportion of trade relationships surviving through their first year, their second year and so on. The large number of observations results in a very tight confidence interval. More information on survivor estimates can also be seen in Table 2.5 which shows not only the benchmark Kaplan-Meier estimates but also the results with alternative treatments of the data as well as data aggregations. In the benchmark case, about 60 percent of the relationships survive through their first year, 33 percent survive 5 or more years and 27 percent survive 10 or more years. The median duration, which shows how much time passes before half the relationships are dissolved, is only 2 years, indicating how short-lived Brazilian trade relationships are. Note that since the Kaplan-Meier estimator takes censoring into consideration, estimated survival times are longer than the observed spells lengths previously discussed in the text. According to the observed spell distribution only about 3 percent of all relationships span the entire sample period, while the Kaplan-Meier estimates indicate that there is a 26 percent probability of exporting a product for more than 18 years.

Visual inspection of the estimated survivor function also gives an idea of when trade relationships are more likely to end. If the survivor function plunges sharply between one year and the next, as it is the case in the early years of a trading relationship's existence (Figure 2.4), it indicates that a large proportion of the products that were being exported in that year ceased to be exported in the following year. Moreover, as we can also infer from the decreasing slope of the survivor function, the risk of a trading relationship failing decreases with time. Estimation of the hazard confirms that trade relationships are more likely to end in the early years of their existence. Figure 2.5 shows the estimated hazard functions resulting from the two estimation methods previously described. Apart from the fact that the smoothed version is aesthetically more pleasing to the eye, the results are very similar. After the initial "riskier" years, only a small proportion of products continue to be exported. The hazard rate in the first year is 40 percent but it decreases considerably to less than 10 percent after 5 years, indicating negative duration dependence (i.e., the probability of failure decreases with survival time).

4.1 Data aggregation

Estimated survival times and hazard rates for product-region and product-world pairs can be seen from Figures 2.6 and 2.7. The probability of a relationship dying in the first year of life declines from 40 percent for the benchmark data to 30 percent with product-region pairs and to only 10 percent for product-world relationship pairs. Because of the extreme aggregation when dealing with exports to the entire world, most products never cease to be exported. As can be seen from Table 2.5, more than half of the products are still being exported after 18 years and as a result we cannot estimate the median lifetime precisely, all we know is that it exceeds 18 years – much longer than the 6-year median obtained with observed spells which did not take censoring into account. Survival estimates shown in Figure 2.6 are higher than observed spells lengths displayed in Figure 2.2.

In order to investigate how sensitive survival estimates are to the level of product aggregation, we estimate survival rates with SITC data with the aggregation level ranging from 1 to 5 digits. As expected, aggregation from products to industries increases estimated survival time considerably. As suggested by Figure 2.8, the duration of trade is highly sensitive to the aggregation level of product classification. We test the equality of the survivor functions across all SITC aggregation levels and we obtain a p-value of

0.000 which confirms that they are all statistically different from each other. Although the estimated survival functions with the SITC data display the same pattern as the benchmark data, with higher hazard in the first few years of trade relationships, survival rates are up to 13 percentage points higher at higher aggregation levels. While with SITC 1-digit less than 30 percent of the spells end in their first year, more than 40 percent of the relationships last just 1 year when data are aggregated at the 4- and 5-digit levels. Comparison of the estimated median survival times also illustrate the longer duration of exports of broad product groups: 2 years for aggregations at 3-, 4- and 5-digit levels, 3 years for 2-digit data and 7 years for data aggregated at the 1-digit level. While the observed spells lengths of the benchmark data were remarkably similar to those at the SITC 5-digit level, benchmark survival estimates are closer to those obtained with SITC 4-digit data. As censoring takes its toll, the benchmark estimated survival function lies above that for the 4- and 5-digit data.

4.2 Multiple spells and trade weights

Next we consider the issue of multiple spells. Recall that alternatives to assuming spell independency included working with single-spell relationships, only the first spell of relationships and finally, adjusting one-year gaps between spells. The estimation results can be seen in Table 2.5 and Figure 2.9. Confirming the analysis of the observed spell length distribution, survival estimates for the benchmark data are most similar to those obtained with first spell data, while estimates with single spell and gap-adjusted data are slightly higher. In all specifications the early years of a relationship are the most hazardous ones with hazard rates around 35-40 percent. The survival function then remains relatively constant after 10 years and the probability of failure decreases sharply to about 2 percent, except for the single spell data for which the hazard decreases even more, to less than 1 percent.

The results with trade weighted data also confirm our findings with the study of observed spell distributions: the duration of trade is significantly longer than in the benchmark case. The estimated probability of surviving the first year is 72 percent against the 60 percent estimated in the benchmark case. Moreover, the longer the time length, the higher the percentage point difference in estimated survival rates between the two specifications. Confirming Besedeš and Prusa's (2006a), our results also indicate that small valued relationships tend to have shorter lives than high value ones.

4.3 Products and destination markets

Lastly, we investigate to what extent the duration of the trade relationships differs for different types of products or different destination markets. The results for these specifications can be seen in Table 2.6. The estimation of the survivor function broken down by country regions, presented in Figure 2.10, shows that exports to the US and the ALADI members tend to last longer than those to European countries which, in turn, last longer than exports to less-traditional markets in Africa, Asia and the Middle. About half of the trade relationships with the Middle East, the EU, African and Asian countries cease to exist after 2 years, while trade relationships with ALADI members and the US last, on average, 1 and 2 years longer, respectively. While the probability of exporting a product to Africa, Asia or the Middle East for more than 18 years is about 20 percent, this number increases to 24 percent, 34 percent and 41 percent for exports to Europe, ALADI and the US, respectively. Although a test for the equality of estimated survivor functions across all regions finds evidence that the difference among them is statistically significant, when we restrict ourselves to the relationships with Africa, Asia and the Middle East we cannot reject the null hypothesis that the survivor functions of these three groups are the same as we obtain a p-value of 0.265.

The results for the estimated survivor function summarized by industry categories are also shown in Table 2.6. The 25th percentile is 1 year for every industry. We also find that relationships involving beverages and tobacco (SITC=1) last longer than others. While in all other categories at least half the spells end after 2 years, for the beverage and tobacco industry it takes 3 years until 50 percent of the relationships fail. While these numbers suggest that there is no dramatic difference among industry categories in terms of estimated duration time, when we test the equality of survivor function across all categories we find that the differences are statistically significant. However, when we restrict the test to crude materials and animal and vegetable oils we obtain a p-value of 0.081 which indicates that the estimated survivor functions of these two groups is not statistically different. The same conclusion is reached when we test the equality of the survivor functions for different categories of manufactures.

To study duration across product types in more detail, we aggregate product codes according to UNCTAD's product classification which results in two broad product categories: (i) primary commodities, comprising food items, agricultural raw materials, fuels, and ores and metals; (ii) and manufactured goods, which are further disaggregated on the basis of the degree of technological intensity. As can be seen from Figure 2.11, survivor estimates for the two main product categories are nearly identical (the difference between them is not statistically significant). In both cases, more than 25 percent of the relationships end within the first year of existence and it takes only 2 years for half the relationships to die. However, if we estimate survival times broken down by sub-categories, divergences emerge. Among primary commodities (Figure 2.12), even though in the first years all sub-categories display very similar survival estimates, as the spells get longer the food group displays slightly higher survival rates than the other 3 groups. Also, while more than 28 percent of relationships involving food products survive after 10 years, this number decreases to 24 percent for agricultural materials and 22 percent for fuels and mineral and ores. Even though a test for the equality of estimated survivor functions across all primary commodities finds their difference to be statistically significant, when we restrict ourselves to food and agriculture we cannot reject the null hypothesis that the survivor functions of these three groups are the same (we obtain a p-value of 0.084). Statistically significant differences across survivor functions are also observed among manufactures (Figure 2.13). The similarities among categories with different levels of technology diminish as spell length increases. As can be seen from the figure, medium-low and low technology sectors exhibit higher survival rates overall and especially in late years.

This final result brings us to the discussion of the usual trade policy recommendations in order to promote export growth. It is often suggested that Brazil should increase the technology level of its exports but, as suggested by our results, exports of goods with the highest technological level have the lowest survival rates. Hence, before investing in new trade relationships involving exports of high tech goods, something should be done to stop the existing ones from ending too soon.

5 Concluding remarks

In this study, we contribute to the research on Brazilian trade by focusing on the duration of export trade relationships. Following the pioneering work of Besedeš and Prusa (2006a), we applied survival analysis to trade data at the product level to investigate how long Brazilian products survive in exporting markets. We find that Brazilian export trade relationships have a very short life, with the median duration of exporting a product of just 2 years. In order to promote export growth, instead of encouraging new relationships to be formed, it might be better to start by preventing the existing ones from ending too soon.

Trade relationships starting with large initial trade values are shown to survive longer than those with small starting values. Our results also suggest that trade relationships are at the greatest risk of being dissolved in the early years of their existence as the probability of failure decreases with duration time. Exports to the US and the ALADI members tend to last longer than those to European countries which, in turn, last longer than exports to less-traditional markets in Africa, Asia and the Middle East. Moreover, duration time is highly sensitive to the aggregation level of product classification and aggregation from products to industries increases estimated survival time considerably. Among industries, those with lowest degree of technology display the longest durations.

Given the heterogeneity observed in estimated survivor functions, a natural extension of this study would be to model how covariates, such as proximity to trade partners, market size and product characteristics (especially technology level), modify or shift the hazard and survivor functions. The Cox (1972) proportional hazard model is the most commonly used in the survival analysis literature not only for the simplicity of its assumptions but also for its computational feasibility.

Chapter 3 Bolivia’s trade-policy options and their implications for household income

1 Introduction

Bolivia's economy has essentially been stagnant for over fifty years. There were two growth spurts, one from the early 1960s to the late 1970s and one during the 1990s, both followed by collapses and crises that offset their achievements. Political instability, weak institutions, macroeconomic mismanagement, discouraging trade policies and taxation are among the factors usually pointed out as reasons for Bolivia's long-term stagnation.

The boom of the 1990s was the result of stabilization policies and structural policies involving trade liberalization, privatization and the decentralization of public spending put in place in the mid-1980s. Average growth was 4.7% per year between 1993 and 1998, 1.2 percentage point above the average in the previous 5 years. Unemployment rates fell in this period. Fueled by foreign direct investment (which grew from 2% of GDP in 1994 to 12% in 1998), export growth made a modest contribution to economic expansion, but it was concentrated in natural resources and capital- and skill-intensive sectors. Hydrocarbons, construction, utilities, transport and communication were among the fastest-growing sectors. Growth was unbalanced geographically as well and fostered regional divergence rather than convergence.

Although urban poverty rates declined from 52% to 46% between 1993 and 1999, the gains were modest and short-lived. Jimenez et al (2005) estimated elasticities of urban poverty to growth and found that a 1% increase in per capita income results in a 0.53% decrease in the headcount index of poverty and in a 1.6% decline in the poverty gap.

With such low poverty-growth elasticities, Bolivia's economy would have to grow much faster than it did in order to generate any meaningful progress on the poverty-reduction front.

Today, Bolivia's extremely high level of persistent poverty is the worst in Latin America and transcends the country's rural-urban and regional boundaries. Although poverty is extreme in the valleys and central highlands, especially in the departments of Potosi and Chuquisaca, urban areas have the largest numbers of poor due to their high populations. The incidence of poverty is also higher among indigenous people (70%) than among non-indigenous ones (50%).

The late 1990s saw the end of Bolivia's short-lived boom. Capital flows dried out following the 1998 Russian crisis, terms of trade deteriorated and exports slumped after the Brazilian and Argentine currency devaluations in 1999 and 2001, and the 1997-2000 coca eradication program reduced coca production by 80%. Growth collapsed to 1.9% during 1999-2003, unemployment increased from 4.4% in 1997 to 9.2% in 2003 and earlier progress in poverty reduction was reversed. The population living in poverty rose from 62% to 65%.

The recovery has been slow. High prices for Bolivia's primary exports (mining, hydrocarbons and soy products) yielded a modest 3.2% growth rate between 2000 and 2006, peaking at 4.6% in 2006. However, as pointed out by Nina and Andersen (2004), "the relatively small impacts of trade on poverty are due to the structure of labor markets and trade in Bolivia, and especially due to the fact that most poor people are concentrated in traditional agriculture and non-tradable sectors, which have only very indirect links with trade."

Bolivia is now faced with the possibility of another adverse trade shock. The trade relationship between the US and Andean countries - Bolivia, Colombia, Ecuador and Peru - is currently ruled by a unilateral trade preferences agreement known as the Andean Trade Preference and Drug Eradication Act (ATPDEA). Like all nonreciprocal preference regimes based on "soft" criteria (and unlike the Generalized System of Preferences (GSP)[31] which is based on a "hard" income criterion), the ATPDEA is not WTO-consistent[32] and thus is likely to evolve through either transformation into a reciprocal Free Trade Agreement (FTA) or outright elimination.

Enacted in 1991 and amended in 2002 by the ATPDEA, the original Andean Trade Preference Act (ATPA) provided duty-free treatment for a wide range of Andean exports in return for cooperation in the struggle against narcotics production and traffic in the Andean region. It expired in December 2001, but in August 2002, the ATPDEA not only restored its benefits but also extended preferential (duty-free) treatment to products that were previously ineligible, including petroleum and petroleum products, certain footwear, tuna in flexible containers, and certain watches and leather products. The most significant extension of the benefits was in the apparel sector. The ATPA, as amended, was set to expire on December 31, 2006, but an additional extension was approved until June 30,

[31] The Generalized System of Preferences (GSP) is a program through which the United States provides preferential tariff treatment on imported items from developing and least-developed countries.

[32] Free Trade Agreements (FTAs) are covered by Article XXIV of the GATT or by the Enabling Clause. In both cases, "substantially all trade" must be liberalized in order to make the agreement WTO-consistent, a requirement that cannot be met if the preferences are non-reciprocal. Non-reciprocal preferences granted by industrial countries to developing ones, such as the GSP, must base eligibility on a verifiable and universal criterion (e.g., the level of income). Cooperation in areas like the war on drugs (the criterion used by the US in its agreements with Andean countries) is not such a criterion.

2007, and for an additional eight months for countries forming reciprocal free trade agreements with the US before then[33]. So far Colombia and Peru have concluded FTAs with the United States, but Bolivia and Ecuador have not, Bolivia's president having expressed a preference for the renewal of the ATPDEA rather than the signature of a FTA.

We approach this issue by combining partial-equilibrium simulations of the trade shock generated by the elimination or transformation of the ATPDEA with household-survey data in order to identify price and income effects on household real incomes. The tariff changes affect both the manufacturing and the agricultural sectors, but the channels of influence are different. For manufacturing, we combine our simulation results with estimates of the number of jobs created or destroyed by the trade shock in the manufacturing industry obtained from Cadot, Molina and Sakho (2008). Given that the trade shock is very small, we assume that wages do not adjust (that is, the trade shock does not trigger a renegotiation of labor contracts in the formal manufacturing sector) and the only margin of adjustment is job creation/destruction.

We estimate predicted incomes in employed and unemployed status using a Heckman two-stage procedure which involves estimating a selection equation by probit in the first step and income equations for employed and unemployed household heads in the second step. When there is job destruction, we use the selection equation to calculate

[33] At the time of writing, an extension had just been passed by the US Congress for an additional eight months.

unemployment propensity scores and rank employed household heads by decreasing order of their probabilities. We then use the estimated number of jobs destroyed, *n*, to switch the first *n* household heads from "employed" to "unemployed" and recalculate their predicted income with the income equation. The difference in predicted income from pre-switch to post-switch gives our estimate of the income loss due to the trade shock in the manufacturing sector. When the shock creates manufacturing jobs, the procedure is analogous but slightly more complex because switching to wage employment involves a choice which must be modeled as such, that is, the "switchers" must make more money by switching than by staying in the pre-shock occupation.

For the agricultural sector, we also use a simplifying assumption. We assume that the termination of the ATPDEA would change Bolivian export prices by the amount of the US Most-Favored-Nation (MFN) tariff[34]. Take the scenario in which preferences are eliminated as an example. If Bolivian farmers could sell at $p^*(1+t^{US})$ when they had duty-free access, they can sell only at the world price, p^*, when they lose preferential access so the price decrease that they face is simply the amount of the tariff. Furthermore, we assume that the domestic price of cash crops in Bolivia is equal to their FOB price, assuming away issues of incomplete pass-through[35]. Thus, the decrease in export prices is

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[34] Normal non-discriminatory tariff charged by a WTO member on imports from other WTO members (excludes preferential tariffs under free trade agreements and other schemes or tariffs charged inside quotas).

[35] In his study on Mexico, Nicita (2004) used time series for the domestic price of several crops inside Mexico to estimate pass-through effects between border prices and domestic prices. We do not have access to such data here.

passed on fully to domestic prices. These price changes affect households on the consumption side for products that they consume and on the production side for products that they produce. We calculate production and consumption effects using Bolivia's latest household survey (Encuesta de Hogares 2005) for each product and household in the sample.

We start by investigating the potential effects of ATPDEA's transformation into a full-fledged FTA with the United States. The impact on employment comes from both the import side (because US imports are granted tariff-free treatment) and the export side (essentially because of trade diversion on the market of other Andean countries that simultaneously sign FTAs with the US). As will be shown later in the text, there is an expansion of manufacturing employment when Bolivia alone signs a FTA with the US owing to an increase in market access. Under the other two scenarios, the trade shock being either reduced market access in the US (if the ATPDEA is unilaterally repealed by the US) or trade diversion on Andean markets (if all Andean countries sign FTAs with the US) its effect is job destruction rather than creation[36]. The overall effects are very small. Simulated US export gains on the Bolivian market are quantitatively small and

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[36] The actual number is difficult to assess. As discussed in Cadot, Molina and Sakho (2008), UNIDO reports only 50'000 manufacturing jobs in Bolivia. This figure is also used in the WTO's latest Trade Policy Review, which quotes Bolivian official sources. By contrast, based on the ENCOVI 2002 household survey, Lara and Soloaga (2006) estimate manufacturing employment at 13% of total employment, which currently stands at about 4 million according to the World Bank's World Development Indicators. This would mean about 500'000 manufacturing jobs. Indeed, they estimate manufacturing job creation resulting from the Doha Round at about 50'000, which is of course incompatible with an initial estimate of 50'000 jobs. Given the large uncertainty about the number of manufacturing jobs, we give results in percentage rather than actual numbers.

their transmission to employment levels is insignificant in most econometric specifications. Simulated export losses on Andean markets are slightly larger. The transmission of the shock on poverty numbers is, however, very small.

In a second set of simulations, we simulate the trade shock that would follow the unilateral elimination of preferences enjoyed by Bolivian exporters under the ATPDEA. A recent study of Bolivia's Ministry of Economic Development (Tellería et al 2006) argued that the expiration of the ATPDEA would only have minor and localized effects on Bolivian exports, as it would only affect clothing, leather manufacturing and the wood industry, situated mainly in the departments of La Paz and El Alto. The rest of the products exported to the US would still enter the US market duty-free under the GSP. This is indeed what we find. The US is a small market for Bolivian exports and the preferential treatment granted is not fully utilized by Bolivian exporters. As a result, the potential trade effects of the non-renewal of preferences are very small.

Lastly, motivated by Bolivia's interest in becoming a full member of MERCOSUR, we explore the potential effects of deepening integration with the trading bloc, with whom Bolivia trades substantially more than with the United States. Although Bolivia signed an association agreement with MERCOSUR in 1996, tariffs have not been completely liberalized so Bolivia's market access is far from equivalent to that of a member. However, Bolivia's exports to the bloc are heavily dominated by hydrocarbons, which already face zero MFN tariffs. Thus, even a complete elimination of MERCOSUR's tariffs would have only limited effects on Bolivian exports given their present structure. We find that while the impact on households that lose their manufacturing jobs is sizable, since the proportion of those households is very small the overall effect in the economy ends up being small. As will be shown later in the text, the burden of job loss falls more than proportionately on indigenous people.

2 Income, consumption and poverty in Bolivia

2.1 Stylized facts

About a third of Bolivia's population is in extreme poverty, and two thirds in poverty (UDAPE 2007). As in most low-income countries, poverty affects rural households more than urban ones, with poverty rates of 76% and 50%, respectively. Poverty is also unevenly spread geographically. Of Bolivia's three ecological regions (the Altiplano, the Valley and the Plain) the poorest is the Altiplano, where farmers are isolated from world markets by difficult terrain and poor infrastructure. Poverty and remoteness translate into low use of fertilizers and low productivity, creating a vicious circle of poverty. As a result, the rate of self-consumption is highest in the Altiplano. By contrast, the share of export-oriented agriculture is highest in the Plain, which produces most of the country's output of soybeans. Poverty also affects ethnic groups differently. About 60% of the population is indigenous, of which 70% are poor households. Indigenous families are also generally less educated and less urbanized than non-indigenous families.

2.2 The 2005 household survey

Household data come from the Encuesta de Hogares 2005[37], a household survey conducted by Bolivia's Instituto Nacional de Estadística (INE) during the months of November and December of 2005 by direct interview. The data were collected at national level, taking into account all Bolivia's nine departments, including both urban and rural areas. The survey is divided into eight sections covering socio-demographic characteristics, education, employment, income, expenditures and agriculture production. The two-stage stratified sampling procedure resulted in a sample with 4,086 households, of which approximately 60% are indigenous households[38]. Table 3.1 shows the geographical distribution of households, distinguishing between indigenous and non-indigenous people. La Paz (30%), Santa Cruz (24%) and Cochabamba (18%) are the most populated departments. While the indigenous population is concentrated in the departments of La Paz, Cochabamba and, to a lesser extent, Potosí and Santa Cruz, most of the non-indigenous households (almost 44%) are located in Santa Cruz. Moreover, in all but two the departments the population is highly dominated by one of the two population groups.

According to the household survey, average monthly income, in Bolivianos, is approximately 54% larger for non-indigenous households: Bol 4'407 for non-indigenous people against Bol 2'845 for indigenous ones (Table 3.2). Average education is also

[37] The help of Fernando Landa in obtaining the data is greatly appreciated.
[38] Definition of indigenous is based on head of household's own perception.

higher for non-indigenous household heads, by 40%. Poverty incidence is higher among indigenous households: while 63% of indigenous families are poor[39] this number decreases to 44 for non-indigenous households.

Table 3.3 reports the average income shares for different sources of income. While non-poor households derive most of their income from self-employment in non-farming activities and wages, agricultural income looms large for the poor. There are considerable differences in income sources between indigenous and non-indigenous households. While the share of farming income is almost 30% in the average indigenous household, it is 16.5% among the non-indigenous ones. In contrast, while wages account for 34.4% of total income of non-indigenous households, they account for 23.6% of the income of the indigenous.

Consumption shares in total household expenditure are given in Table 3.4. By far budgets are dominated by food, especially for the poor households whose food expenses account for 72% of total expenditures. Regarding non-food expenditures, the major difference between poor and non-poor households seems to be concentrated in the Housing category, which includes household maintenance, appliances and furniture.

Taken together Tables 3.3 and 3.4 indicate that changes in the prices of food items should be expected to have large effects in the income of the households, especially the poor ones, given their large shares in both income and consumption.

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[39] Poor households are those whose per capita incomes fall below the official Bolivian poverty line.

Statistics regarding the economically active population are shown in Table 3.5. The overall unemployment rate is 5.3%. The non-indigenous population is more heavily impacted by unemployment, since the probability of being unemployed is 7.1% for non-indigenous against 3.9% for indigenous people[40].

Table 3.6 reports employment numbers by economic activity classified according to the International Standard Industry Classification (ISIC). The agricultural sector has the largest number of workers by far. At the national level, agriculture employs almost 40% of the population, of which 70% are indigenous people. Wholesale and trade and manufacturing come in second and third place, respectively, comprising 14.4 and 10.7% of the employed population. While most of the employed indigenous individuals work in agriculture activities (48%), the majority of the employed non-indigenous population is distributed among agriculture (29%), manufacturing (12%), wholesale and trade (15%) and transport and communications (8%).

3 Tracking the domestic effects of the trade shocks

3.1 The ATPDEA

Enacted in 1991 and amended in 2002 by the ATPDEA, the original Andean Trade Preference Act (ATPA) provided duty-free treatment for a wide range of Andean

[40] These numbers are very similar to Bolivia's unemployed rates in 2005 of 5.4% at the national level, 3.9% for indigenous and 8.3% for non-indigenous (UDAPE 2007).

exports[41] in return for cooperation in the struggle against narcotics production and traffic in the Andean region. It expired in December 2001, but in August 2002, the ATPDEA not only restored its benefits but also increased the number of products covered by the preferential treatment. The benefits were also made retroactive to the date on which the former act had expired.

Although most exceptions were eliminated when the ATPA was transformed into the ATPDEA some Bolivian products still remain taxed in the US market: canned tuna except in flexible containers, rum and tafia, certain products of sugar, a few textile and apparel products, and certain types of skins and leatherwear.

Like other preferential trade agreements, the ATPDEA is not fully used by Bolivian exporters. In 2005, only 6% of the almost 6,300 products eligible for preferential treatment were exported to the US market and only 42% of those took advantage of the preferences. Restrictive rules of origin and costs of complying with requirements relating to certification, traceability and administrative documentation impose additional production costs to exporters and reduce the attraction of preferences. In a non-reciprocal agreement such as the ATPDEA, in which a constant cloud of uncertainty about the status of preferences hangs over an exporter's head, investing in production structures to comply with origin requirements and incurring the costs of proving eligibility are not always worth the gains from claiming preferential treatment.

[41] Exceptions for Bolivia included certain textile & apparel products, footwear, and petroleum products.

The utilization rate of preferences - defined as the share of Bolivian shipments eligible for ATPA/ATPDEA treatment recorded by US customs as "imported under ATPDEA/ATPA regime" - is high. According to data made available by the USITC, in 2005, 80% of ATPDEA-eligible exports entered the US claiming preferential treatment. However, this high utilization rate of US preferences is concentrated in a few economic activities as can be seen from Table 3.7. Only three categories of the International Standard Industrial Classification (ISIC) show positive utilization rates in the period 1997-2005: textiles, apparel and leather manufactures.

3.2 Transformation of ATPDEA into a reciprocal FTA

3.2.1 The approach

The transformation of ATPDEA into a reciprocal FTA involves several simultaneous trade shocks: (i) a direct one due to (ia) improved market access for US products on the Bolivian market, and (ib) improved market access for Bolivia's products; and (ii) an indirect one due to more intense US competition for Bolivian products on Andean markets if all Andean countries sign it simultaneously[42]. We model these shocks using SMART, a highly disaggregated partial-equilibrium model which relies on the so-called "Armington assumption" whereby products are differentiated by country of origin, generating monopolistic competition between differentiated national varieties. The

[42] We treat these shocks as additive rather than letting prices adjust endogenously as in GSIM, the modelling framework used in the simulation of deeper integration with MERCOSUR. We are justified in doing this by the small magnitude of the adjustments involved, even relative to Bolivian and other Andean markets.

appendix describes the model's equations and how we apply them to Bolivian trade. The output of this estimation takes the form of variations in trade values, which are essentially due to two forces: trade creation and trade diversion.

Variations in trade values are then fed into household survey data in order to obtain effects on real incomes. The linkage from trade to household welfare is via prices and incomes; specifically, induced changes in consumer prices, producer prices, and wages. In the simulations that follow, we restrict ourselves to first-order effects, in other words, we assume no quantity response in the short run: households are unable to substitute away from the consumption of goods whose prices have increased and substitute towards the production of such goods[43].

In the manufacturing sector, the trade shock potentially affects industry wages and employment. Because we do not have enough data to estimate wage pass-through equations, we restrict ourselves to employment effects. In the agricultural sector, the trade shock affects income from the production of cash crops.

3.2.2 Manufacturing

In a related paper, Cadot, Molina and Sakho (2008) estimated the long-run elasticity of industry-level employment to trade volumes which are used here to obtain an estimate of the change in manufacturing employment triggered by the trade shock.

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[43] To allow for induced quantity changes (second-order effects) in consumption would require access to income and price elasticities of demand while supply elasticities would be needed when allowing producers to adjust their quantities. We do not have access to such data.

When the trade shock leads to job destruction, we estimate how changes in unemployment affect household incomes using a two-step procedure as follows:

(i) We run a probit of unemployment status on individual and household (HH) characteristics[44]:

$$\lambda_i = \text{prob}(I_i = 1 | \mathbf{z}_i) = f\left(\mathbf{z}_i \boldsymbol{\alpha} + u_i\right) \tag{1}$$

where z_i is a vector of individual and HH characteristics including, among other things, HH head's age, education and household composition, u_i is an error term with standard properties, and

$$I_i = \begin{cases} 1 & \text{if HH } i\text{'s head is unemployed} \\ 0 & \text{otherwise;} \end{cases} \tag{2}$$

(ii) We run a switching regression of HH income on HH characteristics of the following form. Let y_{ei} be the income of HH *i* if the HH head is employed in manufacturing and y_{ui} its income if he is unemployed. Income in each status is determined by the following equations:

$$y_{ei} = \mathbf{x}_{ei} \boldsymbol{\beta}_e + v_{ei} \tag{3}$$

if status is "employed" and

$$y_{ui} = \mathbf{x}_{ui} \boldsymbol{\beta}_u + v_{ui} \tag{4}$$

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[44] Regional department controls as well as a dummy variable for urban or rural location were also used.

if "unemployed". Even though the sample split between employed and unemployed is observed, (3) and (4) cannot be estimated simply with two separate OLS regressions. To see this, suppose that unobserved individual characteristics (say, individual talent) affect both income and other individual characteristics (say, the level of education) while being also correlated with the probability of being unemployed. In that case, there would be a selection bias, even though the unemployment status is not a choice. We correct this bias using Heckman's two-step procedure, i.e., by running (1), retrieving the hazard rate and using it to estimate "augmented" versions of (3) and (4)[45].

From the estimation of equation (1) we obtain the estimated propensity scores $\hat{\lambda}_i$ (estimated probabilities of being unemployed) for household heads employed in manufacturing sectors and we rank them by decreasing order of $\hat{\lambda}_i$ (from the most likely to be unemployed *among the employed ones* to the least likely). Then, knowing that *n* manufacturing jobs would be destroyed (*n* based on employment-trade elasticities obtained from Cadot, Molina and Sakho (2008)), we change the status of the *n* first household heads (the ones with the highest propensity scores) from employed to unemployed, and then recalculate their predicted incomes using the estimates from the income regression.

Predicted income is

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[45] See Maddala (1986) for a detailed description of the estimation method.

$$\hat{y}_{ei} = E\left(y_{ei}\middle|\mathbf{x}_{ei}\right) = \mathbf{x}_{ei}\hat{\boldsymbol{\beta}}_e$$

when the household head is employed and

$$\hat{y}_{ui} = E\left(y_{ui}\middle|\mathbf{x}_{ui}\right) = \mathbf{x}_{ui}\hat{\boldsymbol{\beta}}_u$$

when he is unemployed. The percentage change in predicted income for an individual who loses his job is

$$\delta_i = \frac{\Delta\hat{y}_i}{\hat{y}_{ei}} = \frac{\hat{y}_{ui} - \hat{y}_{ei}}{\hat{y}_{ei}} < 0\,. \qquad (5)$$

We then apply this predicted percent income reduction to observed income, household by household:

$$\left.\frac{\Delta y_i}{y_i}\right|_{simulated} = \delta_i y_i\,. \qquad (6)$$

When the shock creates manufacturing jobs, the procedure is similar but slightly more complex. Switching from unemployment or from an existing job to manufacturing employment involves a choice which must be modeled as such, that is, the "switchers" must make more money by switching than by staying in the pre-shock occupation. For the purposes of estimating the best case scenario in terms of poverty alleviation, we approach this issue by estimating the probability of being employed in manufacturing with a sample of manufacturing workers and unemployed households. Unemployed workers are then ranked in descending order by their probability of participating in the manufacturing sector. Knowing that *n* manufacturing jobs would be created (*n* based on employment-trade elasticities obtained from Cadot, Molina and Sakho (2008)), we change the status of the *n* first household heads whose incomes are lower than their predicted incomes from manufacturing employment from "unemployed" to "employed" and recalculate their predicted incomes using the estimates from the income equation.

The transformation of the ATPDEA into a reciprocal FTA has a very small effect the export side[46]. Bolivia already enjoys duty-free access on the US market except for ATPDEA's exceptions, but in 2002 those were reduced compared to the ATPA vintage 1991. As a result, improvements in market access for Bolivian producers were very limited.

As a consequence of such small trade effects, the estimated impacts in employment are, unsurprisingly, trivial: there is only a 5% increase in manufacturing jobs when Bolivia signs a FTA with the US.

Table 3.8 presents the results for the probit estimation of participation in the manufacturing sector. Model predictions of manufacturing employment are compared to the actual number of employed and unemployed household heads in Table 3.9[47]. The percentage of correct predictions by the model is an indicator of the model predictive ability. As can be seen from the table, 82% of the model's predictions are correct - the model predicts employment correctly for 143 households and predicts unemployment correctly for 67 households.

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[46] The large size of the US makes it possible to treat the US export supply elasticity as infinite, making the "small-country" version of SMART the appropriate framework for the simulation.

[47] For each household, the model prediction is set to 1 if the predicted probability is greater than 0.5 and 0 otherwise.

Regression results for the income equation are shown in Table 3.10. For employed people, income peaks at age 47, which is plausible. Education affects income positively but is only significant in the unemployed equation. Marital status seems to have no effect irrespective of the employment status. Indigenous status (which is as self-reported by the respondents) has a negative coefficient in both equations and a slightly higher value for unemployed individuals, indicating that indigenous people would have fewer "outside opportunities" for earning money once they lose their job. Outside earning opportunities being extremely diverse in the survey (including such idiosyncratic things as alimony or widowhood/orphan hood benefits) there is little direct interpretation of this.

Table 3.11 reports simulated income changes for households switching to employment in the manufacturing sector, distinguishing between indigenous and non-indigenous people. The potential effects for those newly employed are substantial: income more than doubles as a result of the change in employment status. In monetary value, the income increase is of Bol 1'000 on average. Nevertheless, because there is only a 5% expansion of manufacturing employment, the overall effects on the economy are small.

3.2.3 Agriculture

In agriculture, we treated the effect of the trade shock differently. In principle, things were simpler: the trade simulation gave us variations in the quantities of exports, by crop. Since we had export values but not domestic production, we did not know how much the change in US import demand represented relative to Bolivia's initial production and, consequently, we could not use the share of each crop in the cash income of farm households to allocate the new export quantities. Therefore we started instead from the price effect

$$\Delta p_k = \frac{-t_k^{US,MFN}}{1+t_k^{US,MFN}}, \qquad (7)$$

assumed full pass-through[48], and, assuming households were unable to adjust their quantities immediately after the price changes, we calculated the first-order effect for Bolivian farm households involved in the production of crop *k*. The effect for household *i* was calculated as

$$\frac{\Delta y_i^a}{y_i^a} = \sum_{k\in K} \omega_{ik} \Delta p_k \qquad (8)$$

where $\omega_{ik} = y_{ik} / y_i$ is the share of cash income from the production of crop *k* in household *i*'s total income. We also assumed that (i) only cash income was affected by the export reduction, (ii) all farmers producing cash crop *k* for export to the US would be affected (the price change being transmitted backward to all sales of crop *k*, domestic or foreign[49]), and (iii) farmers not producing crops exported to the US would not be affected at all.

The tariff shock simulated by the transformation of the ATPDEA into a FTA with the US generates small price effects since the tariffs on the few remaining ATPDEA exceptions

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[48] When tariffs are eliminated on Bolivian products, Bolivia's exports to the US are assumed to be too small to flood the market so the domestic price stays the same and Bolivian exporters absorb the tariff preference margin. In the political-economy literature, this is what Grossman and Helpman (1995) called the "enhanced protection" case.

[49] Whether this is true or not depends on the curvature of the transformation surface between domestic and export sales. If it is flat, continued export sales to the US require equality between domestic and export prices, so the former must adjust like the latter; if it is strictly convex, price differentials can be consistent with continued export sales.

are still relatively low (9% on average). Table 3.12 presents the income changes for those farm households who not only sell to the US but also experience non-zero price changes in the products they export. Agriculture income increases by 19% on average for that subset of farm households. Simulated income changes experienced by non-indigenous households are 40% higher than that of indigenous households.

3.2.4 Consumption

The transformation of the ATPDEA into a reciprocal FTA has a very small effect on the import side. Bolivia's MFN tariffs are generally low (centered on 10%) and the US represents barely 15% of its imports, with many zero-trade lines. So even assuming an infinite elasticity of US supply to Bolivia – which is what we assume – the effects are very small (we do not consider action at the extensive margin, i.e. the US does not start exporting products that it currently does not export to Bolivia). For consumption, the methodology is the same as that used for the calculation of changes in agriculture incomes except that we apply the price changes on the basket of expenditures rather than farm sales. Once again, we assumed that the quantities of goods consumed by the household do not change in the short run. As can be seen from Table 3.13, the consumption effects that result from the FTA are very small. Overall expenditures decrease by 4%, with similar results for indigenous and non-indigenous households.

An approximation of the potential effects of the trade shock on poverty is shown in Table 3.14. The poverty headcount indicates poverty incidence and is calculated as the proportion of households who are living below the poverty line. The change in the poverty headcount is obtained by putting together the income changes experienced by manufacturing workers and farm households and comparing household per capita income to the Bolivian poverty line before and after the trade shock. The poverty gap index, which measures the depth of poverty, is the mean distance separating the households from the poverty line (with the non-poor being given a distance of zero), expressed as a percentage of the poverty line. Both poverty measures show that transforming the ATPDEA into a FTA would not induce any significant changes in poverty. Overall income changes are positive but small not only because of the modest expansion in manufacturing employment, but also because the simulated price changes that would affect agriculture income were also trivial. Lastly, adapting from the methodology described by McCulloch (2003), we combine the income effects from manufacturing and agriculture and the consumption effects to get an approximation of the percentage change in welfare resulting from the transformation of the ATPDEA into a FTA. Our estimates show a positive but small impact of the FTA on welfare. The average welfare gain is of 5% and there are no disparities in the impacts regarding indigenous and non-indigenous households.

Figure 3.1 shows the welfare changes by centiles of the initial income distribution. The curve is a "smoother regression", that is, a series of non-parametric regressions, one per centile of the income distribution, run over samples centered on the observation in question. The curve generated is a smooth curve that can accommodate any nonlinear relationship between the variable plotted on the horizontal axis (income centiles) and that on the vertical axis (welfare change following the tariff changes). If it is upward-sloping, the welfare change is regressive indicating a pro-rich bias, i.e., more positive for richer centiles than for poorer. Our results show that the welfare changes are positive throughout the entire income distribution and the curve is considerably flat, suggesting no bias either way.

Next, we extend the simulation by exploring the potential consequences for Bolivia when all Andean countries sign FTAs with the US simultaneously. We assumed unchanged market access for Bolivia's products on Andean countries as tariffs are already zero and non-tariff barriers are unlikely to be significantly affected in the short run. So the only substantial effect comes from trade diversion on Andean markets due to enhanced competition of US products on those markets. As Colombia and Peru sign FTAs with the US, the change compared to the current arrangement is that they grant tariff-free access to US products, which means added competition for Bolivian products. The only product where this trade-diversion effect is substantial is soybeans, for which Colombia is a significant outlet. Simulations reported in Cadot, Molina and Sakho (2008) suggest that Bolivia would lose about $4 million in sales of soybeans to Colombia if Colombia signed an FTA with the US. All in all, the export reduction on Andean markets represents a loss of 2.5% of Bolivia's initial exports. With an export elasticity of 3.5, this would translate into a 0.7% decrease in the price of Bolivian soybeans. Income changes for soybeans exporters due to trade diversion in soybeans on the Colombian market are incredibly small, around 0.3% for non-indigenous households and 0.4% for indigenous households. Consumption effects could not be calculated since data on soybeans consumption is not available. Since market access is unchanged, in manufacturing there is almost no effect as only 0.02% of manufacturing jobs are expected to be lost.

3.3 Non-renewal of the ATPDEA

Failure to renew the ATPDEA should not have a substantial effect on Bolivia's exports. Bolivia's shipments to the US are a small fraction of Bolivian's total exports (14% on average during 2001-2006) and they are not largely dependent on ATPDEA preferences. The main industry that would be expected to lose with the elimination of preferential treatment would be the apparel and clothing industry since most of the other manufactured goods could still be exported to the US duty free under the GSP.

We approach the effects of the elimination of preferences that Bolivia enjoys on the US market under the ATPDEA as in the previous section. Replacing duty-free status for eligible (and preference-requesting) Bolivian exports to the US by MFN status triggers a reduction in the dollar value of Bolivian exports which we model using SMART. Unlike the previous scenarios, this simulation only induces changes in the export side since the preferences are unilaterally removed by the US.

3.3.1 Manufacturing

The non-renewal of ATPDEA would not induce any significant loss in aggregate manufacturing income. As reported by Cadot, Molina and Sakho (2008), only 0.13% of manufacturing employment is expected to be destroyed following the elimination of ATPDEA's preferences (2% in the textile and apparel sector, which is the most affected in relative terms). There is a simple explanation for such small simulated effects. First, the US market represents only 14% of Bolivia's overall exports. Second, preferential status is lost only for those exports that requested preferences in the first place. Since utilization rates reported by the US ITC have been consistently low since 2000, the loss of preferential status is barely perceptible.

3.3.2 Agriculture

As a consequence of the extremely small price effects that result from the tariff shock (owing to low US tariffs together with small take-up of the preferences), the effects on agriculture income are also negligible. At the national level, agriculture income decreases by 0.7%. While agriculture income decreases by 1.1% for non-indigenous households, indigenous families experience an income loss of only 0.6%.

3.4 Deepening integration with MERCOSUR

The level of trade between Bolivia and MERCOSUR countries (Brazil, Argentina, Uruguay, and Paraguay) has increased over the years, particularly after Bolivia acquired associate status of the trading bloc in 1996. Almost 50% of total Bolivian exports in 2005 were destined to MERCOSUR countries, mostly due to natural gas exports to Brazil and Argentina. MERCOSUR members are also among the leading sources of Bolivian imports. While only 11% of total imports originated in the Andean Community of Nations (CAN), sales from Brazil and Argentina together accounted for 39% of Bolivian imports in that same year.

The association agreement signed in 1996 provided for the gradual creation of a free trade area covering at least 80 percent of the trade between the parties over a 10-year period and an extra 5 to 8-year period for sensitive products (vegetable oils and sugar). By 2014 there should be no exceptions and all trade between Bolivia and MERCOSUR countries should be duty free. Nevertheless, economic crises in the region have delayed the integration progress and substantial barriers remain, especially on MERCOSUR's side which still imposes tariffs as high as 20% on a few Bolivian products (mostly clothing articles).

We consider the potential income effects of the reciprocal elimination of all remaining taxes between Bolivia and MERCOSUR. Currently, 90% of Bolivia's exports to MERCOSUR consist of hydrocarbons and petroleum oils which already enter the bloc market free of duties. Positive duties are imposed on products which do not have a significant share of Bolivian exports. Thus, in simulations based on current trade patterns, their elimination should not generate substantial effects for Bolivia's economy. This is indeed what we find. It should be kept in mind that long-run supply elasticities may be different from short-run ones and that trade patterns can change substantially over the long run. Such effects, however, can only be "conjectured" and do not appear in the simulations that we carry out here.

The approach here is different from the one in previous scenarios in that when simulating the effects of eliminating all tariffs between Bolivia and MERCOSUR's countries we let prices adjust endogenously rather than treating each trade shock additively. We quantify the potential impact of the elimination of tariffs following deeper integration with MERCOSUR using GSIM, a multi-market extension of SMART developed by Francois and Hall (2003) for partial equilibrium analysis of global trade policy changes[50]. Unlike SMART, which simulates the partial equilibrium impact of tariff changes for a single market at a time, GSIM captures the effects of a full round of tariff negotiations among many countries simultaneously.

[50] Section A.3 in the appendix describes the model's equations.

3.4.1 Manufacturing

Table 3.15 presents the effects in manufacturing income induced by the integration with MERCOSUR countries. The income effects that result from employment destruction are very large for the individuals concerned, with income losses of 70% for indigenous people and 50% for non-indigenous. However, given the small share of manufacturing employment in total employment, overall effects in the economy are not significant.

3.4.2 Agriculture

As can be seen from Table 3.16, the effects in agriculture income were very modest as expected, especially since very few agricultural products were exported to the trading bloc members. Agriculture income decreases by 3% on average with larger income losses for non-indigenous households (4.1%) than indigenous ones (2.6%). It is important to note however that this income loss represents a "worst case" scenario since it assumes no quantity response at all.

3.4.3 Consumption

Table 3.17 shows the changes in expenditures that result from the trade shock. Even though goods in the consumption basket account for almost 60% of total expenditure, the negligible price variation resulted in a small change in total expenditure. Total expenditures decrease by 7.4% on average with no clear disparities between indigenous and non-indigenous households.

To give an idea of how the deeper integration with the bloc would affect poverty among Bolivian households, we present the poverty measures in Table 3.18. There is evidence of a small increase in both poverty incidence and depth. With the income decrease caused by job loss and the decrease in the prices of agriculture products, only a few households switch status from non-poor to poor and, as a consequence, the poverty headcount increases only slightly by 1.2 percentage point. There is no evidence that changes in the incidence of poverty are different for indigenous and non-indigenous people. The poverty gap index, on the other hand, indicates an increase in poverty intensity which is more evident among indigenous households. While the poverty gap index increases by 1.2 percentage point among indigenous households, it only increases by 0.3 percentage point among non-indigenous people. Our estimates also show that the integration with MERCOSUR countries has a small impact on the welfare of the average household. The income loss generated by job destruction and decreases in agriculture prices is offset by the consumption gains (i.e., lower expenditures) that result from tariff elimination and the total welfare increases by 4.9 percent.

Figure 3.2 shows welfare changes by centiles of the income distribution. The effects are positive at all income levels and the downward sloping curve indicates a bias towards the poorer households, with welfare increasing by as much as 8% at low income levels. There is a simple explanation for this pro-poor bias. First, welfare gains are driven by expenditure decreases. All but one of the food items in the household's consumption basket experience price decreases as a result of MERCOSUR integration (and the price increase is trivial for that one product). Moreover, although households at different income levels consume the same set of food products (almost all products have positive shares in every household's budget), the share of these products in total expenditures is much higher for poorer households.

4 Concluding remarks

Our simulation results suggest that ATPDEA's elimination or transformation into a reciprocal FTA would have virtually no effect on poverty and welfare in Bolivia. The reasons are multiple. First, there is little scope for improvements in market access from tariff reductions only since most of Bolivian products already enjoy tariff-free access on the US market. Second, even if there were gains in market access, the rate of utilization of US preferences where they could matter (in textiles and apparel) is very low. Third, Bolivia's preferential liberalization could have only very small effects given the limited number of products that the US exports to Bolivia and the small volumes involved. The only substantial action is trade diversion on Andean markets in soybeans but even that is limited.

Deeper integration with MERCOSUR countries, represented by the reciprocal elimination of all remaining tariffs, would also have no significant impact on poverty. Even thought there is substantial job destruction in the manufacturing sector, given the small share of manufacturing employment in total employment (10%), overall effects in the economy are not significant.

As always with this kind of simulation, however, it should be kept in mind that the trade adjustments considered are at the intensive margin. One could imagine that well-designed preferences could trigger inward investment and the appearance of new export items as the African Growth and Opportunity Act (AGOA) did for East Africa. However whether this would take place depends on a whole lot of internal and external factors that lie beyond the scope of this paper.

Appendix: Simulation equations

A.1 Elimination of US preferences

This section of the appendix describes the equations derived from the SMART model[51]. The reader is referred to Jammes and Olarreaga (2005) for a complete description. US consumers have Dixit-Stiglitz preferences with a quasi-linear "upper-stage" (defined over goods), of the form

$$U\left(c_0, c_1, ..., c_n\right) = c_0 + \sum_{k=1}^{n} u\left(c_k\right) \tag{A.1}$$

where c_0 stands for consumption of a composite good used as numéraire and c_k for consumption of good k (defined at the HS6 level). The function $u(.)$ is increasing, concave and identical in all countries.

Goods themselves are composites of differentiated national "varieties". That is, each country produces a variety *i* and those varieties are combined in the "lower-level" of US preferences through a Constant Elasticity of Substitution (CES) aggregator of the type

$$c_k = \left[\sum_j \left(c_k^j\right)^{1-\sigma}\right]^{1/(1-\sigma)}. \tag{A.2}$$

This formulation makes it possible to construct an aggregate price level for all varieties of good k[52]:

[51] The type of simulation we perform here, which does not involve a formula-based final tariff, is not programmed directly in SMART, so we replicated the equations in Stata.
[52] We omit the derivation of this price index which is somewhat tedious.

$$p_k = \left[\sum_j \left(p_k^j \right)^{1-\sigma} \right]^{\frac{1}{1-\sigma}}. \tag{A.3}$$

This is the "price" to which US consumers will react in trade-creation effects (by contrast, trade-diversion effects will be driven by changes in the relative prices of national varieties).

Consider now a representative good. We use superscript i for Bolivia and ℓ for other exporters to the US. Let $\tilde{m} = m^i / m^\ell$ be the ratio of a US imports of the composite good from i and ℓ respectively, and $\tilde{p} = p^i / p^\ell$ the ratio of their landed (duty-paid) prices. The elasticity of substitution σ between the two origins of our representative good is

$$\sigma = \frac{\tilde{p}}{\tilde{m}} \frac{d\tilde{m}}{d\tilde{p}} < 0. \tag{A.4}$$

and the elasticity of import demand (in algebraic value, i.e. negative) is

$$\varepsilon = \frac{p}{m} \frac{dm}{dp} < 0. \tag{A.5}$$

where p is the CES aggregate of the landed prices of all of the representative good's varieties in the importer country given by (A.3) and m is aggregate imports of all varieties of good i. For each variety i, the relationship between the producer and landed price is

$$p^i = p^{i*} \left(1 + t^i \right) \tag{A.6}$$

and t^i is the applied tariff, i.e. the MFN tariff reduced by the preference margin:

$$t^i = t^{MFN} \left(1 - \delta^i \right). \tag{A.7}$$

Trade creation

What we are looking for here is a "trade-destruction" effect rather than a trade-creation one since the experiment consists of raising US tariffs on Bolivia (from zero back to their

MFN level) instead of cutting them on an preferential basis. The logic is however the same.

We have three unknowns to determine: the change in Bolivian exports to the US, dx^i (equal to dm^i), the change in the landed price of Bolivian exports on the US market, dp^i, and the change in the producer price of Bolivian exports to the US, dp^{i*}, all in terms of the tariff change dt^i. In order to have a solution we need three equations:

(i) the definition of the supply elasticity:

$$\mu^i = \frac{p^{i*}}{x^i}\frac{dx^i}{dp^{i*}}, \tag{A.8}$$

(ii) the equation linking the exporter's producer price, the tariff, and the domestic price, given by (A.6), and (iii) the definition of the importer's price elasticity of import demand, given by (A.5). We close this simple system of equations by noting that US imports from Bolivia equal Bolivian exports to the US.

Starting from (A.5), totally differentiating (A.6), and substituting from (A.7) gives

$$\begin{aligned} dx^i &= \frac{\varepsilon x^i}{p^i} dp^i \\ dp^i &= p^{i*} dt^i + \left(1+t^i\right) dp^{i*} \\ dp^{i*} &= \frac{p^{i*}}{\mu^i x^i} dx^i; \end{aligned} \tag{A.9}$$

replacing x^i by m^i, evaluating p^{i*} at unity, and combining all three equations in (A.9) gives

$$dm^i\Big|_{TC} = \left(\frac{\mu^i \varepsilon}{\mu^i - \varepsilon}\right) m^i \frac{dt^i}{\left(1+t^i\right)}. \tag{A.10}$$

Recall that ε is in algebraic value and is normally negative, so trade creation is *positive* when the tariff goes *down*. Here, the US tariff on Bolivia would go *up* from zero to its

MFN level upon the elimination of the ATPDEA; thus, $t^i = 0$, $\Delta t^i = t^{US,MFN}$, and the formula used in our simulation is

$$\Delta m^{BOL\mapsto US}\Big|_{"TC"} = \left(\frac{\mu^{BOL}\varepsilon^{US}}{\mu^{BOL} - \varepsilon^{US}}\right) m^{BOL\mapsto US}\ t^{US\ MFN} \tag{A.11}$$

Trade diversion

Here again, we are looking for anti-trade diversion effects since preferences are being eliminated. Observe first that using an expression similar to (A.8) for the rest of the world's elasticity of supply gives, after a bit of algebra,

$$\frac{d\tilde{p}}{\tilde{p}} = \frac{dt}{1+t} + \frac{1}{\mu^i}\frac{dx^i}{x^i} + \frac{1}{\mu^\ell}\frac{dx^\ell}{x^\ell}. \tag{A.12}$$

Using again the fact that $x \equiv m$ for both i (Bolivia) and ℓ (the rest of the world) and that, along trade diversion, $dm^\ell \equiv -dm^i$, (A.12) can be rewritten as

$$\frac{d\tilde{p}}{\tilde{p}} = \frac{dt}{1+t} + \left(\frac{1}{\mu^i m^i} + \frac{1}{\mu^\ell m^\ell}\right) dm^i. \tag{A.13}$$

Going back to the definition of the elasticity of substitution in (A.4), we have also

$$d\tilde{m} = \sigma \tilde{m} \frac{d\tilde{p}}{\tilde{p}}; \tag{A.14}$$

expanding $d\tilde{m}$ gives

$$\frac{m^\ell dm^i - m^i dm^\ell}{\left(m^\ell\right)^2} = \sigma \frac{m^i}{m^\ell}\frac{d\tilde{p}}{\tilde{p}}. \tag{A.15}$$

Using again the fact that $dm^\ell \equiv -dm^i$, rearranging (A.15) and using (A.13) gives then

$$
\begin{aligned}
dm^i\Big|_{TD} &= \sigma\left(\frac{m^i m^\ell}{m^i + m^\ell}\right)\frac{d\tilde{p}}{\tilde{p}} \\
&= \sigma\left(\frac{m^i m^\ell}{m^i + m^\ell}\right)\left[\frac{dt^i}{\left(1+t^i\right)} + \left(\frac{1}{\mu^i m^i} + \frac{1}{\mu^\ell m^\ell}\right)dm^i\right] \qquad \text{(A.16)} \\
&= \sigma\left(\frac{\psi_1}{1-\sigma\psi_1\psi_2}\right)\frac{dt^i}{\left(1+t^i\right)}
\end{aligned}
$$

where

$$
\psi_1 = \frac{m^i m^\ell}{m^i + m^\ell} \qquad \text{(A.17)}
$$

and

$$
\psi_2 = \frac{1}{\mu^i m^i} + \frac{1}{\mu^\ell m^\ell}. \qquad \text{(A.18)}
$$

For us, the relevant tariff change is from $t^i = 0$ to $t^i = t^{US,MFN}$, so

$$
\frac{dt^i}{1+t^i} = t^{US,MFN}.
$$

As a (plausible) simplification, consider now the case where the ROW's supply curve is flat ($\mu^{ROW} \to +\infty$). Then $\psi_2 = 1/\mu^{BOL} m^{BOL\mapsto US}$ and

$$
\Delta m^{BOL\mapsto US}\Big|_{"TD"} = \sigma\left[\frac{\mu^{BOL} m^{BOL\mapsto US} m^{ROW\mapsto US}}{\mu^{BOL}\left(m^{BOL\mapsto US} + m^{ROW\mapsto US}\right) - \sigma m^{ROW\mapsto US}}\right] t^{US,MFN} \qquad \text{(A.19)}
$$

Thus, the total change in Bolivian exports ("trade diversion" and "trade creation", keeping in mind that we are working backward on the *elimination* of preferences), is

$$
\Delta m^{BOL} = \phi m^{BOL\mapsto US}\ t^{US,MFN} \qquad \text{(A.20)}
$$

where

$$\begin{aligned}\phi &= \left(\frac{\mu^{BOL}\varepsilon^{US}}{\mu^{BOL}-\varepsilon^{US}}\right)+\sigma\left[\frac{\mu^{BOL}m^{ROW\mapsto US}}{\mu^{BOL}\left(m^{BOL\mapsto US}+m^{ROW\mapsto US}\right)-\sigma m^{ROW\mapsto US}}\right] \\ &= \mu^{BOL}\left(\frac{\varepsilon^{US}}{\mu^{BOL}-\varepsilon^{US}}+\frac{\sigma}{\mu^{BOL}\left(1+\tilde{m}^{US}\right)-\sigma}\right)<0.\end{aligned} \tag{A.21}$$

Note that if one makes use of the fact that $\tilde{m}^{US} = m^{BOL\mapsto US} / m^{ROW\mapsto US}$ is very small, the last expression can be simplified into

$$\phi \approx \mu^{BOL}\left(\frac{\varepsilon^{US}}{\mu^{BOL}-\varepsilon^{US}}+\frac{\sigma}{\mu^{BOL}-\sigma}\right). \tag{A.22}$$

Observe also that is always negative because both and are in algebraic form; it is also an increasing function of and could be, in absolute value, larger than $1/t^{US,MFN}$, in which case the displacement of Bolivian exports by other suppliers on the US market could be more than their initial value[53]. We accordingly bound these effects at the initial level of Bolivian exports[54]. Thus, the expressions used in our simulations are, for each product k, (A.21) and

$$\Delta m_k^{BOL\mapsto US} = \begin{cases} \phi_k m_k^{BOL\mapsto US}\ t_k^{US,MFN} & \text{if } \left|\phi_k\ t_k^{US,MFN}\right| \le 1 \\ -m_k^{BOL\mapsto US} & \text{otherwise} \end{cases} \tag{A.22}$$

where $m_k^{BOL\mapsto US}$ is of course the *initial* level of Bolivian exports to the US.

[53] In practice, given an elasticity of substitution around 5 (the value used in our benchmark scenario) this requires small values of the elasticities of supply and demand and large values of the US MFN tariff. The constraint is binding in only 3% of Bolivia's active export lines.

[54] In this we depart slightly from SMART which applies a smooth downward correction to eliminate corner solutions.

A.2 FTA between Bolivia and the US

Here the exercise is more standard, consisting of replacing the Bolivian tariff on US imports by duty-free treatment. Because of the size asymmetry between the US and Bolivia, we can use the small-country version of SMART and assume that the elasticity of US supply is infinite. The formula for trade creation is then

$$dm^{US\mapsto BOL}\Big|_{TC} = \varepsilon^{BOL} m^{US\mapsto BOL}\left(\frac{t^{BOL,MFN}}{1+t^{BOL,MFN}}\right) \quad \text{(A.23)}$$

where ε^{BOL} is the price elasticity of Bolivia's import demand, and $t^{BOL,MFN}$ is the initial Bolivian tariff on US imports that is eliminated.

The formula for trade diversion is

$$dm^{US\mapsto BOL}\Big|_{TD} = \sigma\left(\frac{m^{US\mapsto BOL} m^{ROW\mapsto BOL}}{m^{US\mapsto BOL} + m^{ROW\mapsto BOL}}\right)\left(\frac{t^{BOL,MFN}}{1+t^{BOL,MFN}}\right); \quad \text{(A.24)}$$

Total effects are given by

$$\Delta m^{US} = \Delta m^{US\to BOL}\Big|_{TC} + \Delta m^{US\to BOL}\Big|_{TD}$$

$$\Delta m^{US} = \phi_k^{US\to BOL} m^{US\to BOL}\left(\frac{t^{BOL,MFN}}{1+t^{BOL,MFN}}\right) \quad \text{(A.25)}$$

where

$$\phi_k^{US\to BOL} = \sigma\left(\varepsilon^{BOL} + \frac{1}{1+\tilde{m}_k^{BOL}}\right) \quad \text{(A.26)}$$

and

$$\tilde{m}_k^{BOL} = \frac{m_k^{US\mapsto BOL}}{m_k^{ROW\mapsto BOL}}. \quad \text{(A.27)}$$

imposing the usual upper bound, we get

$$\Delta m_k^{US\rightarrow BOL} = \begin{cases} \phi_k^{US\rightarrow BOL} m_k^{US\rightarrow BOL} \left(\dfrac{t_k^{BOL,MFN}}{1+t_k^{BOL,MFN}} \right) & if \quad \phi_k^{BOL} t_k^{BOL,MFN} \leq 1 \\ m_k^{US\rightarrow BOL} \quad otherwise & \end{cases} \tag{A.28}$$

A.3 MERCOSUR Integration

This section of the appendix describes the equations derived from the GSIM model, a modeling framework for partial equilibrium analysis of global trade policy changes developed by Francois and Hall (2003)[55]. A feature of this approach is that the goods traded are differentiated by source, which implies that commodities from different countries are treated as imperfect substitutes. The model, however, ignores products that may be substitutes in consumption or production.

In the model, $M_{m,p,x}$ the import demand of country *m* for product *p* exported by country *x* is:

$$M_{m,p,x} = f\,(P_{m,p,x}; P_{m,p,\neq x}; Y_{m,p}) \quad ; \tag{A.29}$$

where $P_{m,p,x}$ is the (tariff-inclusive) domestic price in *m* of product *p* exported by *x*, $P_{m,p,\neq x}$ is the domestic price in *m* of *p* exported by countries other than *x*, and $Y_{m,p}$ is the total expenditure of country *m* on imports of product *p* (in demand theory, this results from the assumption of weakly separability).

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[55] The reader is again referred to Jammes and Olarreaga (2005) for a complete description.

Differentiating (A.29) and making use of relationships from demand theory, own price elasticity and cross-price elasticity can be obtained as follows:

$$\begin{aligned} \varepsilon_{m,p,x} &= \theta_{m,p,x}(\varepsilon_{m,p} + \sigma_{m,p}) \\ \varepsilon_{m,p,\neq x} &= \theta_{m,p,\neq x}\varepsilon_{m,p} - (1-\theta_{m,p,\neq x})\sigma_{m,p}) \end{aligned} \quad ; \qquad \text{(A.30)}$$

where $\theta_{m,p,x}$ is the expenditure share of product *p* exported by *x* in total imports of product *p* by country *m*, $\varepsilon_{m,p}$ is the composite import demand function for product *p* in country *m* and $\sigma_{m,p}$ is the elasticity of substitution in country *m* for product *p* exported from different countries.

Export supply to world markets is defined as being a function of the world price P^*:

$$X_{p,x} = g(P^*_{p,x}) \ . \qquad \text{(A.31)}$$

The expression for the export supply elasticity is derived by differentiating (A.31):

$$e_{p,x} = \frac{\hat{X}_{p,x}}{\hat{P}^*_{p,x}} \quad ; \qquad \text{(A.32)}$$

where the "hat" denotes percentage change. The percentage change in world price that follows a trade reform in one or more countries is obtained by simply solving for the new price that re-equilibrates demand and supply for this product. Taking advantage of matrix notation to obtain the solution to changes in world prices, define $\mathrm{E}_{m,p}$ as a diagonal *x* by *x* matrix of elasticities in *m* for product *p*, where the diagonal elements are equal to $\frac{\varepsilon_{m,p,x}}{e_{p,x}}$ and the off-diagonal elements are $\frac{\varepsilon_{m,p,\neq x}}{e_{p,x}}$. Let $\mathrm{P}^*_{m,p}$ be the vector of percentage changes in *p*'s world prices and let $\mathrm{T}_{m,p}$ be the vector of tariff changes imposed by *m* on imports of *p* from different countries. Moreover, denote $\mathrm{E}_p = \sum_m \mathrm{E}_{m,p}$ and $\mathrm{B}_p = \sum_m \mathrm{E}_{m,p}\mathrm{T}_{m,p}$. Imposing market clearing conditions and solving or changes in world prices gives:

$$P^{*}{}_{p} = (1 - \mathrm{E}_{p})^{-1}\mathrm{B}_{p} \ . \tag{A.33}$$

Once we obtain the percentage changes in world prices from (A.33), changes in the importer price index are easily calculated as follows:

$$\hat{P}^{*}{}_{m,p} = \sum_{x} \theta_{m,p,x} \hat{P}^{*}{}_{p,x} + \hat{\mathrm{T}}_{p,x} \ . \tag{A.34}$$

Tables

Table 1.1

Growth rates of exports (%)

Year	Brazil	World
1989	1.8	8.7
1990	-8.6	13.9
1991	0.7	3.0
1992	13.2	6.0
1993	7.7	0.5
1994	12.9	12.9
1995	6.8	19.9
1996	2.7	5.3
1997	11.0	4.0
1998	-3.5	-2.4
1999	-6.1	3.7
2000	14.7	12.8
2001	5.7	-4.2
2002	3.7	4.6
2003	21.1	16.8
2004	32.0	21.5
2005	22.6	13.9
2006	16.2	17.0

Table 1.2

Distribution of exports by main importers (%)

Rank	1991		1996		2001		2006	
1	USA	19.9	USA	19.5	USA	24.0	USA	18.3
2	Japan	8.3	Argentina	11.0	Argentina	8.9	Argentina	8.7
3	Germany	7.0	Netherlands	7.6	Netherlands	5.1	China	6.2
4	Netherlands	6.9	Japan	6.5	Germany	4.5	Netherlands	4.3
5	Argentina	4.8	Germany	4.4	Japan	3.6	Germany	4.2
6	Italy	4.2	Italy	3.2	China	3.4	Mexico	3.3
7	Belgium-Luxembourg	3.5	Belgium-Luxembourg	3.1	Mexico	3.3	Chile	2.9
8	Great Britain	3.4	Great Britain	2.8	Italy	3.2	Japan	2.9
9	France	2.8	Paraguay	2.8	Belgium	3.1	Italy	2.8
10	Spain	2.3	China	2.4	Great Britain	3.0	Venezuela	2.6

Table 1.3

Distribution of exports by destination markets: Non-traditional partners

	Export value (1987 US$ millions)		Export share (%)	
	2001	2006	2001	2006
Togo	0.7	17.3	0.002	0.023
Iraq	3.9	86.2	0.011	0.113
Moldova	1.4	29.4	0.004	0.039
Cyprus	7.2	96.9	0.020	0.127
Mozambique	1.7	19.7	0.005	0.026
Vietnam	7.3	72.7	0.021	0.096
Ghana	15.1	122.0	0.042	0.161
Azerbaijan	1.8	11.6	0.005	0.015
Ukraine	21.9	124.0	0.061	0.163
Namibia	1.3	7.1	0.004	0.009
Zambia	0.8	4.2	0.002	0.006
Angola	90.7	470.0	0.254	0.619

Table 1.4

Geographical diversification of exports

Year	Number of trade relationships	Partners	
		Total	Average number of destination markets for each product
1989	42,884	173	11
1990	38,214	170	11
1991	41,141	169	11
1992	45,248	164	11
1993	48,429	171	12
1994	47,944	183	12
1995	45,278	181	12
1996	46,658	182	12
1997	46,600	171	12
1998	46,068	173	12
1999	48,287	176	12
2000	50,735	176	13
2001	53,198	192	13
2002	57,482	196	14
2003	78,138	200	18
2004	84,604	201	20
2005	88,129	204	20
2006	87,458	204	20

Table 1.5

Distribution of exports by destination markets (%)

	1991	1996	2001	2006
ALADI	15.9	23.2	21.8	23.3
EU	29.2	24.3	26.6	21.8
USA	19.9	19.5	24.0	18.3
Asia	18.4	16.7	12.5	15.5
Africa	3.3	3.2	3.4	5.5
Middle East	3.6	2.7	3.6	4.3
Other	9.7	10.3	8.1	11.3

Table 1.6

Export basket composition: SITC 1-digit categories (%)

	1991	1996	2001	2006
Machinery and transport equipment	19.0	20.3	27.9	24.7
Food and live animals	20.1	23.0	20.9	18.8
Manufactured goods	29.2	24.1	18.6	18.6
Leather	1.3	1.6	1.8	1.6
Rubber	1.1	1.3	1.1	1.0
Cork and wood	0.7	1.3	1.3	1.1
Paper	2.4	2.2	1.8	1.2
Textile yarn	2.8	2.2	1.6	1.0
Non-metallic mineral manufactures	1.3	1.6	1.6	1.5
Iron and steel	13.4	9.0	5.7	7.1
Non-ferrous metals	4.9	3.5	2.4	3.1
Metals	1.3	1.4	1.3	1.1
Crude materials, inedible, except fuel	14.7	12.7	15.8	16.7
Mineral fuels, lubricants and related materials	0.0	0.1	1.4	7.9
Chemicals and related products	6.1	6.7	5.7	6.7
Miscellaneous manufactured articles	6.8	6.4	6.3	3.6
Beverages and tobacco	2.9	3.5	1.8	1.4
Animal and vegetable oils, fats and waxes	1.1	1.9	1.1	1.0
Other	0.1	1.3	0.6	0.5
Hirschman-Herfindahl Index	0.18	0.16	0.17	0.14

Table 1.7

Export basket composition (%)

	1991	1996	2001	2006
Primary commodities	**43.7**	**44.7**	**43.4**	**48.9**
Food items	25.5	30.5	28.7	25.5
Agricultural raw materials	3.4	3.8	4.3	3.8
Fuels	0.0	0.1	1.4	7.9
Ores and metals	14.8	10.3	9.0	11.8
Manufactured goods	**56.1**	**55.1**	**56.5**	**51.1**
High technology	4.8	4.3	12.5	6.9
Aircraft and spacecraft	1.3	1.2	6.7	2.8
Pharmaceuticals	0.6	0.7	0.7	0.7
Office and computing machinery	0.9	0.8	0.7	0.4
Radio, TV and communications equipment	1.6	1.3	3.7	2.7
Medical, precision and optical instruments	0.5	0.4	0.7	0.5
Medium-high technology	20.9	23.0	21.9	23.8
Electrical machinery	1.4	1.8	1.8	1.9
Motor vehicles and trailers	7.5	8.3	9.6	10.7
Chemicals excluding pharmaceuticals	5.8	6.2	4.9	4.8
Railroad and transport equipment	0.2	0.1	0.2	0.4
Machinery and equipment, n.e.c.	6.0	6.7	5.3	6.0
Medium-low technology	17.8	15.3	10.7	11.7
Building and repairing of ships and boats	0.6	0.4	0.1	0.0
Rubber and plastics products	1.5	1.8	1.7	1.5
Coke, petroleum products and nuclear fuel	0.0	0.0	0.0	0.0
Other non-metallic mineral products	1.1	1.5	1.5	1.6
Basic metals and fabricated metal products	14.6	11.6	7.5	8.6
Low technology	12.6	12.4	11.4	8.7
Manufacturing, n.e.c.; Recycling	0.8	1.3	1.4	1.0
Wood, pulp, paper	3.2	3.4	3.2	2.4
Food products, beverages and tobacco	0.0	0.2	0.2	1.2
Textiles, leather and footwear	8.6	7.5	6.6	4.1
Other / Non-classified	**0.2**	**0.2**	**0.1**	**0.1**

Table 1.8

Export basket composition: products in top 15 list in all four years

	Export share (%)				Rank position			
	1991	1996	2001	2006	1991	1996	2001	2006
Coffee	4.5	3.7	2.2	2.2	2	3	7	8
Soya beans	1.5	2.2	4.9	4.2	11	8	2	3
Soya bean oil	4.4	5.8	3.7	1.8	3	1	3	12
Iron ore, non-agglomerated	5.7	3.7	3.4	4.3	1	2	4	2
Iron ore, agglomerated	2.7	2.0	1.8	2.4	7	10	11	6
Chemical wood-pulp	1.8	2.0	2.1	1.8	10	12	8	11

Table 1.9

Intensive and extensive margins of exports, 1997/98-2003/04: Number of products[1]

	Total number of products			Share of 1997/98 exports (%)			Share of 2003/04 exports (%)		
	New products	Deleted products	Permanent products	New products	Deleted products	Permanent products	New products	Deleted products	Permanent products
HS 6 digits									
Cutoff = $0	500	191	3,794	0	4.8	95.2	11.6	0	88.4
Cutoff = $500	402	289	3,664	0	7.3	92.7	9.9	0	90.1
Cutoff = $1,000	406	299	3,581	0	7.7	92.3	10.2	0	89.8
HS 8 digits									
Cutoff = $0	1,557	986	6,299	0	14.8	94.7	21.6	0	87.4
Cutoff = $500	1,501	1,086	5,715	0	17.4	91.5	22.5	0	85.7
Cutoff = $1,000	1,508	1,101	5,475	0	18.1	89.9	23.2	0	84.3

[1] Trade criteria based on average export value in the two-year period.

Note: Cutoff value in 1987 US dollars.

Table 1.10

Intensive and extensive margins of exports, 1997/98-2003/04: Export value[1]

	Share of 1997/98 export value (%)			Share of 2003/04 export value (%)			Share of export growth, 1997/98-2003/04 (%)		
	New products	Deleted products	Permanent products	New products	Deleted products	Permanent products	New products	Deleted products	Permanent products
HS 6 digits									
Cutoff = $0	0	0.6	99.4	2.4	0	97.6	11.4	-2.3	90.9
Cutoff = $500	0	0.7	99.3	2.4	0	97.6	11.4	-2.6	91.2
Cutoff = $1,000	0	0.7	99.3	2.5	0	97.5	11.7	-2.6	91.0
HS 8 digits									
Cutoff = $0	0	7.0	93.0	8.8	0	91.2	29.9	-16.8	86.9
Cutoff = $500	0	7.0	93.0	8.8	0	91.2	30.1	-16.9	86.8
Cutoff = $1,000	0	7.1	92.9	8.9	0	91.1	30.3	-17.1	86.8

[1] Average export value in the two-year period.

Note: Cutoff value in 1987 US dollars.

Table 1.11

Extensive margin of exports: top destination markets for new Brazilian products (number of 8-digit level products)

	Total number of products[1]	Number of new products at destination market level			Share of newly exported products to country in total number of new products exported by Brazil (%)[5]
		Total[2]	Previously exported by Brazil[3]	Newly exported by Brazil[4]	
Selected countries					
Argentina	5,225	1,347	676	671	43.1
United States	4,888	1,906	1,277	629	40.4
Chile	4,304	1,568	1,122	446	28.6
Paraguay	4,265	1,121	679	442	28.4
Uruguay	4,214	1,209	775	434	27.9
Angola	3,720	1,801	1,426	375	24.1
Bolivia	3,830	1,062	706	356	22.9
Colombia	3,378	1,603	1,252	351	22.5
Mexico	3,378	1,619	1,288	331	21.3
Peru	3,381	1,304	994	310	19.9
Venezuela	3,237	1,327	1,030	297	19.1
Germany	2,859	1,405	1,111	294	18.9
Italy	2,604	1,476	1,218	258	16.6
Portugal	2,617	1,570	1,320	250	16.1
Spain	2,477	1,519	1,275	244	15.7

[1] Total number of products exported to the country in 2003/04.

[2] Number of products exported to the country for the first time in 2003/04.

[3] Number of products exported to the country for the first time in 2003/04 which had already been exported somewhere else in 1997/98.

[4] Number of products exported to the country for the first time in 2003/04 which were also exported by Brazil for the first time in 2003/04.

[5] Sum exceeds 100% because Brazil experiments the new exports in different markets at the same time.

Table 1.12

Extensive margins of exports, 1997/98-2003/04 (8-digit level data): Export value[1]

	New products		New products (permanent Brazilian products only)	
	Share of 2003/04 export value (%)	Share of export growth, 1997/98-2003/04 (%)	Share of 2003/04 export value (%)	Share of export growth, 1997/98-2003/04 (%)
Total Brazil	8.8	29.9	-	-
Selected countries				
Israel	49.3	73.0	45.2	64.9
Canada	29.3	72.8	25.3	64.3
Colombia	25.8	69.5	20.2	56.7
United Arab Emirates	40.5	67.3	38.0	63.1
India	46.3	66.0	41.8	59.0
Algeria	51.1	61.6	49.7	58.7
Russia	25.8	53.3	24.8	51.8
South Africa	33.9	53.1	22.5	37.1
Chile	21.2	50.3	17.4	40.5
Ecuador	21.9	44.6	16.9	34.8
Saudi Arabia	15.9	40.7	15.0	36.8
USA	15.0	37.3	2.7	7.2
Angola	17.7	29.2	13.5	22.3
China	22.2	28.9	16.7	21.9
Mexico	17.2	25.1	13.1	18.7

[1] Average export value in the two-year period.

Note: 8-digit level data, cutoff value = 0 (zero) 1987 US dollars.

Table 1.13

Probit estimation

	Cutoff value = US$0		Cutoff value = US$500		Cutoff value = US$1,000	
	Coefficients	Mg. Effects	Coefficients	Mg. Effects	Coefficients	Mg. Effects
Previous export experience with country (DC)	0.352	0.133	0.791	0.307	0.906	0.348
	(0.034)***	(0.013)***	(0.027)***	(0.011)***	(0.037)***	(0.012)***
Previous export experience with region (DR)	0.047	0.019	0.116	0.043	0.152	0.053
	(0.052)	(0.020)	(0.061)*	(0.023)*	(0.058)***	(0.023)***
Change in tariff (cht)	-0.180	-.0711	-0.130	-0.048	-0.134	-0.046
	(0.153)	(0.060)	(0.159)	(0.058)	(0.162)	(0.055)
Obs.	157,897		157,891		157,889	
Pseudo R^2	0.07		0.11		0.12	
Model prediction	0.63		0.67		0.70	
0's predicted correctly	0.34		0.80		0.83	
1's predicted correctly	0.82		0.53		0.51	

Notes:

A good is considered traded if if is exported in at least one year of the period.

Robust standard errors in parentheses, country and industry dummies not shown.

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 1.14

Probit estimation

	Cutoff value = US$0		Cutoff value = US$500		Cutoff value = US$1,000	
	Coefficients	Mg. Effects	Coefficients	Mg. Effects	Coefficients	Mg. Effects
Previous export experience with country (DC)	0.354	0.134	0.795	0.309	0.911	0.350
	(0.035)***	(0.013)***	(0.029)***	(0.010)***	(0.039)***	(0.013)***
Previous export experience with region, custom union (DRCU)	0.079	0.031	0.186	0.070	0.233	0.083
	(0.044)*	(0.017)*	(0.043)***	(0.017)***	(0.034)***	(0.013)***
Previous export experience with region, no custom union (DRNCU)	0.012	0.005	0.040	0.015	0.063	0.022
	(0.069)	(0.027)	(0.082)	(0.031)	(0.083)	(0.030)
Change in tariff (cht)	-0.182	-.0720	-0.135	-.0496	-0.143	-0.049
	(0.153)	(0.061)	(0.158)	(0.058)	(0.163)	(0.056)
Obs.	157,897		157,891		157,889	
Pseudo R^2	0.07		0.11		0.13	
Model prediction	0.63		0.67		0.70	
0's predicted correctly	0.34		0.78		0.83	
1's predicted correctly	0.80		0.53		0.51	

Notes:

A good is considered traded if if is exported in at least one year of the period.

Robust standard errors in parentheses, country and industry dummies not shown.

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 2.1
Examples of data: exports of Brazil nuts (HS 080120)

	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	No. of Spells	No. of Years In
Angola																x	x	x	1	3
Argentina		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	1	17
Australia	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	1	18
Bolivia									x	x	x				x	x	x	x	2	7
Canada	x	x		x	x	x	x	x	x	x		x	x	x	x	x	x	x	3	16
China										x				x	x	x	x	x	2	6
Denmark								x	x	x		x	x						2	5
France	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x	2	17
Germany	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	1	18
Israel													x	x	x	x	x	x	1	6
Italy	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	1	18
Japan	x	x	x	x			x	x						x	x		x	x	4	10
Jordan														x					1	1
Mexico													x	x			x		2	3
Netherlands	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	1	18
New Zealand	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x	x	x	2	17
Norway								x	x		x	x	x	x	x	x	x		2	9
Portugal										x	x	x	x	x		x	x		2	7
Saudi Arabia													x	x			x	x	2	4
Singapore	x	x	x	x	x	x	x												1	7
South Africa	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	1	18
Spain	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	1	18
Tunisia							x		x	x			x	x		x	x	x	4	8
Ukraine																x			1	1
United Kingdom	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x		2	16
United States	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	1	18
Venezuela						x							x						2	2

Table 2.2

Diversification of exports (HS 6-digit level data)

Year	Number of trade relationships	Products		Partners	
		Total	Average number of products exported to each partner	Total	Average number of destination markets for each product
1989	42,884	3,816	248	173	11
1990	38,214	3,614	225	170	11
1991	41,141	3,768	243	169	11
1992	45,248	3,950	276	164	11
1993	48,429	4,027	283	171	12
1994	47,944	4,030	262	183	12
1995	45,278	3,978	261	181	12
1996	46,658	3,963	256	182	12
1997	46,600	3,971	273	171	12
1998	46,068	3,985	266	173	12
1999	48,287	4,027	274	176	12
2000	50,735	4,053	288	176	13
2001	53,198	4,063	277	192	13
2002	57,482	4,062	293	196	14
2003	78,138	4,294	391	200	18
2004	84,604	4,281	421	201	20
2005	88,129	4,314	432	204	20
2006	87,458	4,288	429	204	20

Table 2.3

Summary Statistics

	No. of product codes	No. of spells	Observed Spell Length (years)	
			Mean	Median
Benchmark	4,917	320,934	3.1	1
Region aggregation	4,917	57,207	4.7	2
World aggregation	4,917	8,293	9.1	6
First spells	4,917	179,960	3.4	1
Single spells	4,893	96,956	4.3	1
Gap-adjusted	4,917	260,559	4.1	2
Trade weighted	4,917	320,934	5	2
Industry aggregation				
SITC1	10	3,800	7.5	3
SITC2	66	19,762	5.8	2
SITC3	236	56,943	4.7	2
SITC4	782	129,626	3.9	2
SITC5	1,441	155,835	3.3	1
Summarized by region				
ALADI	4,740	74,020	7.5	4
USA	4,141	8,572	4.8	2
EU15	4,354	55,234	4.7	2
Africa	4,070	46,958	3.8	2
Asia	3,716	36,394	3.9	2
Middle East	2,678	19,436	3.2	1
Other	4,089	80,320	4.8	2

Table 2.4

Product code reclassification

Year	Number of new codes	Number of deleted codes
1989	3816	-
1990	250	14
1991	210	5
1992	161	8
1993	120	11
1994	74	11
1995	54	10
1996	30	9
1997	35	65
1998	31	13
1999	22	14
2000	31	23
2001	24	27
2002	15	58
2003	27	28
2004	8	48
2005	5	87
2006	4	198
2007	-	4288

Table 2.5

Kaplan-Meier estimation results

	Survivor function				Survival time		
	1 year	5 years	10 years	15 years	25%	50%	75%
Benchmark	0.59	0.33	0.27	0.26	1	2	.
Region aggregation	0.70	0.47	0.43	0.43	1	4	.
World aggregation	0.89	0.78	0.76	0.76	.	.	.
First spells	0.59	0.34	0.30	0.29	1	2	.
Single spells	0.62	0.45	0.43	0.43	1	3	.
Gap-adjusted	0.66	0.43	0.36	0.35	1	3	.
Trade weighted	0.72	0.49	0.44	0.43	1	5	.
Industry aggregation							
SITC1	0.72	0.51	0.48	0.46	1	7	.
SITC2	0.66	0.44	0.39	0.38	1	3	.
SITC3	0.63	0.38	0.33	0.31	1	2	.
SITC4	0.59	0.33	0.27	0.25	1	2	14
SITC5	0.56	0.30	0.23	0.21	1	2	8

Table 2.6

Kaplan-Meier estimation results summarized by region, industry and product type

	Survivor function				Survival time		
	1 year	5 years	10 years	15 years	25%	50%	75%
By region							
ALADI	0.67	0.42	0.36	0.35	1	3	.
USA	0.70	0.47	0.42	0.42	1	4	.
EU15	0.58	0.31	0.26	0.25	1	2	12
Africa	0.54	0.28	0.23	0.22	1	2	7
Asia	0.56	0.28	0.22	0.20	1	2	6
Middle East	0.55	0.27	0.20	0.19	1	2	7
Other	0.57	0.3	0.24	0.23	1	2	9
By SITC 1-digit							
0. Food and live animals	0.61	0.34	0.29	0.28	1	2	.
1. Beverages and tobacco	0.65	0.39	0.33	0.31	1	3	.
2. Crude materials	0.61	0.32	0.25	0.24	1	2	11
3. Mineral fuels	0.59	0.31	0.27	0.25	1	2	15
4. Animal and vegetable oils	0.60	0.31	0.26	0.25	1	2	16
5. Chemicals	0.60	0.32	0.27	0.25	1	2	.
6. Manufactured goods	0.60	0.33	0.28	0.26	1	2	.
7. Machinery equipment	0.58	0.32	0.27	0.26	1	2	.
8. Miscellaneous manufactures	0.59	0.33	0.28	0.27	1	2	.
9. Other	0.52	0.20	0.11	0.10	1	2	4
By product type							
Primary commodities	0.60	0.33	0.27	0.26	1	2	.
Food items	0.61	0.34	0.29	0.28	1	2	.
Agricultural raw materials	0.61	0.33	0.26	0.24	1	2	12
Fuels	0.60	0.31	0.25	0.22	1	2	11
Ores and metals	0.58	0.30	0.24	0.22	1	2	9
Manufactures	0.59	0.33	0.27	0.26	1	2	.
Low technology	0.59	0.33	0.27	0.26	1	2	.
Medium-low technology	0.61	0.35	0.29	0.28	1	2	.
Medium-high technology	0.58	0.32	0.27	0.26	1	2	.
High technology	0.58	0.31	0.25	0.24	1	2	10

Table 3.1

Geographical distribution

	Total	Indigenous	Non-indigenous
La Paz	29.5	22.6	6.8
Santa Cruz	24.3	7.2	17.1
Cochabamba	17.8	13.8	4.0
Potosí	8.5	7.3	1.2
Chuquisaca	6.1	3.8	2.2
Oruro	5.0	4.0	1.0
Tarija	4.8	0.9	3.8
Beni	3.6	1.3	2.3
Pando	0.7	0.1	0.6
Total	100.0	61.0	39.0

Table 3.2

Summary Statistics

	No. of obs	HH income (in Bs)	No. of children	Urban dummy (urban=1)	Poverty dummy (poor=1)	Gender dummy* (male=1)	Age* (years)	Education* (years)
Total	4,086	3,453.58	1.80	0.65	0.55	0.77	45.46	7.69
		(244)	(0.04)	(0.02)	(0.01)	(0.01)	(0.42)	(0.17)
Indigenous	2,433	2,845.0	1.84	0.54	0.63	0.78	46.64	6.66
		(227)	(0.05)	(0.03)	(0.02)	(0.01)	(0.60)	(0.19)
Non-indigenous	1,653	4,407.09	1.73	0.81	0.44	0.76	43.61	9.30
		(483)	(0.06)	(0.02)	(0.02)	(0.01)	(0.45)	(0.23)

*Head of household's information.

Note: Std errors in parentheses.

Table 3.3

Income sources (%)

	Total			Indigenous			Non-indigenous		
	Total	Poor	Non-Poor	Total	Poor	Non-Poor	Total	Poor	Non-Poor
Self employment	52.3	60.7	41.2	57.3	64.6	45.0	44.8	53.1	37.1
Farming activities	24.5	36.5	8.7	29.9	42.0	9.5	16.5	25.8	7.8
Non-farming activities	27.8	24.2	32.5	27.4	22.5	35.6	28.3	27.3	29.3
Wages	28.0	22.7	34.9	23.6	18.2	32.7	34.4	31.4	37.2
Other work related[1]	3.7	2.4	5.3	3.0	1.8	5.0	4.6	3.4	5.7
Non-work related[2]	4.7	1.7	8.8	4.7	1.8	9.5	4.9	1.5	8.0
Transfers	8.1	7.7	8.7	7.4	7.8	6.7	9.3	7.6	10.8
Other sources[3]	4.4	6.3	1.8	5.6	7.6	2.0	2.6	3.8	1.5

[1] Bonus, comission, overtime, etc.

[2] Retirement savings, rent, interests, dividends, etc.

[3] Pensions, scholarships, copyrights, etc.

Table 3.4

Budget Shares (%)

	Total			Indigenous			Non-indigenous		
	Total	Poor	Non-Poor	Total	Poor	Non-Poor	Total	Poor	Non-Poor
Food	66.3	71.9	58.8	68.0	72.7	60.0	63.8	70.5	57.6
Inside the home	58.2	66.6	47.1	60.9	68.0	48.9	54.3	64.0	45.1
Outside the home	8.1	5.3	11.8	7.1	4.7	11.2	9.5	6.4	12.4
Clothing	3.5	3.2	3.9	3.6	3.4	4.0	3.5	3.0	3.9
Education	5.4	4.9	6.2	5.4	5.0	6.1	5.5	4.6	6.2
Housing	8.6	7.3	10.4	7.7	6.5	9.6	10.0	8.7	11.2
Transport	3.3	2.8	3.8	3.4	3.0	4.1	3.0	2.6	3.5
Personal Goods	2.1	2.0	2.3	1.9	1.8	2.1	2.4	2.4	2.5
Health	1.5	1.5	1.7	1.4	1.4	1.5	1.7	1.6	1.9
Tobacco	0.2	0.1	0.2	0.1	0.1	0.1	0.3	0.2	0.3
Remittances	1.2	0.4	2.1	1.4	0.5	2.9	0.7	0.2	1.3
Other	7.9	5.9	10.5	7.1	5.7	9.5	9.0	6.2	11.6

Table 3.5

Employment Status Frequency (%)

	Employed	Unemployed
Total	94.7	5.3
Indigenous	96.1	3.9
Non-indigenous	92.9	7.1

Table 3.6

Employment sector (%)

Economic Activity	Total	Indigenous	Non-indigenous
Agriculture, hunting and forestry	39.9	27.9	12.0
Fishing	0.1	0.1	0.0
Mining and quarrying	1.6	1.1	0.5
Manufacturing	10.7	5.8	4.9
Electricity, gas and water supply	0.3	0.1	0.2
Construction	6.3	3.2	3.1
Wholesale and retail trade	14.4	8.0	6.4
Hotels and restaurants	4.0	1.9	2.1
Transport, storage and communications	5.9	2.6	3.3
Financial intermediation	0.3	0.1	0.2
Real estate, renting and business activities	2.4	0.8	1.6
Public administration and defence	2.1	1.0	1.1
Education	4.4	2.3	2.2
Health and social work	1.5	0.6	0.9
Other community, social activities	3.5	1.6	2.0
Private households with employed persons	2.5	1.3	1.2
Extra-territorial organizations and bodies	0.1	0.0	0.1
Total	100.0	58.2	41.8

Table 3.7

ATPA/ATPDEA utilization rates: ISIC Rev.2 (%)

		1997	1998	1999	2000	2001	2002	2003	2004	2005
311/312	Food products	0	0	0	0	0	0	0	0	0
313	Beverage	0	0	0	0	0	0	0	0	0
314	Tobacco	0	0	0	0	0	0	0	0	0
321	Textiles	0	0	0	10.3	3.9	0	0	4.7	0
322	Wearing apparel, except footwear	99.6	72.5	96.5	19.7	55.7	5.3	11.0	14.5	4.2
323	Leather products	96.0	81.9	75.5	77.8	86.1	18.9	78.4	85.4	78.1
324	Footwear, except rubber or plastic	0	0	0	0	0	0	0	0	0
331	Wood products, except furniture	0	0	0	0	0	0	0	0	0
332	Furniture, except metal	0	0	0	0	0	0	0	0	0
341	Paper products	0	0	0	0	0	0	0	0	0
342	Printing and publishing	0	0	0	0	0	0	0	0	0
351	Industrial chemicals	0	0	0	0	0	0	0	0	0
352	Other chemicals	0	0	0	0	0	0	0	0	0
353	Petroleum refineries	0	0	0	0	0	0	0	0	0
354	Miscellaneous petroleum products	0	0	0	0	0	0	0	0	0
355	Rubber products	0	0	0	0	0	0	0	0	0
356	Plastic products	0	0	0	0	0	0	0	0	0
361	Pottery, china, earthware	0	0	0	0	0	0	0	0	0
362	Glass products	0	0	0	0	0	0	0	0	0
369	Other non-metallic mineral products	0	0	0	0	0	0	0	0	0
371	Iron and steel	0	0	0	0	0	0	0	0	0
372	Non-ferrous metal	0	0	0	0	0	0	0	0	0
381	Metal products, except machinery and equipment	0	0	0	0	0	0	0	0	0
382	Machinery, except electrical	0	0	0	0	0	0	0	0	0
383	Electrical machinery	0	0	0	0	0	0	0	0	0
384	Transport equipment	0	0	0	0	0	0	0	0	0
385	Professional and scientific equipment	0	0	0	0	0	0	0	0	0
390	Other manufacturers	0	0	0	0	0	0	0	0	0

Table 3.8

Regression results: Probit

Dep. variable: employed in manufacturing = 1	
Male	1.484
	(0.334)***
Age	0.136
	(0.046)***
Age squared	-0.002
	(0.001)***
Education	0.118
	(0.127)
Education squared	-0.011
	(0.006)*
Indigenous	-0.181
	(0.238)
Urban	1.141
	(0.427)***
Constant	-3.496
	(1.323)***
No. of obs	257

Standard errors in parentheses.

Regional dummies not shown.

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 3.9

Actual and predicted outcomes (%)

	Actual		Total
	Employed	Unemployed	
Predicted			
Employed	143	34	177
Unemployed	13	67	80
Total	156	101	257

Table 3.10

Regression results: Income equation

Dependent variable: log(income)

	Employed	Unemployed
Age	0.0936	0.0030
	(0.0345)***	(0.0410)
Age squared	-0.0010	0.0001
	(0.0004)**	(0.0004)
Education	0.0539	0.1514
	(0.0851)	(0.0655)**
Education squared	0.0014	-0.0022
	(0.0043)	(0.0030)
Indigenous	-0.0307	-0.3105
	(0.1168)	(0.2691)
Marital status (married = 1)	0.0029	-0.1801
	(0.1074)	(0.2980)
Constant	4.1704	4.4996
	(1.0932)***	(0.9718)***
No. obs	156	101

Standard errors in parentheses

* significant at 10%; ** significant at 5%; *** significant at 1%

Regional dummies not shown.

Table 3.11

Income effects, FTA Bolivia-US: Manufacturing

Income change (%)

	Total	Indigenous	Non-indigenous
Percent variation: δ (mean over hhs)	161.5	187.4	149.7
	(0.33)	(0.09)	(0.50)
Variation in money terms: δ*y (mean over hhs	1,016	592	1,210
	(335)	(169)	(402)

Standard errors in parentheses.

Table 3.12

Income effects, FTA Bolivia-US: Agriculture

Income change (%)

	Total	Indigenous	Non-indigenous
Percent variation: δ (mean over hhs)	19.1	18.4	25.7
	(0.06)	(0.05)	(0.14)
Variation in money terms: δ*y (mean over hhs	306	290	453
	(166)	(153)	(275)

Standard errors in parentheses.

Table 3.13

Consumption effects, FTA Bolivia-US

Expenditure change (%)

	Total	Indigenous	Non-indigenous
Percent variation: δ (mean over hhs)	-4.0	-4.2	-3.7
	(0.00)	(0.00)	(0.00)
Variation in money terms: δ*y (mean over hhs	-61	-52	-75
	(1.82)	(2.07)	(2.72)

Standard errors in parentheses.

Table 3.14

Total effects, FTA Bolivia-US: Poverty and Welfare

	Total	Indigenous	Non-indigenous
Poverty headcount (%)			
Before the trade shock	41.8	47.4	33.1
After the trade shock	41.7	47.1	33.0
Poverty gap index (%)			
Before the trade shock	19.4	23.1	13.6
After the trade shock	19.2	22.9	13.5
Welfare change (%)	4.9	5.3	4.4

Table 3.15

Income effects, Mercosur Integration: Manufacturing

Income change (%)

	Total	Indigenous	Non-indigenous
Percent variation: δ (mean over hhs)	-63.1	-70.4	-50.3
	(0.02)	(0.02)	(0.03)
Variation in money terms: δ*y (mean over hhs)	-1,266	-878	-1,982
	(308)	(96)	(643)

Standard errors in parentheses.

Table 3.16

Income effects, Mercosur Integration: Agriculture

Income change (%)

	Total	Indigenous	Non-indigenous
Percent variation: δ (mean over hhs)	-2.9	-2.6	-4.1
	(0.00)	(0.00)	(0.01)
Variation in money terms: δ*y (mean over hhs)	-62	-54	-97
	(16)	(17)	(44)

Standard errors in parentheses.

Table 3.17

Consumption effects, Mercosur Integration

Expenditure change (%)

	Total	Indigenous	Non-indigenous
Percent variation: δ (mean over hhs)	-7.4	-7.8	-6.8
	(0.00)	(0.00)	(0.00)
Variation in money terms: δ*y (mean over hhs)	-109	-94	-132
	(2.47)	(2.66)	(3.41)

Standard errors in parentheses.

Table 3.18

Total effects, Mercosur Integration: Poverty and Welfare

	Total	Indigenous	Non-indigenous
Poverty headcount (%)			
Before the trade shock	41.8	47.4	33.1
After the trade shock	43.1	49.2	33.4
Poverty gap index (%)			
Before the trade shock	19.4	23.1	13.6
After the trade shock	20.2	24.2	13.9
Welfare change (%)	4.9	4.9	5.0

Figures

Figure 1. 1

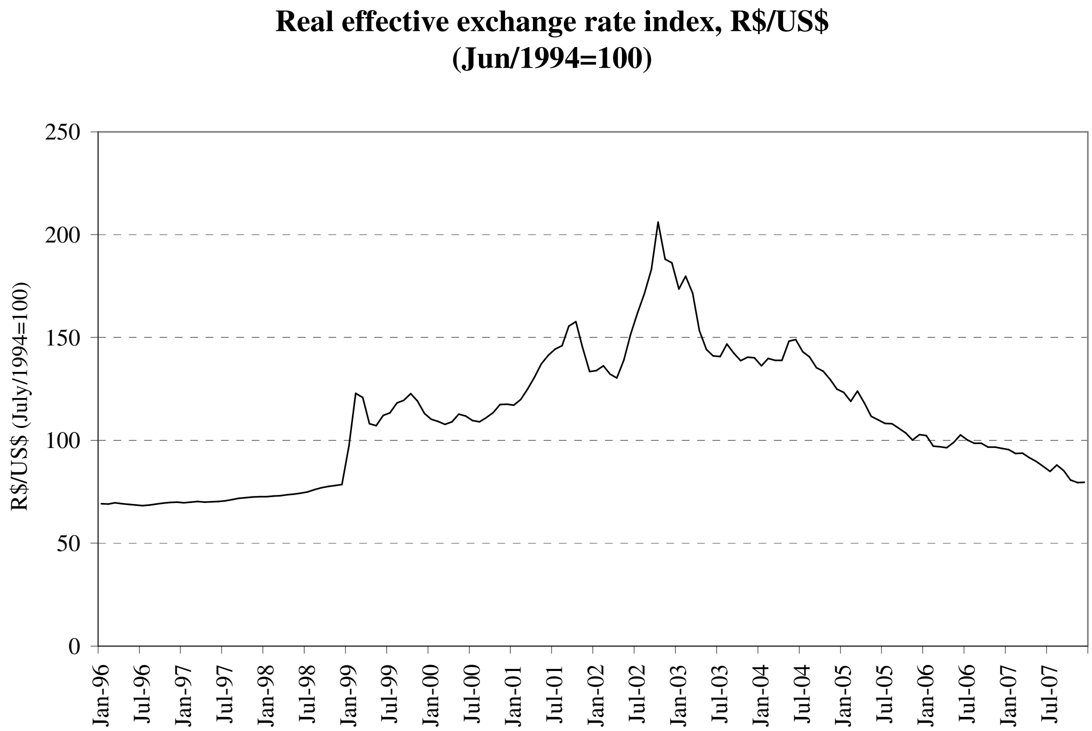


Figure 1. 2

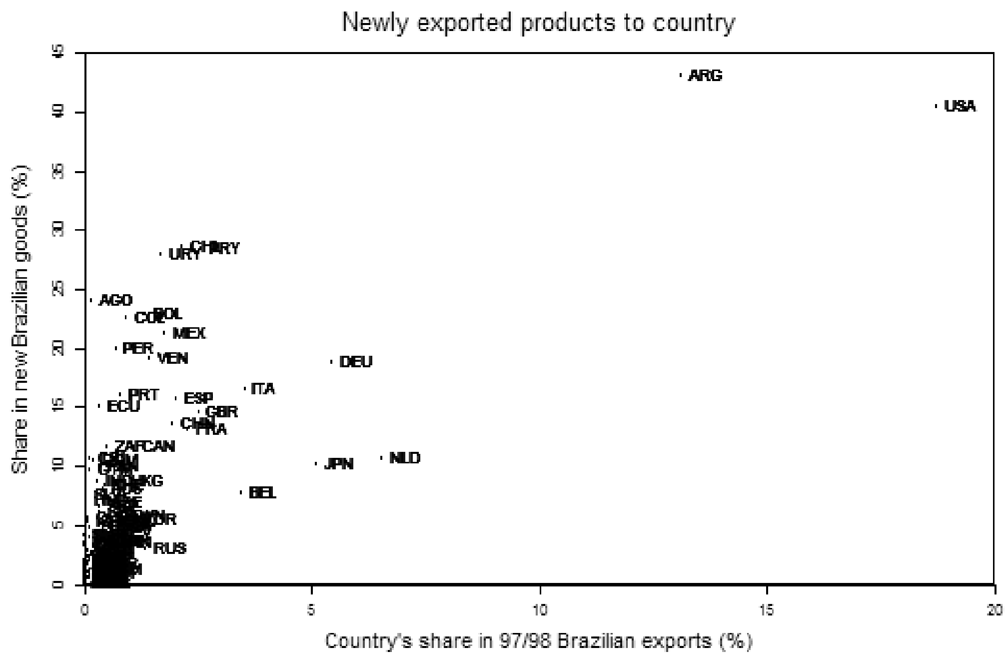


Figure 1. 3

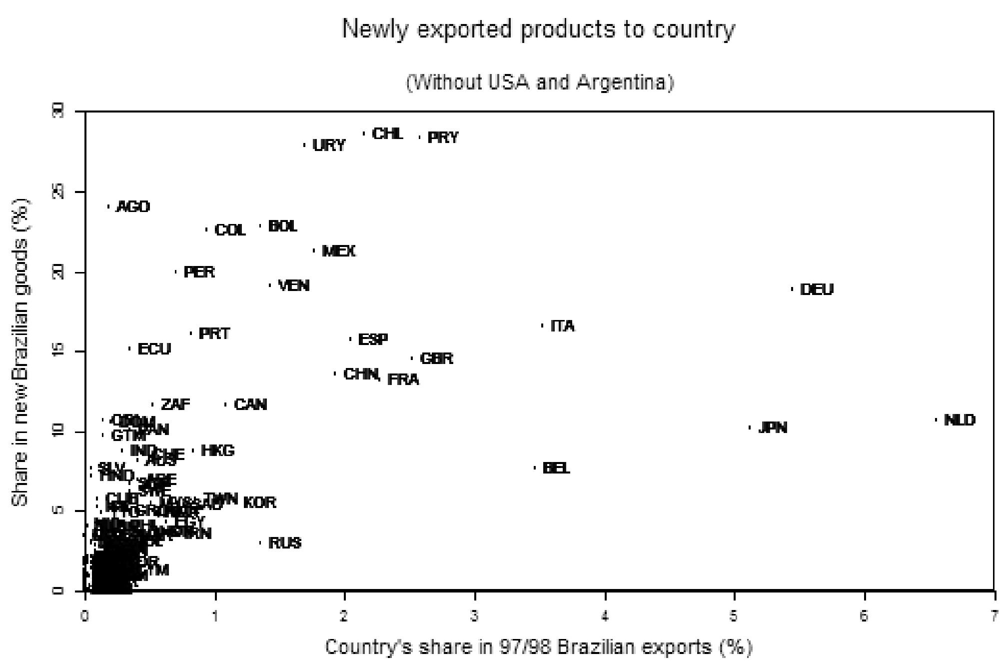


Figure 1. 4

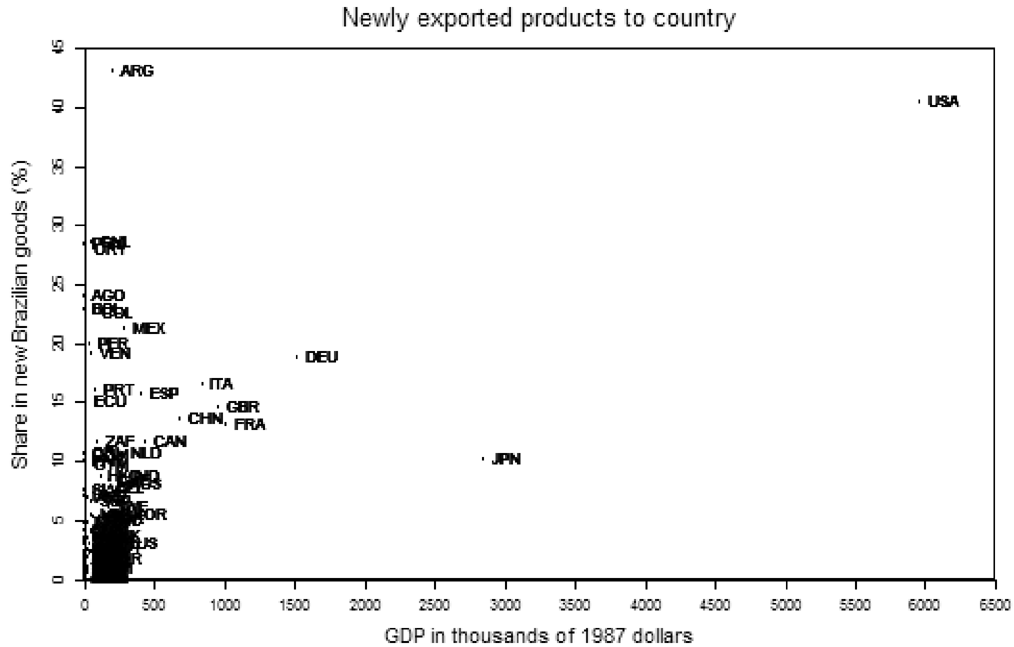


Figure 1. 5

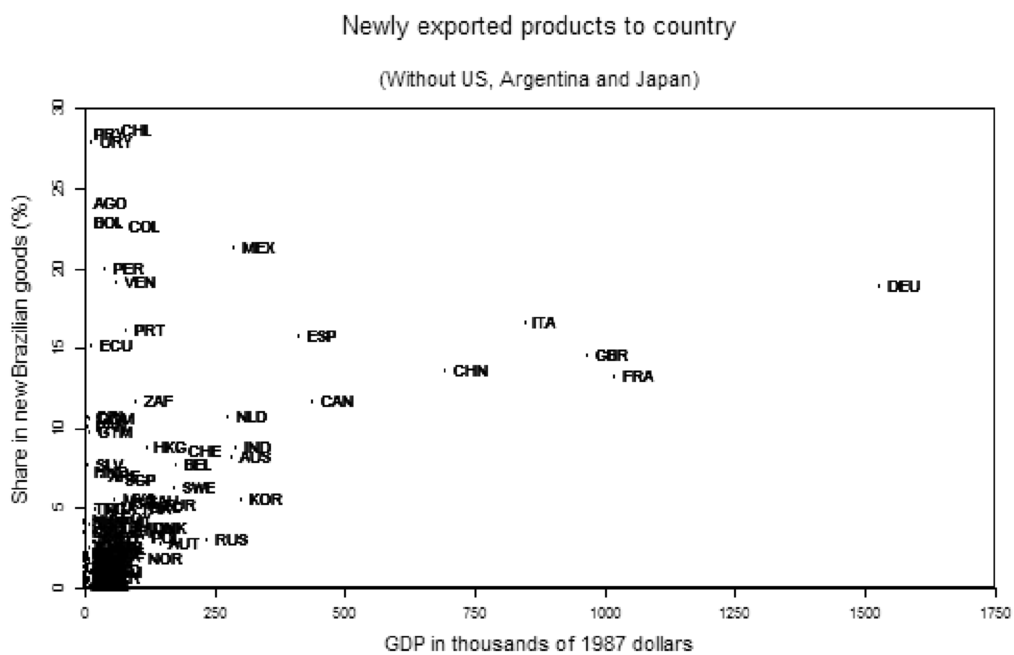


Figure 2. 1

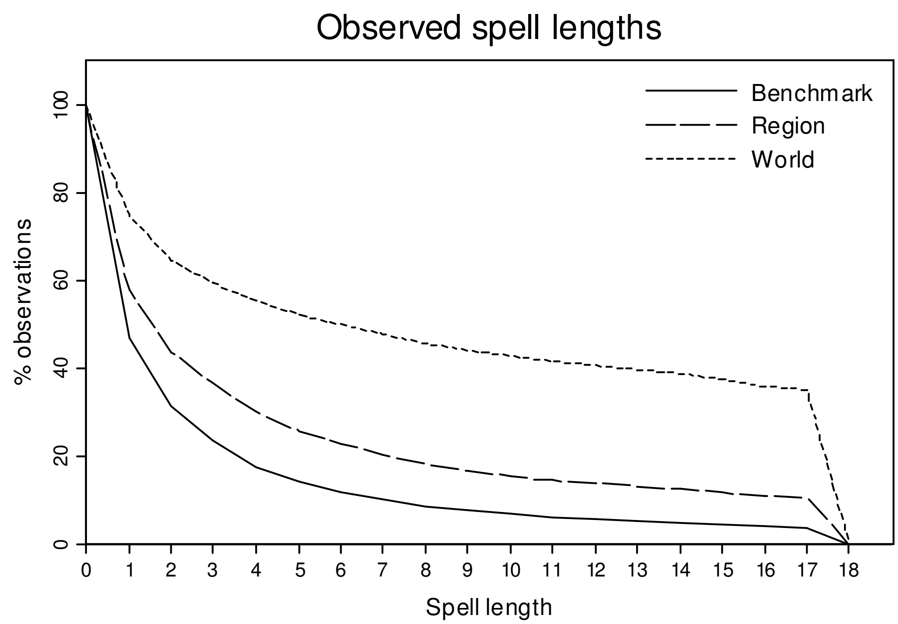


Figure 2. 2

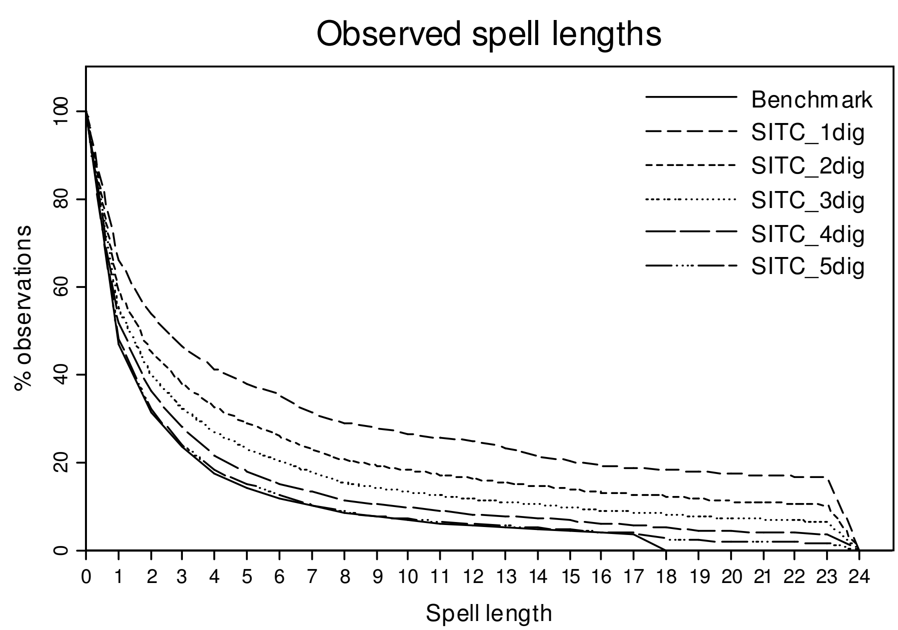


Figure 2. 3

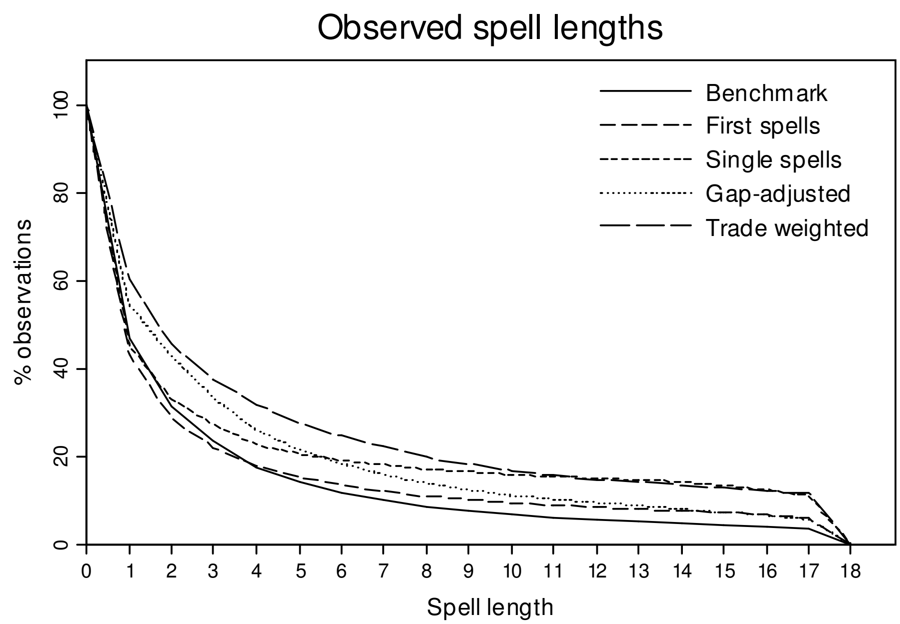


Figure 2. 4

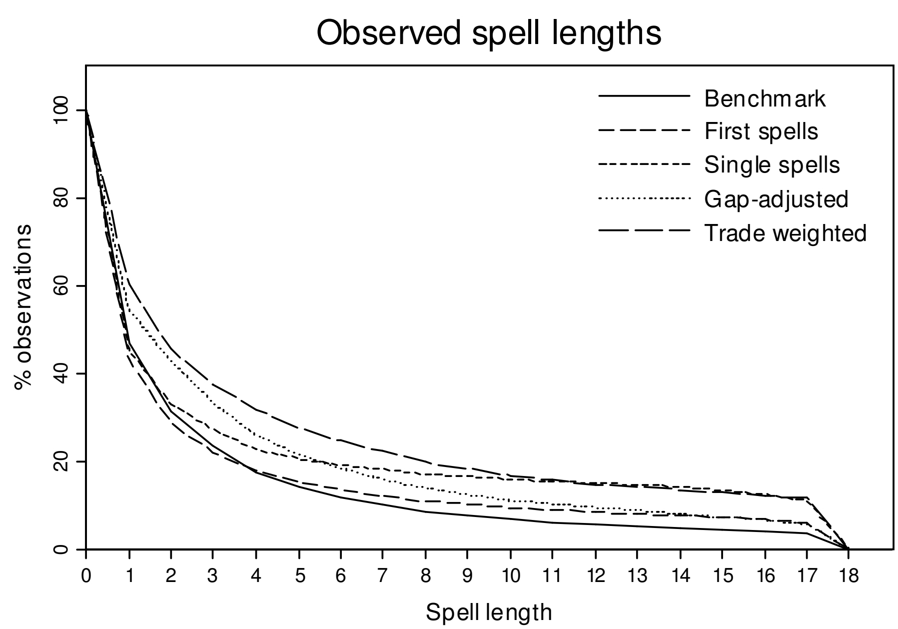


Figure 2. 5

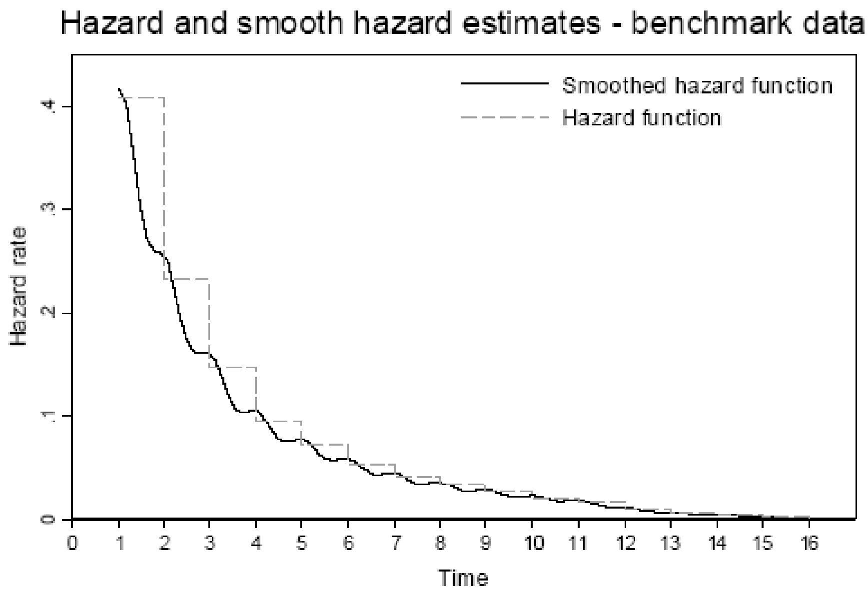


Figure 2. 6

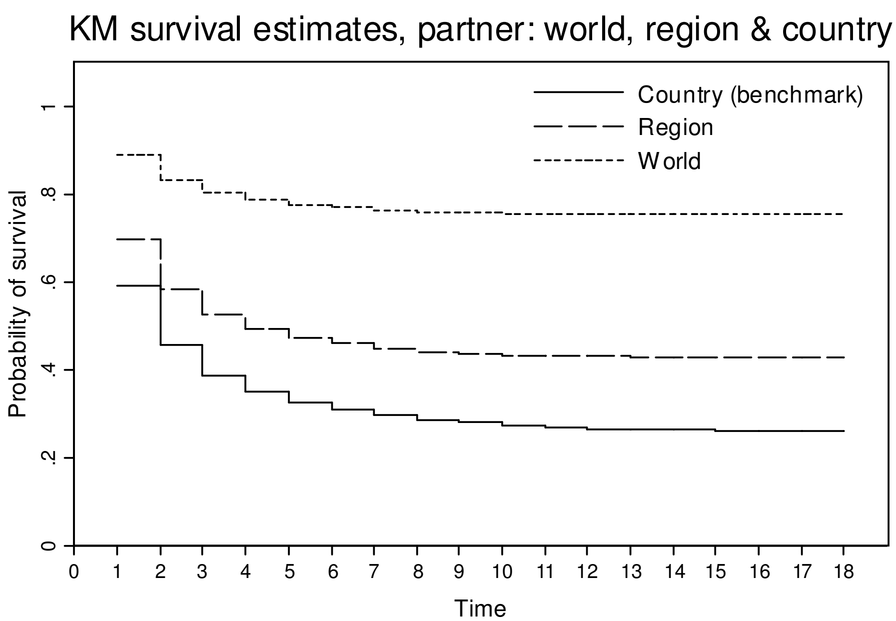


Figure 2. 7

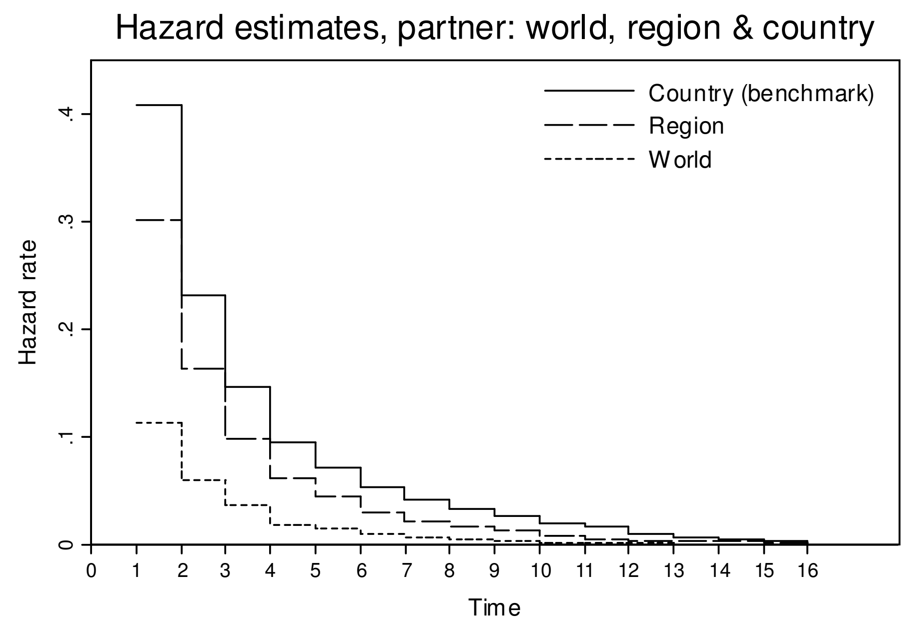


Figure 2. 8

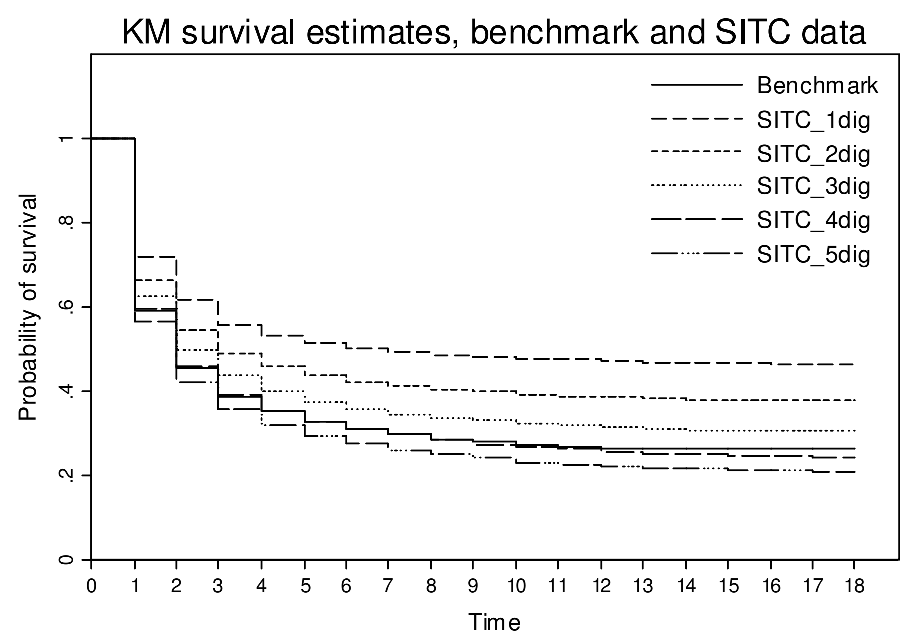


Figure 2. 9

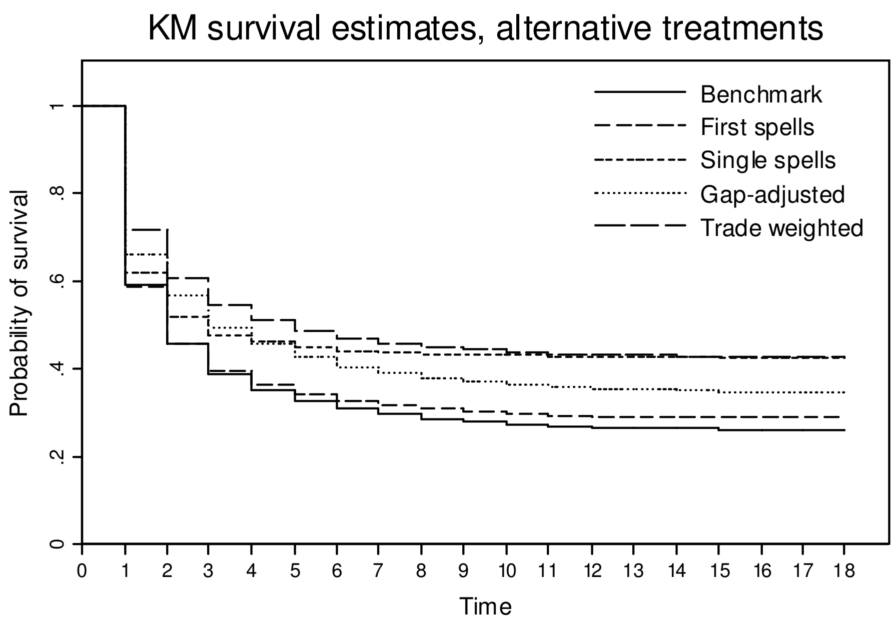


Figure 2. 10

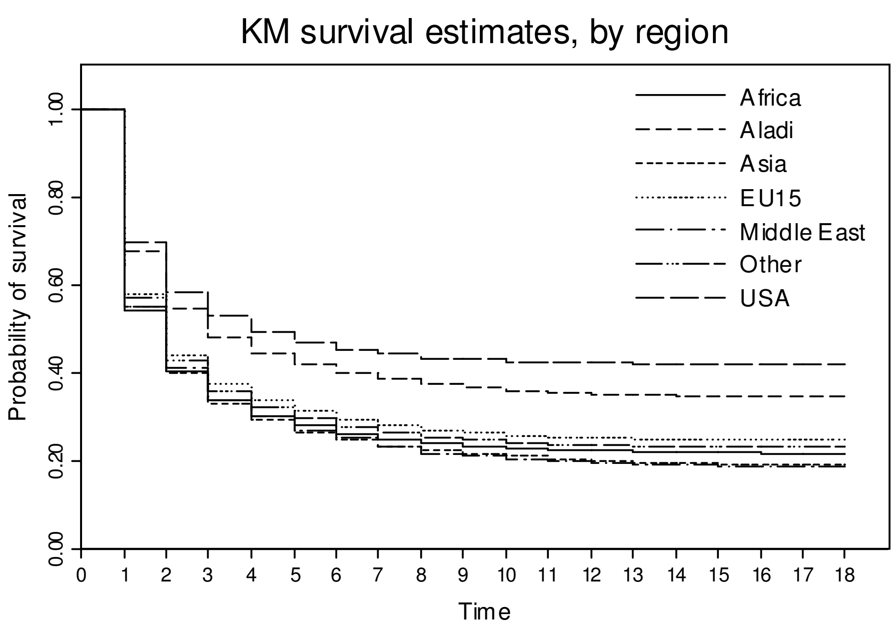


Figure 2. 11

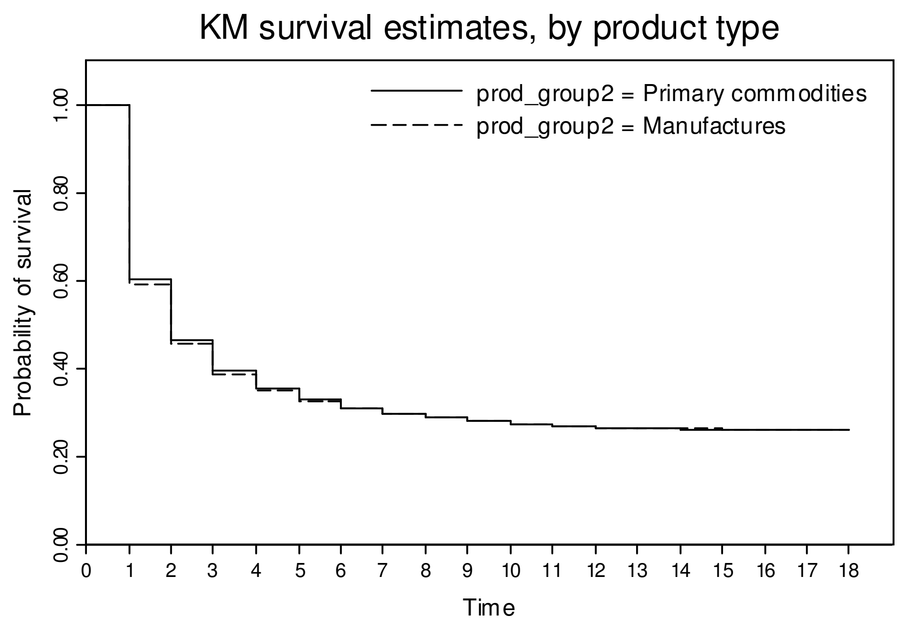


Figure 2. 12

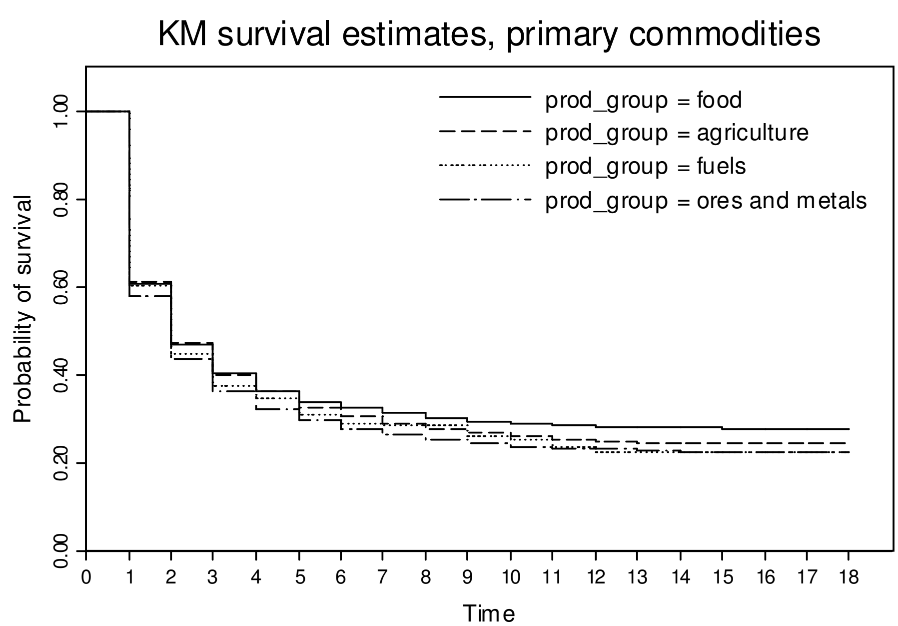


Figure 2. 13

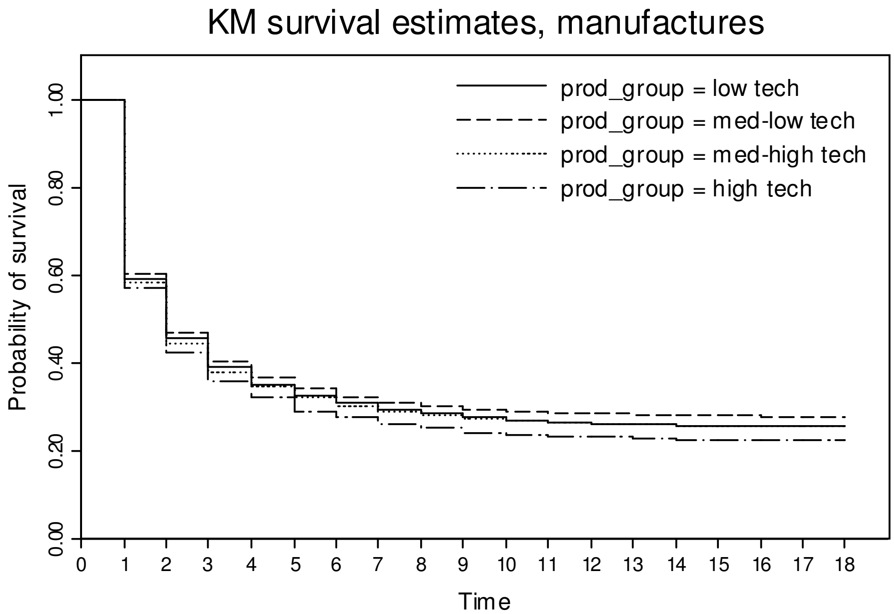

KM survival estimates, manufactures
prod_group = low tech
prod_group = med-low tech
prod_group = med-high tech
prod_group = high tech
Probability of survival
0.00
0.20
0.40
0.60
0.80
1.00
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18
Time

Figure 3. 1

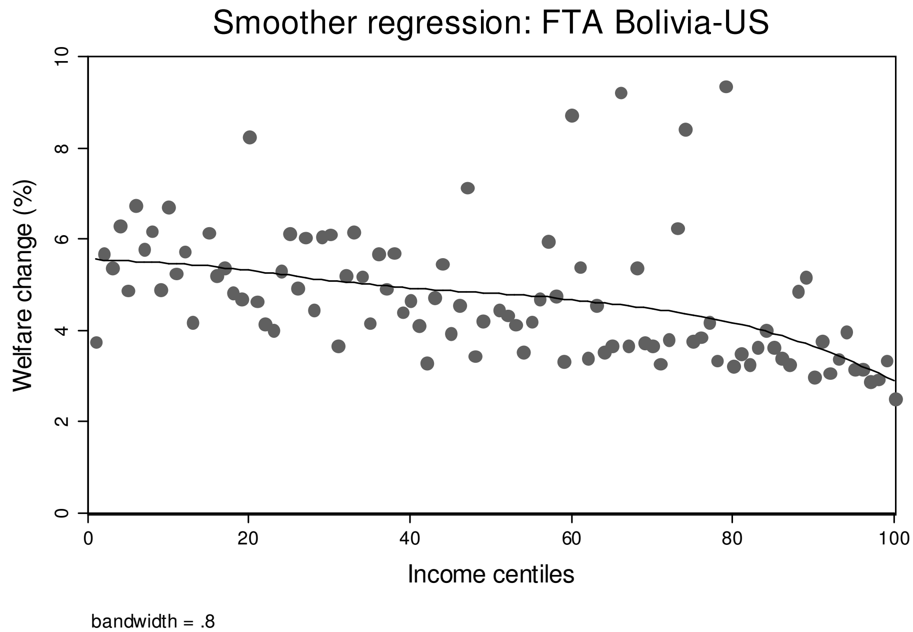
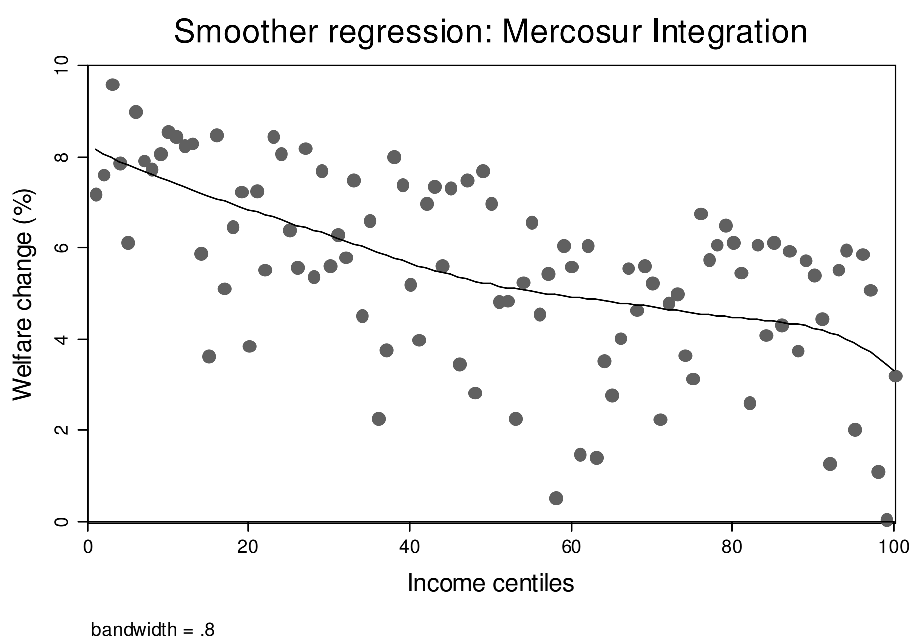


Figure 3. 2



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