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Abstract

We quantify the role of the extensive margin in the recent trade dynamics of selected countries that are running large and persistent trade imbalances. We find that the role of the extensive margin is quite substantial, although it varies in significance across the countries in the sample. Finally, we highlight differences in behaviour between the fixed-varieties and varieties-adjusted terms of trade.

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1. Introduction

Our goal in this paper is to investigate the role of the extensive margin in accounting for the trade dynamics of countries running large external imbalances. Recent developments in the theoretical and empirical literatures have highlighted that new varieties account for a substantial proportion of the growth in the volume of exports and imports over time. As is extensively analyzed by Corsetti, Martin and Pesenti (2008), this has direct implications for the analysis of external imbalances. In particular, these authors show that the scale of exchange rate adjustment that is required to close a given external imbalance is radically different between fixed-variety environments and those that allow trade adjustment to also take place along the extensive margin. In general, the intuition is that an expansion in the volume of exports of a given variety (that is, the intensive margin) places downward pressure on the level of export prices, whereas an expansion in the volume of exports that takes the form of exporting new varieties (that is, the extensive margin) may be accomplished with a smaller impact on the level of international prices.

The role of the extensive margin in understanding the long-term evolution of trade volumes and the terms of trade has been extensively analysed. For instance, Houthakker and Magee (1969) highlighted the puzzle that the rapid growth of Japan in the 1950s and 1960s was not accompanied by a secular decline in its terms of trade. The most elegant explanation belongs to Krugman (1989) who argued that if growth takes the form of an expansion in varieties, then expansion in exports need not be associated wtih a decline in the terms of trade: the increase in supply of new goods will be matched by an increase in demand from variety-loving consumers. In influential work, Feenstra (1994) and Broda and Weinstein (2006) have emphasized the importance of correctly measuring varieties-corrected price indices for imports: for fixed prices of existing goods, an expansion in varieties reduces the true price of achieving a given level of utility. As highlighted by Broda and Weinstein (2006), the varieties correction can generate a substantial cumulative reduction in the imports price index – over 1972 to 2001, these authors estimate that the true import price index grew by 28 percent less than the measured import price index.

However, it is plausible that the extensive margin matters less at higher frequencies, especially if there are substantial costs involved in the introduction of new varieties. Accordingly, it may be less problematic to ignore the extensive margin for business cycle analysis as compared to long-term growth analysis. In relation to current account adjustment, the relevant horizon is somewhere in between. Current account expansions

and contractions tend to be multi-year processes, such that an exclusive focus on the short-run is not appropriate, while at the same time adjustment is not so gradual that a long-term horizon is suitable. Accordingly, it is desirable to assess the importance of the extensive margin over the medium-term, which we take to be four years for our empirical work.

In order to investigate this question, we focus on a set of countries that each have exhibited large external imbalances in recent years. The set includes the United States - the predominant net capital importer in the world economy - and four surplus countries (Germany, Switzerland, Japan and China). We jointly examine the evolution of trade volumes and trade prices over 2000-2004 (the most recent year for which we have comprehensive trade data), with a primary focus on identifying the role of the extensive margin.

The paper is structured as follows. In section 2, we develop the empirical strategy. The results are presented in section 3. Section 4 concludes.

2. Empirical strategy

Our goal is to employ an internally-consistent framework that jointly generates a decomposition of trade between intensive and extensive margins and a set of price indices for exports and imports. As is elaborated in Galstyan and Lane (2008), the method follows Feenstra (1994) and Broda and Weinstein (2006) for the construction of import price data and Feenstra (2004) for the construction of export price data. The methodological approach produces estimates of the contributions of the intensive and extensive margins to trade volume growth.[1] Importantly, it also produces consistent export and import price indices that are corrected for changes in the number of varieties over time. In turn, this allows us to construct new estimates of the terms of trade.

2.1. Import prices

We assume that preferences over the aggregate import good are given a by two-level utility function. We define a 4 digit HS category as a good, while the higher level digits and import sources are interpreted as varieties. At the upper level of aggregation, we

[1] The focus here is on changes across time. In contrast, Hummels and Klenow (2005) focus on the roles of the intensive and extensive margins in explaining differences across countries in trade patterns at a given point in time.

define the aggregate imports of any country country at period t as

$$M_t = \left(\sum_{g \in M} M_{g,t}^{\frac{\gamma-1}{\gamma}} \right)^{\frac{\gamma}{\gamma-1}} \tag{1}$$

where M_t is the volume of total imports, $M_{g,t}$ is the volume of imports of good g, $\gamma > 1$ is the elasticity of substitution between the goods, M is the set of all imported goods.[2]

At the lower level of aggregation, denoting the volume of imports of variety j of good g at period t by $q_{gj,t}$, we define the preferences of the importing country by

$$M_{g,t} = \left(\sum_{j \in IM_{g,t}} d_{gj,t}^{m\,\frac{1}{\theta_g}} q_{gj,t}^{m\,\frac{\theta_g-1}{\theta_g}} \right)^{\frac{\theta_g}{\theta_g-1}} \tag{2}$$

where $M_{g,t}^i$ is the aggregate import good g, $d_{gj,t}^{mi}$ is the taste or quality parameter for variety j of good g, $IM_{g,t}$ is the set of varieties of good g that country i imports at time t, and $\theta_g > 1$ is the elasticity of substitution between varieties.

Let $IM_g \subset (IM_{g,t} \cap IM_{g,s})$ be the set of varieties that are imported in two periods s and t, where $IM_{g,t} \cap IM_{g,s} \neq \emptyset$ and $s < t$. Define the share of variety j in this set as $\mu_{gj,t}^m = q_{gj,t}^m p_{gj,t}^m / \sum_{j \in IM_g} \left(q_{gj,t}^m p_{gj,t}^m \right)$, and $\lambda_{g,t}^m = \sum_{j \in IM_g} \left(q_{gj,t}^m p_{gj,t}^m \right) / \sum_{j \in IM_{g,t}} \left(q_{gj,t}^m p_{gj,t}^m \right)$. Following Feenstra (1994) and Sato (1976), the log change weights are defined as[3]

$$w_{gj,t}^m = \left(\frac{\mu_{gj,t}^m - \mu_{gj,s}^m}{\ln \mu_{gj,t}^m - \ln \mu_{gj,s}^m} \right) / \sum_{j \in IM_g} \left(\frac{\mu_{gj,t}^m - \mu_{gj,s}^m}{\ln \mu_{gj,t}^m - \ln \mu_{gj,s}^m} \right) \tag{3}$$

Assuming that preferences are constant ($d_{gj,t}^m = d_{gj,s}^m$ for $j \in IM_g$), the import price index for good g is constructed as

$$\frac{P_{g,t}^m}{P_{g,s}^m} = \left(\frac{\lambda_{g,t}^m}{\lambda_{g,s}^m} \right)^{\frac{1}{\theta_g - 1}} \prod_{j \in IM_g} \left(\frac{p_{gj,t}^m}{p_{gj,s}^m} \right)^{w_{gj,t}^m} \tag{4}$$

where $p_{gj,t}^m$ is the nominal price of imported variety j of good g, and $P_{g,t}^m$ is the welfare-based price index for CES preferences. As explained by Feenstra (1994), the effect of new and disappearing varieties on the true import price index depends on two param-

[2] We assume that the number of goods is fixed, whereas the number of varieties within each product category may change across different time periods.

[3] Note that as $\mu_{gj,t}^m \to \mu_{gj,s}^m$, the limit of $(\mu_{gj,t}^m - \mu_{gj,s}^m)/(\ln \mu_{gj,t}^m - \ln \mu_{gj,s}^m)$ is just the expenditure share $\mu_{gj,s}$.

eters: (i) the elasticity of substitution between the varieties; and (ii) the weight of new goods in total expenditures. The effect of new varieties is limited if the elasticity of substitution between varieties is high (new varieties add little to utility in that case) but is non-negligible when the elasticity of substitution is small. A larger elasticity of substitution reduces the first term in the equation above, and causes the true price index to be very close to the "conventional" price index. Equation (4) shows that the larger the share of existing varieties in aggregate expenditure ($\lambda^m_{g,t}$), the smaller the bias.

It is useful to also define the fixed-varieties import price index for good g as

$$\frac{P^{Fm}_{g,t}}{P^{Fm}_{g,s}} = \prod_{j \in IM_g} \left(\frac{p^m_{gj,t}}{p^m_{gj,s}} \right)^{w^m_{gj,t}} \tag{5}$$

where equation (5) excludes the correction for a shift in the number of varieties.

The import volume index is in turn given by:

$$\frac{M_{g,t}}{M_{g,s}} = \left(\frac{\lambda^m_{g,t}}{\lambda^m_{g,s}} \right)^{-\frac{\theta_g}{\theta_g - 1}} \prod_{j \in IM_g} \left(\frac{q^m_{gj,t}}{q^m_{gj,s}} \right)^{w^m_{gj,t}} \tag{6}$$

Since these indices are ideal, at the level of goods, the nominal growth rate of imports is:

$$\frac{\sum_{j \in IM_{g,t}} q^m_{gj,t} p^m_{gj,t}}{\sum_{j \in IM_{g,s}} q^m_{gj,s} p^m_{gj,s}} = \left(\frac{\lambda^m_{g,t}}{\lambda^m_{g,s}} \right)^{-1} \prod_{j \in IM_g} \left(\frac{p^m_{gj,t} q^m_{gj,t}}{p^m_{gj,s} q^m_{gj,s}} \right)^{w^m_{gj,t}} \tag{7}$$

The first part on the RHS represents the growth rate of extensive margin, while the product expression the intensive the nominal growth rate of the intensive margin. Note that a one percent growth of extensive margin translates into one percent growth of nominal imports. The distribution of the growth is not evenly distributed across the price and quantity components, since a one percent growth rate along the extensive margin increases the volume of imports by $\theta_g/(\theta_g - 1) > 1$ but decreases the price index by $1/(\theta_g - 1) < 1$.

Once the goods price index is corrected for the impact of new and disappearing varieties, the aggregate import price index is constructed as

$$\frac{P_{M,t}}{P_{M,s}} = \prod_{g \in M} \left(\frac{P^m_{g,t}}{P^m_{g,s}} \right)^{w^m_{g,t}} \tag{8}$$

where

$$w_{g,t}^m = \left(\frac{\mu_{g,t}^m - \mu_{g,s}^m}{\ln \mu_{g,t}^m - \ln \mu_{g,s}^m} \right) / \sum_{g \in M} \left(\frac{\mu_{g,t}^m - \mu_{g,s}^m}{\ln \mu_{g,t}^m - \ln \mu_{g,s}^m} \right) \tag{9}$$

and $\mu_{g,t}^m = M_{g,t} P_{g,t}^m / \sum_{g \in M} \left(M_{g,t} P_{g,t}^m \right)$.

Accordingly, the aggregate import price index is just a geometric average of the price indices of imported goods, each of which have been corrected for variety effects. Again, it is also useful to define the fixed-varieties aggregate import price index

$$\frac{P_{M,t}^F}{P_{M,s}^F} = \prod_{g \in M} \left(\frac{P_{g,t}^{Fm}}{P_{g,s}^{Fm}} \right)^{w_{g,t}^m} \tag{10}$$

which excludes the impact of the change in the number of varieties.

In turn, the aggregate import volume index is also a geometric average of quantity indices of goods corrected for variety effects and is given by

$$\frac{M_t}{M_s} = \prod_{g \in M} \left(\frac{M_{g,t}}{M_{g,s}} \right)^{w_{g,t}^m} \tag{11}$$

Accordingly, the nominal growth rate of aggregate imports can be written as a product of extensive and intensive margins

$$\frac{\sum q_{gj,t}^m p_{gj,t}^m}{\sum q_{gj,s}^m p_{gj,s}^m} = \underbrace{\prod_{g \in M} \left(\frac{\lambda_{g,t}^m}{\lambda_{g,s}^m} \right)^{-w_{g,t}^m}}_{\textit{Extensive margin}} \underbrace{\prod_{g \in M} \left(\prod_{j \in IM_g} \left(\frac{p_{gj,t}^m q_{gj,t}^m}{p_{gj,s}^m q_{gj,s}^m} \right)^{w_{gj,t}^m} \right)^{w_{g,t}^m}}_{\textit{Intensive margin}}$$

where the intensive margin is itself given by the product of price and quantity components:

$$\underbrace{\prod_{g \in M} \left(\prod_{j \in IM_g} \left(\frac{p_{gj,t}^m}{p_{gj,s}^m} \right)^{w_{gj,t}^m} \right)^{w_{g,t}^m}}_{\textit{Price component}} \underbrace{\prod_{g \in M} \left(\prod_{j \in IM_g} \left(\frac{q_{gj,t}^m}{q_{gj,s}^m} \right)^{w_{gj,t}^m} \right)^{w_{g,t}^m}}_{\textit{Quantity component}} \tag{12}$$

2.2. Export prices

We assume that the production technology for aggregate exports is given by a two-level aggregator. We define a 4 digit HS category as a good, while varieties are comprised of the higher level digits and export destinations. At the upper level of aggregation, we

define aggregate exports in period t as

$$X_t = \left(\sum_{g \in X} X_{g,t}^{\frac{\sigma+1}{\sigma}} \right)^{\frac{\sigma}{\sigma+1}} \tag{13}$$

where X_t is the volume of total exports, $X_{g,t}$ is the volume of exports of good g, $\sigma > 0$ is the elasticity of transformation between the goods and X is the set of all exported goods.[4]

At the lower level of aggregation, denoting the volume of exports of variety j of good g at period t by $q^x_{gj,t}$, we define the production function for export good g by

$$X_{g,t} = \left(\sum_{j \in EX_{g,t}} d^{x\,\frac{1}{\psi_g}}_{gj,t} \, q^{x\,\frac{\psi_g+1}{\psi_g}}_{gj,t} \right)^{\frac{\psi_g}{\psi_g+1}} \tag{14}$$

where $X_{g,t}$ is the aggregate export good g, $d^x_{gj,t}$ is the share parameter for variety j of good g, $EX_{g,t}$ is the set of varieties of good g that a country exports at time t, and $\psi_g > 0$ is the elasticity of transformation between varieties.

Let $EX_g \subset (EX_{g,t} \cap EX_{g,s})$ be the set of varieties that are exported in both periods s and t, where $EX_{g,t} \cap EX_{g,s} \neq \emptyset$ and $s < t$. Define the share of variety j in this set as $\mu^x_{gj,t} = q^x_{gj,t} p^x_{gj,t} / \sum_{j \in EX_g} \left(q^x_{gj,t} p^x_{gj,t} \right)$, and $\lambda^x_{g,t} = \sum_{j \in EX_g} \left(q^x_{gj,t} p^x_{gj,t} \right) / \sum_{j \in EX_{g,t}} \left(q^x_{gj,t} p^x_{gj,t} \right)$. Again following Sato (1976), the log change weights are defined as

$$w^x_{gj,t} = \left(\frac{\mu^x_{gj,t} - \mu^x_{gj,s}}{\ln \mu^x_{gj,t} - \ln \mu^x_{gj,s}} \right) \Big/ \sum_{j \in EX_g} \left(\frac{\mu^x_{gj,t} - \mu^x_{gj,s}}{\ln \mu^x_{gj,t} - \ln \mu^x_{gj,s}} \right) \tag{15}$$

Assume that for any variety $j \in EX_g$, preferences are stable across the two periods ($d^x_{gj,t} = d^x_{gj,s}$). Then our export price index for good g is constructed as

$$\frac{P^x_{g,t}}{P^x_{g,s}} = \left(\frac{\lambda^x_{g,t}}{\lambda^x_{g,s}} \right)^{-\frac{1}{\psi_g+1}} \prod_{j \in EX_g} \left(\frac{p^x_{gj,t}}{p^x_{gj,s}} \right)^{w^x_{gj,t}} \tag{16}$$

where $p^x_{gj,t}$ is the nominal price of exported variety j of good g, and $P^x_{g,t}$ is the price index for the CES aggregator. Accordingly, the creation of new varieties increases the true price index of exports. In symmetric fashion to the treatment of imports, the impact of new and disappearing varieties on the price index depends on two parameters: (i) the export

[4] As with imports, we assume a fixed number of goods but allow for shifts in the number of varieties within each product category.

supply elasticity; and (ii) the share of new goods. A smaller export supply elasticity increases the value of new varieties, while the importance of new varieties is inversely related to the share of existing varieties in the value of total production.

As is the case for imports, we can define the fixed-varieties export price index for good g by

$$\frac{P^{Fx}_{g,t}}{P^{Fx}_{g,s}} = \prod_{j \in EX_g} \left(\frac{p^x_{gj,t}}{p^x_{gj,s}} \right)^{w^x_{gj,t}} \tag{17}$$

where equation (17) excludes the correction for varieties.

The export volume index is given by

$$\frac{X_{g,t}}{X_{g,s}} = \left(\frac{\lambda^x_{g,t}}{\lambda^x_{g,s}} \right)^{-\frac{\psi_g}{\psi_g+1}} \prod_{j \in EX_g} \left(\frac{q^x_{gj,t}}{q^x_{gj,s}} \right)^{w^x_{gj,t}} \tag{18}$$

Since these indices are ideal at the level of goods, the nominal growth rate of exports is:

$$\frac{\sum_{j \in EX_{g,t}} q^x_{gj,t} p^x_{gj,t}}{\sum_{j \in EX_{g,s}} q^x_{gj,s} p^x_{gj,s}} = \left(\frac{\lambda^x_{g,t}}{\lambda^x_{g,s}} \right)^{-1} \prod_{j \in IM_g} \left(\frac{p^x_{gj,t} q^x_{gj,t}}{p^x_{gj,s} q^x_{gj,s}} \right)^{w^x_{gj,t}} \tag{19}$$

The first term on the right of equation (19) represents the growth rate of the extensive margin, while the second product term represents the nominal growth rate of the intensive margin. Note that a one percent growth rate for the extensive margin translates into one percent growth rate of nominal exports, after controlling for the effects on the intensive margin. Again, we note that the distribution of the growth is not uniform across the price and quantity components, since a one percent growth rate of the extensive margin increases the volume of exports by $\psi_g/(\psi_g + 1) < 1$, while it increases the price index by $1/(\psi_g + 1) < 1$.

Once the goods price index is corrected for new and disappearing varieties, the aggregate export price index is constructed as

$$\frac{P_{X,t}}{P_{X,s}} = \prod_{g \in X} \left(\frac{P^x_{g,t}}{P^x_{g,s}} \right)^{w^x_{g,t}} \tag{20}$$

where

$$w^x_{g,t} = \left(\frac{\mu^x_{g,t} - \mu^x_{g,s}}{\ln \mu^x_{g,t} - \ln \mu^x_{g,s}} \right) \Big/ \sum_{g \in X} \left(\frac{\mu^x_{g,t} - \mu^x_{g,s}}{\ln \mu^x_{g,t} - \ln \mu^x_{g,s}} \right) \tag{21}$$

and $\mu^x_{g,t} = X_{g,t} P^x_{g,t} / \sum_{g \in X} \left(X_{g,t} P^x_{g,t} \right)$.

The fixed-varieties aggregate export price index is given by

$$\frac{P^F_{X,t}}{P^F_{X,s}} = \prod_{g \in X} \left(\frac{P^{Fx}_{g,t}}{P^{Fx}_{g,s}} \right)^{w^x_{g,t}} \tag{22}$$

The aggregate export volume index is constructed as

$$\frac{X_t}{X_s} = \prod_{g \in X} \left(\frac{X_{g,t}}{X_{g,s}} \right)^{w^x_{g,t}} \tag{23}$$

As in the case of imports, both aggregate export price and quantity indices are just a geometric average of price and quantity indices for each export good category, each of which have been corrected for variety effects

Similar to the growth rate of imports, we can write the nominal growth rate of aggregate exports as a product of extensive and intensive margins

$$\frac{\sum q^x_{gj,t} p^x_{gj,t}}{\sum q^x_{gj,s} p^x_{gj,s}} = \underbrace{\prod_{g \in X} \left(\frac{\lambda^x_{g,t}}{\lambda^x_{g,s}} \right)^{-w^x_{g,t}}}_{\textit{Extensive margin}} \underbrace{\prod_{g \in X} \left(\prod_{j \in EX_g} \left(\frac{p^x_{gj,t} q^x_{gj,t}}{p^x_{gj,s} q^x_{gj,s}} \right)^{w^x_{gj,t}} \right)^{w^x_{g,t}}}_{\textit{Intensive margin}} \tag{24}$$

The intensive margin itself is given by the product of price and quantity components:

$$\underbrace{\prod_{g \in X} \left(\prod_{j \in EX_g} \left(\frac{p^x_{gj,t}}{p^x_{gj,s}} \right)^{w^x_{gj,t}} \right)^{w^x_{g,t}}}_{\textit{Price component}} \underbrace{\prod_{g \in X} \left(\prod_{j \in EX_g} \left(\frac{q^x_{gj,t}}{q^x_{gj,s}} \right)^{w^x_{gj,t}} \right)^{w^x_{g,t}}}_{\textit{Quantity component}} \tag{25}$$

2.3. Terms of Trade

We define two measures of the terms of trade: (i) a fixed-varieties measure, where the export and import price indices are calculated over the set of varieties that are traded in both periods; and (ii) a varieties-corrected index, where both export and import price indices are corrected for varieties.

The evolution of the fixed-varieties terms of trade is given by

$$\frac{TT^F_t}{TT^F_s} = \frac{\left(P^F_{X,t} / P^F_{X,s} \right)}{\left(P^F_{M,t} / P^F_{M,s} \right)} \tag{26}$$

where the export price and import price indices are from equations (22) and (10), while

the growth in the varieties-corrected terms of trade is given by

$$\frac{TT_t^V}{TT_s^V} = \frac{(P_{X,t}/P_{X,s})}{(P_{M,t}/P_{M,s})} \tag{27}$$

where the trade price indices follow equations (20) and (8).

The differential behaviour of these indices provides insights into the contribution of the extensive margin to terms of trade dynamics. In particular, all else equal, faster growth in the extensive margin of exports and imports will improve the varieties-corrected terms of trade.[5]

3. Empirical Analysis

3.1. Data

The United Nations COMTRADE database provides bilateral export and import data for a wide range of countries at the 6 digit level under the Harmonized Classification system. However, there are often discrepancies between the trade values reported by source and destination countries. Also, some of the volume data are missing and units are not consistent across countries and categories. Accordingly, we rely on the BACI version of the COMTRADE data, which is produced by CEPII (Gaulier et al. 2008). The BACI database fixes these issues, providing a finely-tuned version of the COMTRADE data. The data are available for HS92 (from 1995 to 2004) and HS96 (from 2000 to 2004) classifications. On the import side, we use the estimated elasticities of substitution from Broda and Weinstein (2006).[6] For exports, we use the estimated elasticities from Broda and Weinstein (2008).[7]

In this paper, we use BACI HS92 data on international trade flows for 2000-2004. We define a 4 digit HS category as a good and 6 digit category with corresponding sources / destinations as varieties. For instance, each of 'Fresh cheese, unfermented whey cheese, curd', 'Cheese, grated or powdered, of all kinds', 'Cheese processed, not grated or powdered', 'Cheese, blue-veined' and 'Cheese except fresh, grated, processed or blue-veined' are 6 digit categories, but these are aggregated at 4 digit to represent a good category 'Cheese and Curd'. The BW elasticity of substitution for this category is estimated to be

[5]However, it is important to be aware that an expansion along the extensive margin may also exert an indirect influence on the terms of trade by altering the prices of existing varieties. We explore this channel in Galstyan and Lane (2008).

[6]Broda and Weinstein report elasticities at the 3 digit SITC level. These have been converted to HS 4 digit using the concordance table provided by COMTRADE.

[7]We use the estimates from the US data for this paper.

11.37, while the BW export supply elasticity is 1.93. To take another example, the 4-digit good category 'Automatic data processing machines (computers)' includes the 6-digit sub-categories 'Analogue or hybrid computers', 'Digital computers with cpu and input-output units', 'Digital computer cpu with some of storage/input/output', 'Computer input or output units', 'Computer data storage units', and 'Automatic data processing machines and units, nes'. For this good, the BW elasticity of substitution for imports is estimated to be 2.18, while the BW export supply elasticity is 3.4.

3.2. Results

Table 1 shows the basic external balance data for our selected group of countries over 2000-2006, which shows the United States as a persistent deficit country, while the other countries run substantial surpluses. In fact, the United States was already running a large deficit in 2000, such that the 2000-2004 period provides only a partial window on its trade dynamics during its great imbalance phase. Among the other countries, we note the striking growth in export-output ratios for Germany and China, with the latter also experiencing vary rapid import growth.

We begin the analysis of the trade data in Table 2 by showing the decomposition of the growth in trade volumes over 2000-2004. In relation to exports, the extensive margin was important for the United States, Switzerland and Japan but not for Germany and Japan during this period. Moreover, the United States is unique in this group in that the extensive margin grew more quickly than the intensive margin, whereas Switzerland and especially China exhibited strong growth along the intensive margin as well as the extensive margin. The behavior of Germany is also striking, in that it combined rapid export growth along the intensive margin, with little change along the extensive margin.

Turning to imports, Table 2 shows that the extensive margin was important for the United States and China during this period, but much less for Germany, Switzerland and Japan. (There is typically less scope for expansion along the extensive margin in relation to imports, since an economy typically imports a much wider variety of goods than it exports.)

The role of the extensive margin is further illuminated in Table 3. This table shows the expansion in the average number of varieties in each 4-digit sector over 2000-2004. On the export side, the United States, Germany and Switzerland each show a 10-12 percent expansion in the number of varieties, while Japan is noticeably lower at 5 percent and China is "off the charts" with a doubling in the number of varieties. In relation to imports, the advanced economies show growth in the (9, 15) percent range, while the number of import varieties grew by 132 percent in the Chinese case.

Under Armington-type assumptions, an important element in the growth of varieties is the expansion in the number of destination markets for exports and the number of source countries for imports. Accordingly, Table 3 also shows the expansion in the average number of destination countries for exports and source countries for imports in each 6-digit sector over 2000-2004. China shows the most extreme expansion in the number of trading partners - a 102 percent increase in the average number of export destinations and 136 percent increase in the average number of source countries for imports. The United States is next, with a 15 percent increase in export destinations and 18 percent increase in the number of sources for each variety category. Each of the other countries also show substantial growth in the numbers of export destination and import sources.

An expansion in the number of varieties of imports is more valuable, the lower is the elasticity of substitution across varieties; similarly, an expansion in the number of export varieties has a greater impact, the lower is the elasticity of transformation across varieties (that is, the lower is the export supply elasticity). Table 5 reports average export supply and import demand elasticities for each of the countries in the sample.[8] Although the import demand elasticities are reasonably similar across the countries, there is significant variation in the export supply elasticities. This variation accords with intuition in that high export supply elasticities are associated with the types of undifferentiated goods that are exported by China, while low export supply elasticities are associated with the highly specialised goods exported by Switzerland.[9]

We turn to the dynamics of trade prices in Table 6. The varieties correction matters most for China - the terms of trade improvement is 46 percent better compared to the fixed-varieties measure. It is also highly important for the United States and Switzerland, at 34 percent and 30 percent respectively. Japan and Germany show smaller differences between the two measures, with the gap at 13 percent and 7 respectively. Figure 1 highlights the positive association between the extensive margin of trade and ratio of varieties-corrected price indices to fixed-varieties measures.

4. Conclusions

The goal of this paper has been to examine the role of the extensive margin in the recent trade dynamics of major deficit and surplus countries. We have found a substantial

[8]The estimated elasticities are based on US data. Accordingly, differences across countries in the weighted-average elasticities are explained by differences in the sectoral composition of imports and exports.

[9]See also the extensive discussion in Broda and Weinstein (2008) on the interpretation of export supply elasticities.

role for the extensive margin even over a relatively short four year period. In addition to gaining a better understanding of the sectoral implications of shifts in trade balances, the extensive margin is also important in quantifying the impact on international relative prices. In particular, the presumed adverse impact on the terms of trade of an improvement in the trade balance is ameliorated if much of the trade adjustment occurs along the extensive margin.

Accordingly, it seems useful to develop models of external adjustment that incorporate an extensive margin of trade. Moreover, while we have focused only on international trade, endogeneity in the number of varieties of nontradables and the numbers of firms operating within each variety category are also potentially important margins of adjustment (Corsetti et al 2008).

From a policy perspective, an important issue is whether the extensive margin of adjustment is facilitated by the regulatory environment. In particular, anti-competitive rules and restrictions can contribute to high entry barriers that deter the creation of new firms and product lines. In related fashion, the efficiency of a country's international trading infrastructure (transport networks, ports, air connections) may also be important in determining the scope for trade expansion along the extensive margin.

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Table 1: External Imbalances, 2000-2006

Year	Country	Exports	Imports	TB	CA
2000	United States	10.9	14.8	-3.9	-4.3
2004	United States	9.9	15.1	-5.2	-5.5
2006	United States	11.0	16.7	-5.7	-6.2
2000	Germany	32.9	32.8	0.1	-1.7
2004	Germany	38.1	33.1	5.0	4.3
2006	Germany	44.7	39.4	5.3	5.0
2000	Switzerland	32.0	25.6	6.5	12.3
2004	Switzerland	32.5	23.2	9.3	12.9
2006	Switzerland	35.7	28.4	7.3	15.1
2000	Japan	11.3	9.8	1.5	2.6
2004	Japan	13.8	11.8	2.0	3.7
2006	Japan	16.7	15.3	1.4	3.9
2000	China	23.3	20.9	2.4	1.7
2004	China	34.0	31.4	2.6	3.6
2006	China	40.1	32.2	7.9	9.4

Source: World Economic Outlook database.

Table 2: Evolution of Trade Volumes, 2000-2004

	United States	Germany	Switzerland	Japan	China
Export Volumes:					
Fixed Varieties	0.91	1.20	1.05	1.12	1.78
Varieties-Corrected	0.93	1.21	1.11	1.12	1.84
Import Volumes:					
Fixed Varieties	1.06	1.10	1.03	1.04	1.83
Varieties-Corrected	1.38	1.17	1.22	1.19	3.03

Note: Authors' calculations based on BACI dataset.

Table 3: Growth in Varieties, 2000-2004

	United States	Germany	Switzerland	Japan	China
Varieties					
Exports in 2000	440	518	277	359	293
Exports in 2004	497	559	312	379	586
Imports in 2000	246	247	148	149	74
Imports in 2004	280	270	165	164	172
Destinations:					
Exports in 2000	66	76	45	55	42
Exports in 2004	76	83	51	59	85
Sources:					
Imports in 2000	34	35	22	22	11
Imports in 2004	40	39	25	24	26

Note: Varieties are average number of varieties per 4 digit sector; Destinations/Sources are average number of country destinations/sources per 6 digit sector.

Table 4: Margins of Trade, 2000-2004

	United States	Germany	Switzerland	Japan	China
Exports:					
Intensive Margin	1.03	1.60	1.39	1.17	1.79
Extensive Margin	1.15	1.01	1.20	1.01	1.15
Imports:					
Intensive Margin	1.21	1.45	1.36	1.18	2.08
Extensive Margin	1.09	1.01	1.03	1.02	1.26

Note: Authors' calculations based on BACI dataset.

Table 5: Weighted Sectoral Elasticities

	Supply	Demand
United States	0.27	3.33
Germany	0.31	2.93
Switzerland	0.07	2.94
Japan	0.35	3.60
China	0.85	2.94

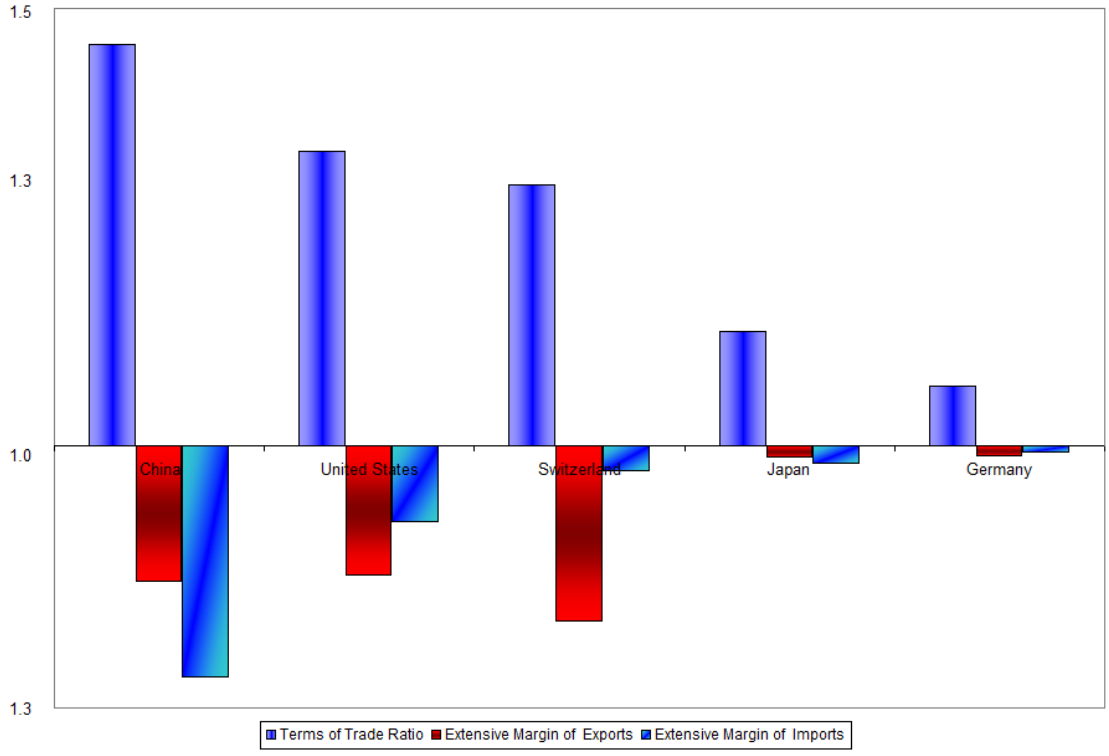
Note: Supply: weighted average of export supply elasticities across 4 digit goods categories, based on the estimates of Broda and Weinstein (2008). Demand: weighted average of import demand elasticities across 4 digit goods categories, based on the estimates of Broda and Weinstein (2006).

Table 6: Evolution of International Trade Prices, 2000-2004

	United States	Germany	Switzerland	Japan	China
Export Prices:					
Fixed Varieties	1.14	1.33	1.33	1.06	1.01
Varieties-Corrected	1.27	1.34	1.51	1.07	1.12
Import Prices:					
Fixed Varieties	1.15	1.32	1.32	1.13	1.13
Varieties-Corrected	0.95	1.25	1.15	1.01	0.87
Terms of Trade:					
Fixed Varieties	1.00	1.01	1.01	0.94	0.89
Varieties-Corrected	1.34	1.08	1.31	1.06	1.30

Note: The terms of trade is defined as the ratio of export to import prices.

Figure 1: Terms of Trade and the Extensive Margin of Trade



Note: Authors' calculations based on BACI data. The terms of trade ratio is defined as the ratio of varieties-corrected to fixed varieties terms of trade.

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