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# Trade Patterns, Trade Balances and Idiosyncratic Shocks

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**Abstract**

International Macroeconomics has long sought an explanation for current account fluctuations that matches the data. The approaches have typically focused on better models and new macroeconomic variables. We demonstrate the limitations of this approach by showing that idiosyncratic shocks are an important cause of macroeconomic volatility even for large countries. When explaining these fluctuations, standard macroeconomic models generally assume that firms are small and that their microeconomic shocks cancel out. We show that the high degree of concentration of bilateral trade flows means that idiosyncratic shocks can have a significant impact on aggregate economic fluctuations. We theoretically develop a decomposition of the variance of trade flows into its macroeconomic and its microeconomic components. Taking the model to data on bilateral trade flows from 1970 to 1997, we find that the most comprehensive macroeconomic model can only account for at most half of the observed variance in trade account volumes of each country. Thus, this paper highlights the importance of considering disaggregated data when modeling the current account.



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# 1 Introduction

There is a deep disconnect between the types of variables that economists typically turn to when explaining trade balance fluctuations and those used by market analysts. Consider, for example, a typical news story discussing the release of trade deficit numbers drawn from The New York Times:

> "America's appetite for foreign imports broke all records in January, reaching $159.1 billion and contributing to a monthly trade deficit that is the second highest on record. The $58.3 billion trade deficit defied predictions that a weakened dollar and lower oil prices would narrow the United States' trade gap.
>
> Instead, the Commerce Department said on Friday that American consumers continued to buy foreign-made goods at an avid pace, raising the trade deficit 4.5 percent from $55.7 billion in December. January's trade figures included a 75 percent surge in Chinese textile and apparel shipments, reflecting the end to global quotas and the beginning of what some experts see as a future of China supplying as much as 70 percent of the United States textile and apparel market." - Elizabeth Becker, "Trade Gap Widens on Record Imports," The New York Times, March 11, 2005, p. C1.

As the quotation makes clear, economic forecasters tend to focus on macroeconomic variables – exchange rates, oil prices, etc. – while market analysts often turn to more idiosyncratic explanations of trade balance movements, in the example above Chinese textile shipments.

This paper seeks to understand the relative importance of macroeconomic and idiosyncratic shocks in trade balance movements. We define "macroeconomic shocks" as movements in the trade balance that can be attributed to characteristics of the importer, the exporter or the industry and "idiosyncratic shocks" as those which are specific to each individual trade flow. We find that each kind of shock can explain around one half of the total variance of the trade balance for the typical OECD country. This suggests that the difficulty economists have had in explaining trade balance fluctuations may not be due to using the wrong set of macroeconomic variables or the wrong models. Instead, we document that economies are buffeted by large idiosyncratic shocks that do not fit easily into a standard macroeconomic framework. We identify an idiosyncratic shock as one affecting a particular trade flow with respect to a given location in a given industry. For example, a surge in oil prices could push up demand for fuel-efficient cars in the United States which could, in turn, lead to an increase in Japanese car exports to the United States without directly affecting the rest of Japanese exports (in other industries) or exports of Japanese cars to other destinations.

On some level, the distinction between idiosyncratic shocks and macroeconomic shocks is semantic. Macroeconomic identities must hold, and since all trade balance movements can be decomposed into demand and supply shocks, one could argue that all shocks to the trade balance must, by definition, be macroeconomic. Seen in this context, our definition of "macroeconomic shock" is closer to "common shock." That said, there is a good reason for using the term "macroeconomic shock." Macroeconomic models and empirical exercises focus almost exclusively on country- or industry-level variables such as GDP fluctuations or movements in the price of oil and other commodities. As a result, while it is fair to say that most macroeconomists already know that country-industry shocks could matter, it is also fair to say that these have largely been ignored.

There are several reasons why economic explanations for trade balance and current account movements have focused on common rather than idiosyncratic shocks. First, these are, by far, the easiest forces to model. Idiosyncratic shocks are necessarily messy and do not lend themselves easily to beautiful theory. Secondly, most international macroeconomic models tended to assume that demand is homothetic and output is specialized. These two assumptions work together to guarantee that import volumes are not highly concentrated in particular country-industry flows. If all bilateral trade flows are small, the Law of Large Numbers applies, and idiosyncratic shocks will not have much of an impact on aggregate trade flows. Unfortunately, these assumptions do not seem to hold in the data where the top 1% of largest flows account for 75% of total US exports, meaning that 99% of flows account for only 25%. This implies that idiosyncratic shocks could aggregate to non-trivial shocks.

While there is no question that both forces - common and idiosyncratic - are important in determining the level of national net exports, economic theory has almost entirely focused on the former determinants of trade balances. In this paper, we argue that ignoring the latter is not an innocuous assumption.

This paper develops a theoretical model that is taken to the data on bilateral trade flows in order to quantify the importance of these country-industry shocks. Our empirical specification corresponds to the best conceivable macroeconomic model of the global economy, one that would perfectly forecast the typical behavior of every industry and every country. Our measure of idiosyncratic shocks, then, stems from shocks to particular country-industry pairs. We find that the idiosyncratic shocks in our model could account for up to 24% of the behavior of exports and up to 31% for imports in the typical OECD country. Unfortunately, common shocks do not fare so well at explaining the evolution of trade balances where they can only account for up to 45% of the total variation, leaving the remaining 55% to be explained by idiosyncratic shocks. This implies that every three years, one sees movements in exports of almost 50% of the actual growth rate due to idiosyncratic shocks. Similarly, the corresponding movements in import and trade balance growth are around 65% and 110%, respectively.

The magnitude of these numbers suggests that there is room for both macroeconomists and analysts when making predictions of the trade account since both common and idiosyncratic shocks seem to be important at moving aggregate flows.

This paper is organized as follows. Section 2 contains a literature review, while the motivation for our study showing the lumpiness and the volatility of trade flows is given in section 3. A basic theoretical model is introduced in section 4 and taken to the data in section 5. Section 6 shows the results of the empirical estimation. Section 7 presents a particular study of what could be driving idiosyncratic shocks using Japan as an example. Finally, section 8 concludes.

# 2 Literature survey

Our paper connects to several lines of enquiry. In the last few years, a large and increasing body of literature has focused on the importance that heterogeneous firms could have in explaining several features of international trade flows (Bernard et al. 2003, Chaney 2005, Eaton, Kortum and Kramarz 2005, Melitz 2002) or industries (Alvarez and Lucas 2005, Eaton and Kortum 2002). The main motivation for this work is that the ultimate determinant of trade flows will be better understood by looking at the microeconomic data. Tipically, those models are static and, in their simplest dynamic extension, they would predict that, for instance, a productivity shock in a given country would cause exports to increase by the same proportion across all destination countries. Our findings lead to an even more disaggregated view. For example, a given shock to Toyota will typically have very varied outcomes across destination countries. We suspect that this has to do with other additional factors generally unknown to the observer such as fit of the given product to the country, the existence of distribution networks, or the intensity of the local competition. Establishing the main reasons for the idiosyncratic impact of shocks remains an open research question.

We also suspect that analysis of trade shocks may shed light on the perennial question of the determinants of trade. Interestingly, most models (e.g. the monopolistic competition model in Helpman and Krugman 1985) would typically predict a fairly homogenous structure of trade across destination countries, which in its pure form is at odds with the data (Davis and Weinstein 2001, 2002).

Our paper may also help flesh out the shocks postulated in models of the current account (Obstfeld and Rogoff 1996, Backus, Kehoe and Kydland 1992, Kray and Ventura 2003). These models typically postulate an aggregate demand or supply shocks per period. Again, our results may inform future developments in model of the current account.

Finally, our paper relates to work that focuses in those instances where a few large idiosyncratic agents could affect aggregate outcomes. Gabaix et al. 2003 explores this effect for the stock market while, Gabaix 2005 theoretically and empirically studies this hypothesis for the aggregate macroeconomy. He shows how, if firm sizes are distributed according to a fat-tailed distribution (a plausible assumption when one analyzes the data), a few large firms will account for a non-vanishing fraction of the economic activity. Hence, implying that idiosyncratic firm shocks could potentially generate sizable aggregate fluctuations. In this paper, we explore the existence of similar effects in our trade flow data.

# 3 Lumpiness and Idiosyncratic Volatility

In this section, we aim to demonstrate that bilateral trade flows are not only lumpy but also subject to idiosyncratic volatility. To this effect, in the first subsection we compute various concentration ratios and Herfindahl indices to ascertain the degree of lumpiness. In the next subsection, we report different measures of idiosyncratic volatility of bilateral trade flows.

## 3.1 Lumpiness

Simple inspection of the data on bilateral trade flows reveals that these are, indeed, very concentrated. This lumpiness becomes evident at three different levels. First, looking at the industrial composition of a country's total trade, we find that the bilateral flows of a few industries account for a large portion of overall trade. For our sample of 24 OECD countries, the top 5 traded industries account for over 55% of total exports and imports for the typical country[1]. This share of the top 5 traded industries with respect to total exports and imports for each country is depicted in Figure 1. Secondly, if we look at the destinations (origins) of a country's exports (imports), we find that a small number of countries account for a very large portion of each country's overall exports (imports). As shown in Figure 2, the top 5 trading partners account for around 55% of total trade flows for the typical country[2].

Furthermore, flows are not only concentrated at the country and at the industry level but also at the country-industry level. In other words, a few trade flows with respect to a few countries in a few industries account for a large portion of overall trade flows. Figures 3 and 4 show the importance of the top 1% and 5% largest flows to total trade for exports and imports, respectively. The data for these figures is available in Table 1. Inspecting these data, it is apparent that *only* the top 1% trade flows account for over 80% of the total trade volume for the typical OECD country (and over two thirds for any country). If we consider the top 5% trade flows, these cover over 92% of total exports and over 98% of total imports. Since each country could potentially trade in 59 industries with 140 trading partners, keeping track of the top 1% of flows means considering at most 83 country-industry pairs which would allow us to track the practical entirety of total exports or imports for any given country[3]. To get a sense of concentration in terms of the number of flows, we compute the importance of the top 25 and 100 raw country-industry flows for exports and imports and we report them in Table 2. The largest 25 flows account for almost two thirds of total trade for the average country while the largest 100 flows a country for over 85% of total trade.

Another commonly used measure of concentration is the Herfindahl Index. Just like with the concentration ratios above, we can compute this index at three separate

[1] Our data comprise 59 2-digit SITC industries.

[2] We use data of bilateral trade flows between 24 OECD countries with respect to 141 trading partners.

[3] For a potential maximum number of observations of $(59 \cdot 140 =)$ 8260.

levels: country, industry, and country-industry.

First, we calculate the Herfindahl index for industry flows which informs us about the degree of industrial concentration in a country's trade. We define country $c$'s industry Herfindahl at time $t$ as:

$$IH_{ct} = \sum_i \theta_{cit}^2 \quad \text{where } \theta_{cit} = \frac{\sum_{c'} S_{cc'it}}{\sum_{c'i} S_{cc'it}}$$

where $S_{cc'it}$ corresponds to the trade flow between country $c$ and $c'$ in industry $i$ at time $t$. We compute $IH_{ct}$ for every country and year and report the yearly average for each country in Table 3. Not surprisingly, there is a high degree of correlation between these Herfindahl indices and the concentration ratios obtained earlier. The median industry Herfindahl for our sample of 24 OECD countries is about 0.09 for exports and 0.1 for imports both indicating a high degree of concentration at the industry level[4].

Analogously, we compute a Herfindahl index for country flows to get a sense of the geographical concentration of a country's trade. We define country $c$'s country Herfindahl at time $t$ as:

$$CH_{ct} = \sum_{c'} \theta_{cc't}^2 \quad \text{where } \theta_{cc't} = \frac{\sum_{i} S_{cc'it}}{\sum_{c'i} S_{cc'it}}$$

Again, we compute $CH_{ct}$ for every country and year and report the yearly average for each country in Table 4. The median country Herfindahl for our sample is about 0.11 for exports and 0.09 for imports[5]. It is particularly striking the high degree of concentration of Canadian and Mexican trade (with the United States) which results in a very high Herfindahl index for these two countries.

Finally, we move our focus to country-industry flows by computing what we call the overall Herfindahl. We define country $c$'s overall Herfindahl at time time $t$ as:

$$OH_{ct} = \sum_{c'i} \theta_{cc'it}^2 \quad \text{where } \theta_{cit} = \frac{S_{cc'it}}{\sum_{c'i} S_{cc'it}}$$

[4] A low degree of concentration at the industry level would be if all 59 industries had the same share in the country. Thus, we would obtain an industry Herfindhal of 0.016, which is five times smaller that the one obtained.

[5] A low degree of concetration is found when we import or export to each country the same amount. In this case the Herfidhal would be 0.07, again a lot lower that the one obtained

In this case, the higher degree of disaggregation[6] means that the share of each flow ($\theta_{cc'it}$) is smaller resulting in substantially lower Herfindahls. The typical Herfindahl for country-industry flows is about 0.03 for exports and 0.04 for imports which still indicate a high degree of concentration.

## 3.2 Idiosyncratic Volatility

In order to show whether bilateral trade flows are volatile, we start by constructing a measure of idiosyncratic volatility at the industry level as follows. For a given country and year, we compute the growth rate of exports (imports) for each industry, from this number we subtract the growth rate of total exports (imports) in that country in that given year and obtain what we call "demeaned growth rates". These growth rates give us an idea of the differential behavior of exports (imports) for a given industry in a given year and we use their magnitude as a proxy for the magnitude of idiosyncratic shock in a given industry for a given country. Next, for each country, we compute the standard deviation of the "demeaned growth rates" over time. We use this as a measure of the volatility in industry flows for a given country and, therefore, of the volatility of the idiosyncratic component of industry flows. Finally, we compute the median of this measure of volatility per industry and a weighted average with larger weight given to larger industries.[7]

Table 6 reports these median and weighted average measures of volatility for industry idiosyncratic shocks for our sample of 24 OECD countries for exports and imports. A few results are worth noting. The coefficient of export volatility for the *average* industry in the typical country is around 8.2% meaning that the average industry in these countries has a large volatility. We also report the idiosyncratic volatility of the median industry and find it to be generally significantly larger than the weighted average. This is because when we compute the weighted average, a larger weight is given to larger industries that have smaller volatility.

Analogously, we construct a measure of idiosyncratic volatility at the importer (exporter) level. Instead of computing the growth rates over each industry, now it is done over each importer for exports and over each exporter for imports. The results

[6] Unlike in the calculation of $IH_{ct}$ and $CH_{ct}$ we are not aggregating trade flows over country nor industry.

[7] The weight given to each industry $i$ corresponds to the average square root of the industry share in total exports (imports). Mathematically, $\frac{\sqrt{\sum_{c'} S_{cc'it}}}{\sum_i \sqrt{\sum_{c'} \S_{cc'it}}}$

for the median and weighted average measures of volatility for importer (exporter) idiosyncratic shocks for our sample of 24 countries are reported in Table 7. Our findings are consistent with a significant amount of volatility coming from idiosyncratic shocks to importers (exporters), and again the coefficient of volatility both for exports and imports is around 8.5%

# 4 Theory

## 4.1 A basic model

We provide a simple theoretical model that grounds our empirical work. This model can be easily extended, yet this simple version already provides all the insights that are needed for the purposes of this paper.

Country $c'$ is populated by a representative household that at time $t = T + 1$ maximizes the following utility function:

$$U_{c'} = Z_{c'} + \sum_{cit} q_{cc'it} \tag{1}$$

where $Z_{c'}$ is our numeraire "settlement good", and $q_{cc'it}$ is the quantity of good $i$ from country $c$ consumed by country $c'$ at time $t$[8,9]. Notice that the utility function is linear in the consumption of all goods.

Our economies are endowment economies: $Q_{c'cit}$ is given.[10] Later we specify the structure of stochastic processes of the endowments. Thus, total income in this economy is given by:

$$Y_{c'} = \sum_{cit} p_{c'cit} \cdot Q_{c'cit} \tag{2}$$

The budget constraint of the representative household in country $c'$ is given by:

$$Z_{c'} + \sum_{cit} p_{cc'it} \cdot q_{cc'it} = Y_{c'} \tag{3}$$

[8] $Z_{c'}$ can be thought as the net asset position of country $c'$.

[9] We use the terms industry and good interchangably

[10] This corresponds to a fixed quantity of good $i$ that country $c'$ owns and that it can only be sold to country $c$.

Finally, the settlement good is in zero net supply:

$$\sum_{c'} Z_{c'} = 0 \tag{4}$$

The household maximizes utility, equation (1) subject to the budget constraint, equation (3). Optimizing over $Z_{c'}$ and $q_{cc'it}$ gives $p_{cc'it} = 1$. Linear utility implies that all goods have a price of 1. Therefore, exports in industry $i$ from country $c$ to country $c'$at time $t$, are:

$$S^X_{cc'it} = Q_{cc'it} \tag{5}$$

Total exports originating from country $c$ and total imports coming into $c$ are given by:

$$S^X_{ct} = \sum_{c'i} Q_{cc'it} \tag{6}$$

$$S^I_{ct} = \sum_{c'i} Q_{c'cit} \tag{7}$$

Net exports are given by:

$$T_{ct} = S^X_{ct} - S^I_{ct} = \sum_{c'i} \left(Q_{cc'it} - Q_{c'cit}\right) \tag{8}$$

This setup is probably the simplest multi-country multi-good model with stochastic dynamic general equilibrium.

## 4.2 Fluctuations of Exports

We postulate the general structure for the endowment economy. The initial values are taken as given, and $Q_{cc'it}$ evolves according to:

$$\Delta ln(Q_{cc'it}) = \delta_{cc't} + \omega_{cit} + \epsilon_{cc'it} \tag{9}$$

where country $c$ is the exporter. $\delta_{cc't}$ represents the shock to all exports to country $c'$ at time $t$, $\omega_{cit}$ is a shock to all exports in industry $i$ at time $t$, and $\epsilon_{cc'it}$ is a shock that is idiosyncratic to destination $c'$ and industry $i$. Moreover, $\epsilon_{cc'it}$ has mean zero and is uncorrelated with the other shocks. This setup together with the assumption that all goods' prices are normalized to one allows us to assimilate the volume to the value of exports and abstract from the industry reallocations that would occur following a shock to a given industry via changes in relative price levels.

By (5), the value of exports follows:

$$\Delta ln(S^X_{cc'it}) = \delta_{cc't} + \omega_{cit} + \epsilon_{cc'it} \tag{10}$$

Log-linearizing the above equation, total exports growth is:

$$\Delta ln(S^X_{ct}) = \sum_{c'i} \frac{S^X_{cc'it-1}}{S^X_{ct-1}} \cdot \frac{\Delta S_{cc'it}}{S^X_{cc'it-1}} = \sum_{c'i} \frac{S^X_{cc'it-1}}{S^X_{ct-1}} \cdot (\delta_{cc't} + \omega_{cit} + \epsilon_{cc'it}) \tag{11}$$

equivalently

$$\Delta ln S^X_{ct} = \gamma_{ct} + \eta_{ct} \tag{12}$$

where

$$\gamma_{ct} = \sum_{c'i} \frac{S^X_{cc'it-1}}{S^X_{ct-1}} \cdot (\delta_{cc't} + \omega_{cit}) \tag{13}$$

are the fluctuations due to shocks that are common to a destination ($c'$), or common to an industry ($i$), and

$$\eta_{ct} = \sum_{c'i} \frac{S^X_{cc'it-1}}{S^X_{ct-1}} \cdot \epsilon_{cc'it} \tag{14}$$

are the fluctuations of export growth due to shocks that are idiosyncratic to country-industry pairs. Basically, $\eta$ is the sum of idiosyncratic shocks weighted by their share in exports.

The outlined procedure corresponds to the growth rates of exports. We can proceed analogously with import growth rates simply substituting $S^X_{(\cdot)}$ by $S^I_{(\cdot)}$

## 4.3 Λ Ratio

The aim of this paper is to quantify the importance of idiosyncratic shocks (that is the $\eta_{ct}$ term). We define the Λ ratio as:

$$\Lambda_c = \frac{var(\eta_{ct})}{var(\Delta ln S^X_{ct})} \tag{15}$$

and it is a measure of the fraction of the variance of exports growth that comes from idiosyncratic shocks. Using equation (12), we can rewrite the above expression for $\Lambda_c$ as:

$$\Lambda_c = \frac{var(\eta_{ct})}{var(\gamma_{ct} + \eta_{ct})} \tag{16}$$

# 5 Econometrics

## 5.1 Data Description

We use data on bilateral trade flows for the period 1970-97. These data were extracted from the World Trade Flows CD-ROM put together by Statistics Canada and Robert C. Feenstra. We use data on 24 OECD countries that trade with a maximum of 163 countries in 59 2-digit SITC categories. We trim these data by dropping trade flows corresponding to unknown sectors or unspecified countries[11]. Trade flows in our sample account for over two thirds of total world trade.

## 5.2 Bilateral Trade Flows Estimation

Just like in the theoretical section, we describe our estimating procedure for exports, keeping in mind that the one for imports is completely analogous. We define idiosyncratic shocks as those affecting only a particular country-industry flow, that is, net of shocks common to a given industry or destination country. Ultimately, the goal is to identify the importance of these idiosyncratic shocks in explaining the variance of export growth. Thus, we estimate equation (10) as:

$$s_{cc'it} - s_{cc'it-1} = \delta_{cc't} + \omega_{cit} + \epsilon_{cc'it} \tag{17}$$

where $s_{cc'it}$ corresponds to the logarithm of exports from country $c$ to country $c'$ in industry $i$ at time $t$.[12]; the dependent variable is the log growth rate of exports between countries c and c' in industry i between time $t-1$ and $t$; $\delta_{cc't}$ and $\omega_{cit}$ are, respectively, dummy variables for each country pair and each exporting industry in country $c$ for every $t$; $\epsilon_{cc'it}$ is a well-behaved error term with mean zero and variance $\sigma_\epsilon$. Note that, by construction, $\delta_{cc't}$ is the conditional average growth rate of exports

[11] This leaves us with a total of 141 countries.

[12] Note that, in order to simplify notation, we omit the superindex $^X$ for exports.

from country $c$ to country $c'$ at time $t$ and, similarly, $\omega_{cit}$ is the conditional average growth rate of exports from country $c$ in industry $i$ at time $t$.

These dummy variables allow us to control for shocks at the industry level as well as at the importing country level. For instance, if all Japanese exports in a given sector experience an increase in a given year, this will be captured by $\omega_{cit}$. If all Japanese exports to the United States increase (or decrease) for whichever reason, this will be captured by $\delta_{cc't}$. The error term ($\epsilon_{cc'it}$) captures the idiosyncratic component of shocks affecting only trade volumes in a particular industry for a given country pair.

Unfortunately, we can not estimate this equation using ordinary least squares (OLS) since there is an heteroscedasticity problem. As we have already discussed, trade flows are both lumpy and volatile so the variance of the shocks to a flow is likely to depend on its destination, its industry and its magnitude. To solve this problem, we use weighted least squares (WLS). First, we estimate equation (17) using OLS. Since we expect larger trade volumes to be less volatile, we assume the following structure for the variance of the error term:

$$\sigma_\epsilon^2 = v_{ct} \cdot S_{cc'it}^{-\beta} \tag{18}$$

where $\beta > 0$ and $S_{cc'it}$ represents, as previously defined, the volume of exports from country $c$ to $c'$ in industry $i$ at time $t$.[13] Next, we estimate (18), by taking logarithms on both sides:

$$ln\left(\sigma_\epsilon^2\right) = ln(v_{ct}) - \beta \cdot ln\left(S_{cc'it}\right) \tag{19}$$

Since $\sigma_\epsilon^2$ is unknown, we use the equation above using the square of the estimated errors in equation (17) as its estimator. Formally:

$$ln\left(\widetilde{\epsilon}_{cc'it}^2\right) = ln(v_{ct}) - \beta \cdot ln\left(S_{cc'it}\right) \tag{20}$$

Finally, in the third stage, we re-estimate equation (17) using the exponential of the predicted values from equation as weights.

[13] Intriguingly, Lee et al. (1998) find a similar negative relationship between volatility and size when they analyze firms and GDPs, and interpret this result by pointing out that large economic entities are midly more diversified than small ones.

### 5.2.1 Aggregation

After estimating (17), we are in a position to disentangle the relative importance of macroeconomic and idiosyncratic shocks in determining the volatility of a country's exports. To this effect, first we define:

$$\widehat{\gamma}_{cc'it} \equiv \widehat{\delta}_{cc't} + \widehat{\omega}_{cit} \quad (21)$$

where $\widehat{\gamma}_{cc'it}$ is our model's prediction for the percentage change in exports due to macroeconomic shocks either to importing countries or to certain industries. Analogously, we define:

$$\widehat{\epsilon}_{cc'it} \equiv (s_{cc'it} - s_{cc'it-1}) - \widehat{\gamma}_{cc'it} \quad (22)$$

which represents the part of exports growth that is left unexplained by our model and that we attribute to idiosyncratic shocks. We aggregate these values across importers and industries analogously to equations (13) (14) in the Theory section in order to obtain our estimators for the macroeconomic and idiosyncratic components of the growth rate of exports of country $c$ at time $t$. Respectively:

$$\widehat{\gamma}_{ct} = \sum_{c'i} \frac{S_{cc'it-1} \cdot \widehat{\gamma}_{cc'it}}{S_{ct-1}} \quad (23)$$

$$\widehat{\eta}_{ct} = \sum_{c'i} \frac{S_{cc'it-1} \cdot \widehat{\epsilon}_{cc'it}}{S_{ct-1}} \quad (24)$$

Note that, by construction, the sum of the two components will always equal the log change in aggregate exports:

$$s_{ct} - s_{ct-1} = \widehat{\gamma}_{ct} + \widehat{\eta}_{ct} \quad (25)$$

where $s_{ct} = ln\left(\sum_{c'i} S_{cc'it}\right)$.

For instance, Japanese exports grew by 12.6% in 1985. Our model's prediction ($\gamma_{ct}$) was an increase of 8.1%, with idiosyncratic shocks ($\eta_{ct}$) accounting for an additional 4.5% growth in exports.

### 5.2.2 Variance and Measurement Error

As seen in the theoretical section, and given the fact the $\eta$ and $\gamma$ are independent, equation 16 can be rewritten by:

$$\Lambda_c = \frac{Var_t(\eta_{ct})}{Var_t(\eta_{ct}) + Var_t(\gamma_{ct})} \tag{26}$$

where $\Lambda$ can be seen as good measure of the variance of exports growth that comes from idiosyncratic shocks. By definition $\Lambda_c$ is bounded between 0 and 1. Values closer to 1 indicate that idiosyncratic shocks play an important role in determining aggregate exports' variance while values closer to 0 indicate that there is little volatility beyond that predicted by a comprehensive macroeconomic model.

However, since we are not able to observe $\eta_{ct}$ or $\gamma_{ct}$, we can only estimate them. Unfortunately, our estimates for $\eta_{ct}$ and $\gamma_{ct}$ are bound to suffer from measurement error which would, in turn, bias our estimates of their variance and, ultimately, our estimate of $\Lambda_c$.

Appendix A shows how measurement error in each coefficient of equation (17) gets aggregated into the measurement error of our macroeconomic shocks:

$$\widehat{\gamma}_{ct} = \gamma_{ct} + e_{ct} \tag{27}$$

where $e_{ct}$ denotes the measurement error on $\gamma_{ct}$ and is, by definition, uncorrelated with it. By construction, the measurement error enters with the same magnitude into our measure of idiosyncratic shocks. Combining this with (25) and (12), we obtain:

$$\widehat{\eta}_{ct} = \eta_{ct} - e_{ct} \tag{28}$$

In order to get an unbiased estimate of $\Lambda_c$, we need unbiased estimates of each of the components of equation (26). It can be shown that:

$$\begin{aligned} Var_t(\widehat{\gamma}_{ct}) &= Var_t(\gamma_{ct}) + Var_t(e_{ct}) \\ Var_t(\widehat{\eta}_{ct}) &= Var_t(\eta_{ct}) - Var_t(e_{ct}) \end{aligned} \tag{29}$$

since $Cov(\eta_{ct}, e_{ct}) = Var(e_{ct})$, as proven in Appendix B. Thus, we can express the variance of the true parameters as a function of the variance of our estimates and of our measurement error, both of which are computable.

$$\begin{aligned} Var_t(\gamma_{ct}) &= Var_t(\widehat{\gamma}_{ct}) - Var_t(e_{ct}) \\ Var_t(\eta_{ct}) &= Var_t(\widehat{\eta}_{ct}) + Var_t(e_{ct}) \end{aligned} \tag{30}$$

Therefore, a consistent estimator of $\widehat{\Lambda}_c$, is given by:

$$\widehat{\Lambda}_c = \frac{Var_t(\widehat{\eta}_{ct}) + Var_t(e_{ct})}{Var_t(\widehat{\eta}_{ct}) + Var_t(\widehat{\gamma}_{ct})} \tag{31}$$

The magnitude of $\Lambda_c$ for each of the 24 countries in our sample allow us to assess the importance of idiosyncratic shocks in determining the variance of aggregate export growth for each country.

### 5.2.3 Trade Account

Ultimately, our goal is to understand the importance of idiosyncratic shocks in explaining trade account fluctuations. So far, our procedure has been able to determine the importance of macroeconomic and idiosyncratic shocks for export and import growth volatility. One might be tempted to use the previous results on exports and imports to explain trade account fluctuations; after all, trade account balance is just exports minus imports. However, since the same factors might be driving exports as well as imports, there are important insights to be gained from focusing our attention on the trade account per se.

We estimate trade account fluctuations using an analogous procedure to the one we use for exports and imports. However, given that the trade account balance can be negative, using log differences as the dependent variable is no longer an option. We solve this problem by using mid-point growth rates as our dependent variable, so that our estimating equation becomes:

$$\Delta T_{cc'it} = \delta_{cc't} + \omega_{cit} + \epsilon_{cc'it} \tag{32}$$

where $\Delta T_{cc'it}$ is the change in the trade balance defined as:

$$\Delta T_{cc'it} \equiv \frac{(S_{cc'it} - S_{c'cit}) - (S_{cc'it-1} - S_{c'cit-1})}{\frac{1}{4} \cdot (S_{cc'it} + S_{c'cit} + S_{cc'it-1} + S_{c'cit-1})} \tag{33}$$

The numerator in this equation corresponds to the absolute change in the trade account balance, and the denominator is the average trade flow between country $c$ and $c'$ in industry $i$ at times $t$ and $t-1$. The interpretation of the coefficients is the same as in the export analysis, $\delta_{cc't}$ captures shocks specific to the country pair, while $\omega_{cit}$ captures country-industry specific shocks.

As before, heteroskedasticity is still an issue. In this case, we proceed in a similar way as we did for exports and imports, that is, by using WLS. Notice, however, that we amend our assumption regarding the structure for the variance of the error term:

$$\sigma_\epsilon^2 = v_{ct} \cdot B_{cc'it}^{\beta} \tag{34}$$

where $B_{cc'it} = \frac{1}{4}\left(S_{cc'it} + S_{c'cit} + S_{cc'it-1} + S_{c'cit-1}\right)$

After our final stage of the WLS estimation, we construct the macroeconomic and idiosyncratic components for the overall change in the trade account as:

$$\widehat{\gamma}_{ct} = \frac{\sum_{c'i} B_{cc'it-1} \cdot \left(\widehat{\delta}_{cc't} + \widehat{\omega}_{cit}\right)}{\sum_{c'i} B_{cc'it-1}} \tag{35}$$

$$\widehat{\eta}_{ct} = \frac{\sum_{c'i} B_{cc'it-1} \cdot \widehat{\epsilon}_{cc'it}}{\sum_{c'i} B_{cc'it-1}} \tag{36}$$

Just like for exports and imports, the sum of the two components equals the overall change in trade account. By sorting out the measurement error problem in an analogous way as before, we compute $\widehat{\Lambda}_c$ for the trade account.

# 6 Results

The importance of idiosyncratic shocks in explaining aggregate variance is given by the magnitude of $\widehat{\Lambda}_c$. We run our procedure for exports, imports, and trade account.

Initially, we estimate equation (17) for exports and imports, follow our aggregation procedure and compute $\widehat{\Lambda}_c$. Table 8 resports the value of $\widehat{\Lambda}_c$ for each type of flow and by country. We also report, underneath each $\widehat{\Lambda}_c$, we include a 95% one-sided confidence interval whose maximum we set at 100%, which is the maximum theoretical value $\Lambda_c$ can take[14]. In other words, with 95% probability, the value of $\widehat{\Lambda}_c$ will be

[14] You should simply note that $\frac{(var(\eta)/\widehat{var(\eta)})}{(var(\gamma)/\widehat{var(\gamma)})}$ is distributed as an F(24,24), since the number of

larger than the lower bound. Note that the complementarity to $\widehat{\Lambda}_c$ corresponds to the *maximum* amount of variance that can be explained by the most comprehensive macroeconomic model.

The median $\widehat{\Lambda}_c$ for our set of countries is 24% for exports and 31.2% for imports. For instance, $\widehat{\Lambda}_c$ for the United States in exports is 13%, thus, almost 13% of the total variance in exports can be attributed to idiosyncratic shocks. The rest being attributable and being explained by macroeconomic shocks. The confidence interval for our $\widehat{\Lambda}_c$ is $[6.5\%, 100\%]$, which means that at least 6.5% of the total variance in aggregate exports cannot be explained by common shocks.

For exports, a more detailed analysis of $\widehat{\Lambda}_c$ reveals that countries with a more diversified export portfolio (that is with a lower degree of industrial and importer concentration) have lower values of $\widehat{\Lambda}_c$.[15] For instance the value of $\widehat{\Lambda}_c$ for countries such as United States, Japan, France, and Germany is much lower than for countries with exports concentrated in a few industries such as Iceland or Mexico or with respect to a few countries such as Ireland or Canada. A similar pattern emerges when we turn our attention to imports.

Turning our attention to the trade account, we estimate equation (32). Recall that since trade account can be negative log differences can not be used to compute the growth rate of bilateral trade flows. For this reason, we use the aforementioned mid-point growth rates. Again we follow our aggregation procedure described in section 5.2 and compute $\widehat{\Lambda}_c$ for the trade account. Results are presented in Table 9, where, for comparison purposes we also report the results of our procedure on exports and imports using mid-point growth rates instead of log differences.

With few exceptions, our $\widehat{\Lambda}_c$ for exports and imports are generally lower using the mid-point growth rate instead of the log differences but this difference is rather small and can be attributed to the fact that mid-point growth rates are less volatile than log-differences. The median $\widehat{\Lambda}_c$ is 21% for exports and 26% for imports which are slightly lower than the medians we were obtaining before (24% and 31%, respectively).

The results for the trade account in the third column of Table 9 are significantly

years taken to compute the variance are 25.

[15] Note that if a country was only trading with another country in several industries (or a country trading with several others in just one industry), our procedure would still capture all shocks and identify them as macroeconomic, resulting in a small value for $\widehat{\Lambda}_c$

larger coefficients than the ones we were obtaining for exports and imports. The intuition driving this results is that there are factors affecting both exports and imports that are "forced" to enter our model symmetrically since we define $T = X - M$. The median country has a $\widehat{\Lambda}_c$ of 55.3% meaning that our procedure attributes to idiosyncratic shocks over 50% of the total variance in the trade account. This suggests that every two years, the total movement of the trade account can be attributed to shocks in particular country-industry flows. The interpretation of the intervals for $\widehat{\Lambda}_c$ provided in this column is the same as before.

# 7 Case Study: Japan

We have shown that bilateral trade flows are lumpy and volatile and that this leads to idiosyncratic shocks having aggregate effects. One driving force of these idiosyncratic shocks could be shocks to non-atomistic firms. Macroeconomic models generally assume that firms are small and, hence, there is little information to be gained from understanding the individual behavior of individual firms. As a result, economic models of international fluctuations are built using only aggregate macroeconomic data. These models leave no role to be played by individual firms because it is assumed that the Law of Large Numbers can be applied and, hence, any idiosyncratic movements by firms will cancel out in the economy as a whole.

We show that this assumption is wildly at odds with the data. Using data on exports by Japanese firms between 1983 and 1999,[16] we find that the top 5 Japanese firms account for around 20% of total Japanese exports, the top 25 already account for almost 50% of total exports. A more detailed decomposition of Japanese exports by the top exporting firms is available in Table 10. This high degree of concentration suggests that the success or failure of individual firms in the export arena can have a significant impact on economic fluctuations. For example, if some of Japan's largest exporters have a particularly bad year this might move Japanese exports by several percentage points.

Other empirical studies suggest that the results for Japan are not unique. Andrew B Bernard and J. Bradford Jensen have found similar type of concentration in US Data, and Eaton, Kortum, and Kramarz in French data. All of this suggests that

[16]We have data on over 600 firms listed in the Tokyo, Osaka and Nagoya stock exchanges. A data description section is coming up.

firms might matter for understanding international fluctuations.

In order for shocks to firms to matter, we need firms' exports to be lumpy but also volatile. To show that firms' exports are volatile, we follow a similar procedure to the one we used to show that bilateral trade flows are volatile. For each firm and year, we compute a "demeaned growth rate" by subtracting the growth rate of exports in the industry in which that firm operates from the growth rate of the firm's exports. Next, we compute the standard deviation of this "demeaned growth rates" which we report in Table 11 together with the average "demeaned growth rate" for the largest 25 exporters. The second column in Table 11 suggest that there is a high degree of volatility in individual firm's exports growth rates.

## 7.1 Data Description

For the Japanese firm-level analysis, we use DBJ data on manufacturing companies listed in the Tokyo, Osaka and Nagoya stock exchanges. We use data on exports at the firm level for the period 1982-99. For each year, we have data for approximately 600 firms that export in consecutive years, these flows account for around 75% of overall Japanese manufacturing exports. Over our period of interest, a small amount of firms change the reporting date of their financial statements which resulted in a missing observation in the original data. When this happens, we take the missing value to be the average of the adjacent years for which we have data. As we do for the bilateral trade flows data, we drop those sectors for which data availability is very limited (with 3 or fewer exporting firms in every year).

## 7.2 Firm Level Estimation

The study of bilateral trade flows suggests that the idiosyncratic component of trade flows fluctuations is sizable. The availability of a firm-level data set will allow us to get further insight into the sources of these idiosyncratic shocks. Unfortunately, our firm-level data set only has information on the value of the exports and the industry to which the firm belongs, but not on the precise geographical destination of its exports. We adjust our procedure to take into account this fact and our estimating equation becomes:

$$s_{fit} - s_{fit-1} = \gamma_{it} + \epsilon_{fit} \tag{37}$$

where $s_{fit}$ corresponds to the logarithm of exports by firm $f$ in industry $i$ at time $t$; $\gamma_{it}$ represent industry-time fixed effects and $\epsilon_{fit}$ is a normally-distributed error term with mean zero and variance $\sigma_\epsilon^2$ . In the unweighted regression, it will be the case that $\gamma_{it}$ is the average growth rate of industry $i$ at time $t$. As it has been shown above, firm flows are both lumpy and volatile, which means that equation (37) can not be estimated by OLS and that a heteroskedasticity correction needs to be applied. We assume the following functional form for the variance of the error term:

$$\sigma_\epsilon^2 = v_t \cdot S_{fit}^{-\beta} \tag{38}$$

where $S_{fit}$ are total exports by firms $f$ in industry $i$ at time $t$. Taking logs on both sides, estimating the equation and using the predicted values as weights, we estimate equation (37). Applying the same steps as in Section 5, we obtain the disaggregation of exports growth into its macroeconomic and idiosyncratic components:

$$\widehat{\gamma}_t = \frac{\sum_i S_{it-1} \cdot \widehat{\gamma}_{it}}{\sum_i S_{it-1}} \tag{39}$$

$$\widehat{\eta}_t = \frac{\sum_i S_{fit-1} \cdot \widehat{\epsilon}_{fit}}{\sum_f S_{fit-1}} \tag{40}$$

where $S_{it-1} = \sum_{f\in i} S_{fit-1}$ corresponds to the total exports by industry $i$ at time $t$. Using similar measurement error correction, we can calculate the corresponding $\widehat{\Lambda}$ for the firm-level procedure.

### 7.3 Results and Summary

The magnitude of $\widehat{\Lambda}$ represents the importance of firm-level shocks in moving aggregate exports. A larger $\widehat{\Lambda}$ will indicate that these shocks play a big role in determining the overall growth rate of exports. We find a value of 7.4% for $\widehat{\Lambda}$ meaning that every three years, almost 15% of the total variation in aggregate Japanese exports is due to idiosyncratic shocks to individual firms. Again, we can compute a 95% confidence interval for our estimate of $\widehat{\Lambda}$ which is $[3.2\%, 100\%]$.

It is apparent from this results that using firm-level estimation allows us to reduce the importance of idiosyncratic shocks to a smaller level than when we were only considering bilateral trade flows. Recall that for our estimation using bilateral exports, Japan's $\widehat{\Lambda}_c$ was about 18% which is significantly larger than the 7.4% obtained in this section using firm-level data.

# 8 Conclusions

The goal of this paper was to gain a deeper understanding of the relative importance of macroeconomic and idiosyncratic shocks in trade account movements. We argue that in order for idiosyncratic shocks to play a role, they need to be both lumpy and volatile. For instance, the top 1% of trade flows for the typical country already account for over 80% of the country's total trade.

As far as we know, this is one of the first systematic studies considering the relevance of idiosyncratic (country-industry) shocks in explaining exports, imports and trade account balances. Our findings suggest that idiosyncratic shocks indeed play a significant role. Over half of the overall variance of the trade account can not be explained by what we have termed as macroeconomic shocks, that is, shocks specific to a trading partner or to an industry. The remaining fraction of the unexplained variance is attributed to idiosyncratic shocks, that is shocks to specific country-industry flows.

Nonetheless, it is important to keep in mind that macroeconomic models do a better job at explaining the evolution of a country's exports and imports since they can account for around 70% of the total variance. Still, the performance of these models varies a lot by country doing a much better job at explaining the growth of export and imports for countries with more diversified trade flows.

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# A Appendix: Measurement Error

In this Appendix, we derive an expression for the measurement error, $e$, and its variance, $Var_t(e_{ct})$. From estimating (17) with weights given by (18) and remembering the theory of partitioned regression, we get the following expression for our parameters:

$$\widehat{\delta_{cc't}} = \sum_i \frac{S^{\beta}_{cc'it} \cdot g_{cc'it}}{\sum_i S^{\beta}_{cc'it}} - \sum_i \frac{S^{\beta}_{cc'it} \cdot \widehat{\omega_{cit}}}{\sum_i S^{\beta}_{cc'it}}$$

$$\widehat{\omega_{cit}} = \sum_{c'} \frac{S^{\beta}_{cc'it} \cdot g_{cc'it}}{\sum_{c'} S^{\beta}_{cc'it}} - \sum_{c'} \frac{S^{\beta}_{cc'it} \cdot \widehat{\delta_{cit}}}{\sum_{c'} S^{\beta}_{cc'it}}$$

Substituting this into (23) we get:

$$\widehat{\gamma_{ct}} = \gamma_{ct} + e$$

where

$$\gamma_{ct} = \sum_{c'i} \frac{S_{cc'it} \cdot \gamma_{cc'it}}{\sum_{c'i} S^{\beta}_{cc'it}}$$

and

$$e_{ct} = \sum_{c'i} \frac{S_{cc'it} \cdot \left[ \frac{\sum_i S^{\beta}_{cc'it} \cdot \varepsilon_{cc'it} + \sum_{c'} S^{\beta}_{cc'it} \cdot \varepsilon_{cc'it}}{\sum_i S^{\beta}_{cc'it}} \right]}{\sum_{ic'} S_{cc'it}}$$

Note that from the above equation we can also compute $Var(e_{ct})$, and get that:

$$Var(e_{ct}) = 2 \left( \sum_{c'i} S_{cc'it} \right)^{-2} \sum_{c'i} \left( S^2_{cc'it} \left( \sum_i S^{\beta}_{cc'it} \right)^{-1} \right)$$

With this correction we can get the desired consistent estimator for $\Lambda_c$.

# B Appendix: $Cov(e_t, \eta_t) = Var(e_t)$

$$Cov\left(e_t, \eta\right) = Cov\left(\sum_{c'i} \frac{S_{cc'it} \cdot \left[\frac{\sum_i S^{\beta}_{cc'it} \cdot \epsilon_{cc'it} + \sum_{c'} S^{\beta}_{cc'it} \cdot \epsilon_{cc'it}}{\sum_i S^{\beta}_{cc'it}}\right]}{\sum_{c'i} S_{cc'it}}, \frac{\sum_{c'i} S_{cc'it} \cdot \epsilon_{cc'it}}{\sum_{c'i} S_{cc'it}}\right) =$$

$$= \left(\sum_{c'i} S_{cc'it}\right)^{-2} \sum_{c'i} \left(\left(\sum_i S^{\beta}_{cc'it}\right)^{-1} S^2_{cc'it} \sum_i v \cdot S^{-\beta}_{cc'it} \sum_i S^{\beta}_{cc'it}\right) +$$

$$+ \left(\sum_{c'i} S_{cc'it}\right)^{-2} \sum_{c'_i} \left(\left(\sum_i S^{\beta}_{cc'it}\right)^{-1} S^2_{cc'it} \sum_i v \cdot S^{-\beta}_{cc'it} \sum_i S^{\beta}_{cc'it}\right) =$$

$$= 2 \cdot \left(\sum_{c'i} S_{cc'it}\right)^{-2} \sum_{c'i} \left(\left(\sum_i S^{\beta}_{cc'it}\right)^{-1} S^2_{cc'it} \sum_i v \cdot S^{-\beta}_{cc'it} \sum_i S^{\beta}_{cc'it}\right) = Var\left(e_t\right)$$

# C Appendix: Computation of $Var(e_{ct})$

At each point in time we know that:

$$\widehat{\gamma}_{ct} = \gamma_{ct} + e_{ct}$$

Furthermore, $\gamma_{ct}$ is a true parameter, implying that $Var(\gamma_{ct})$ is zero. Thus:

$$Var(\widehat{\gamma}_{ct}) = Var(e_{ct})$$

where we can compute $Var(\widehat{\gamma}_{ct})$ as:

$$Var(\widehat{\gamma}_{ct}) = \sum_{ijde} \beta_{cdit} \cdot \beta_{cejt} \cdot VCV(\widehat{\omega}, \widehat{\delta})$$

where $VCV$ is the variance covariance matrix between the two regressors in the main regression, and $\beta_{cejt} = \frac{S_{cejt-1}}{\sum_{ej} S_{cejt-1}}$.

Using this we can compute the variance of the measurement error at each point in time. To compute the variance over time we simply take the average of the different values.

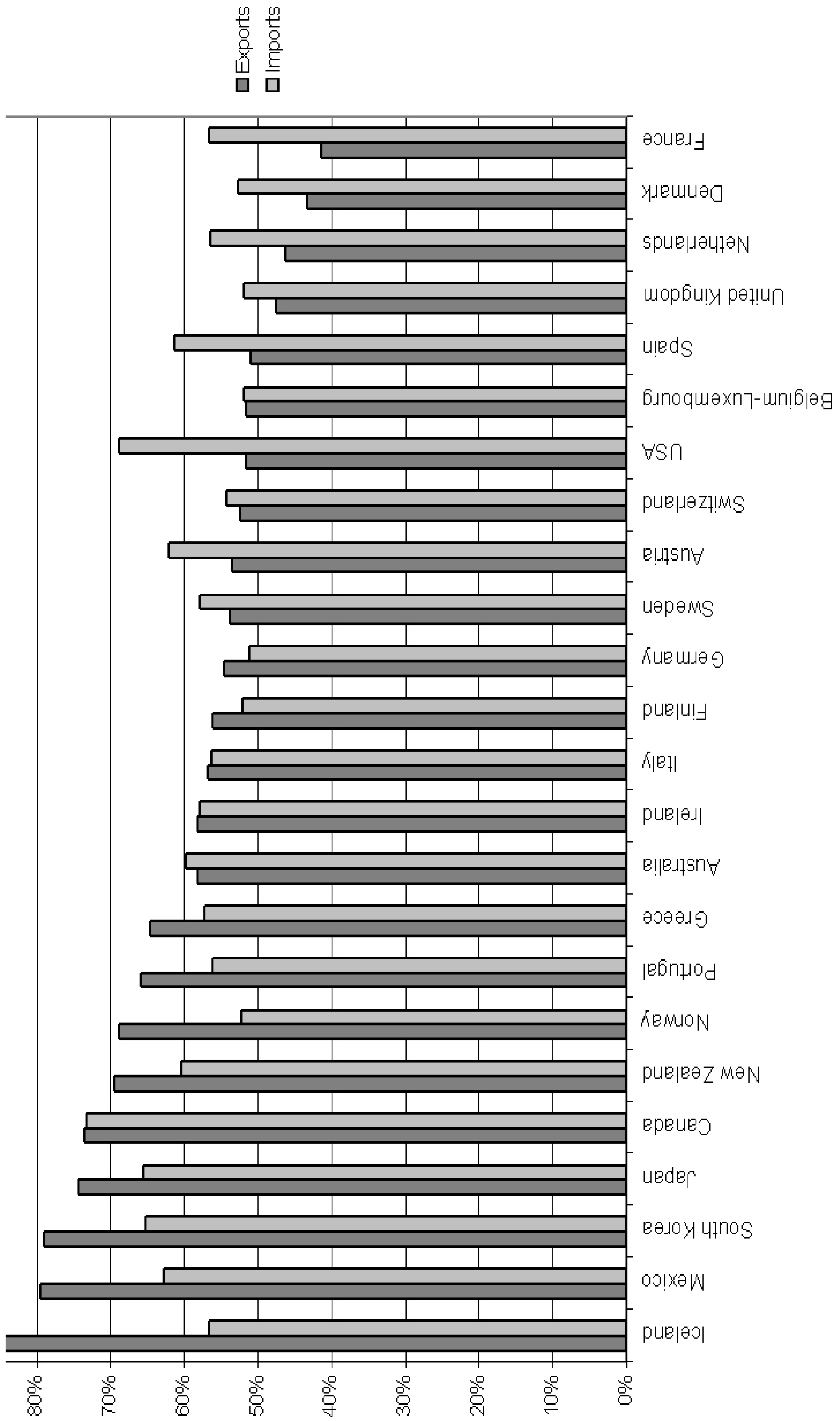


Figure 1: Ratio of Top 5 Industries to Total Trade. Concentration of Exports and Imports by Industry.Source: NBER - UCD - Statistics Canada Trade Data, 1970-1997

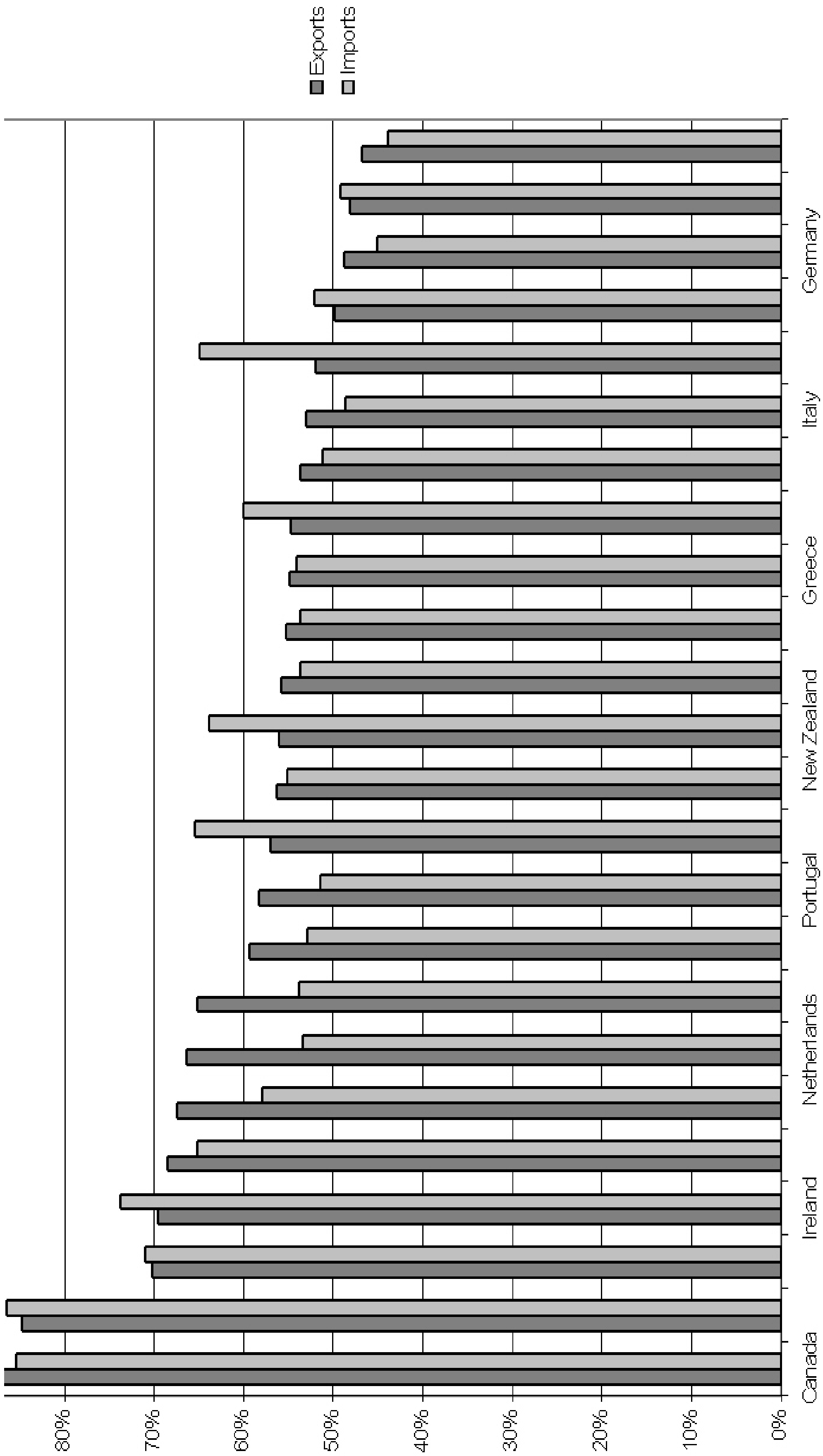


Figure 2: Ratio of Top 5 Trading Partners to Total Trade. Concentration of Exports and Imports by Trading Partner. Source: NBER - UCD - Statistics Canada Trade Data, 1970-1997

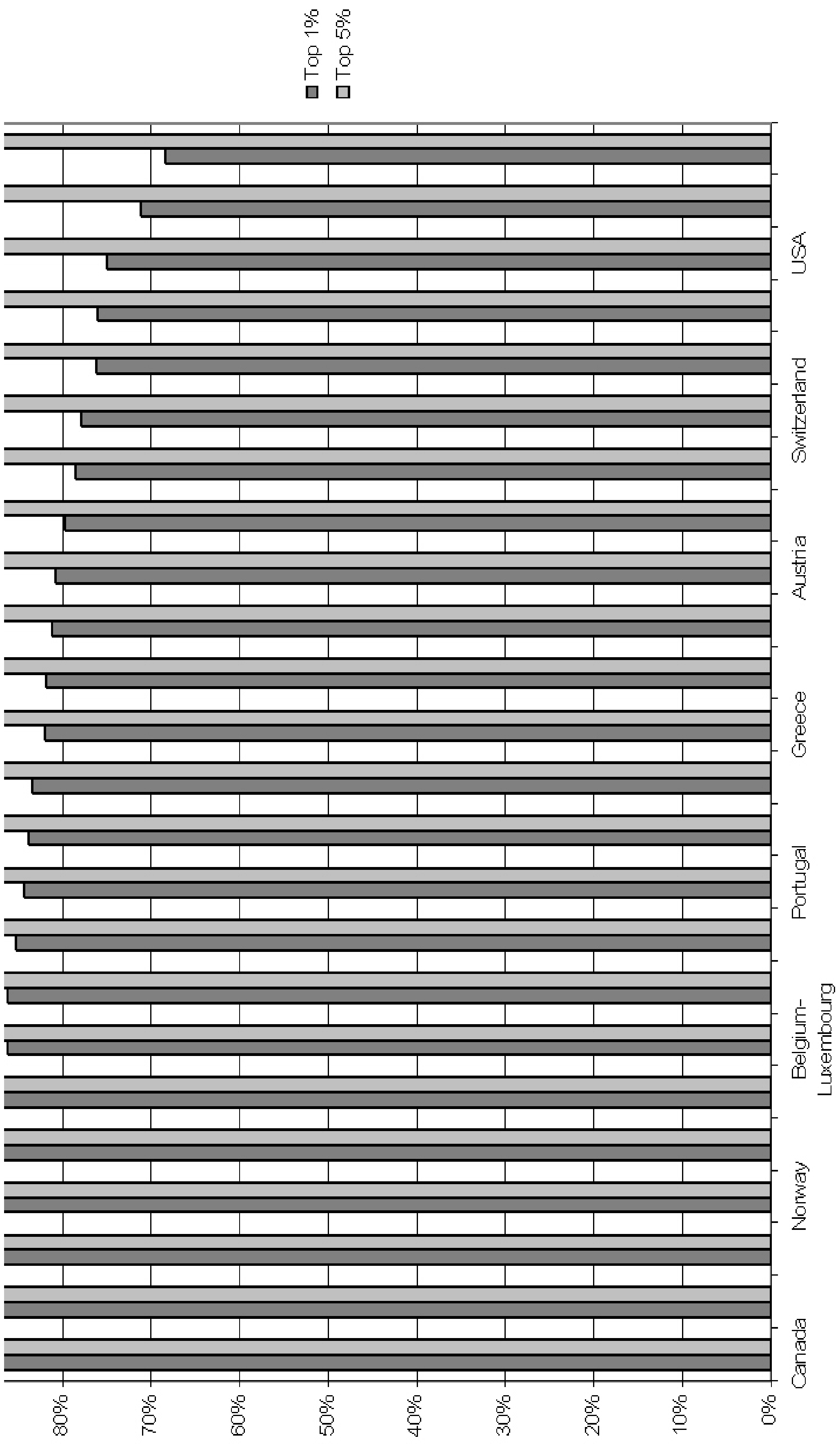


Figure 3: Ratio of Top 1% and Top 5% Bilateral Trade Flows to Total Exports. Source: NBER - UCD - Statistics Canada, Trade Data 1970-1997

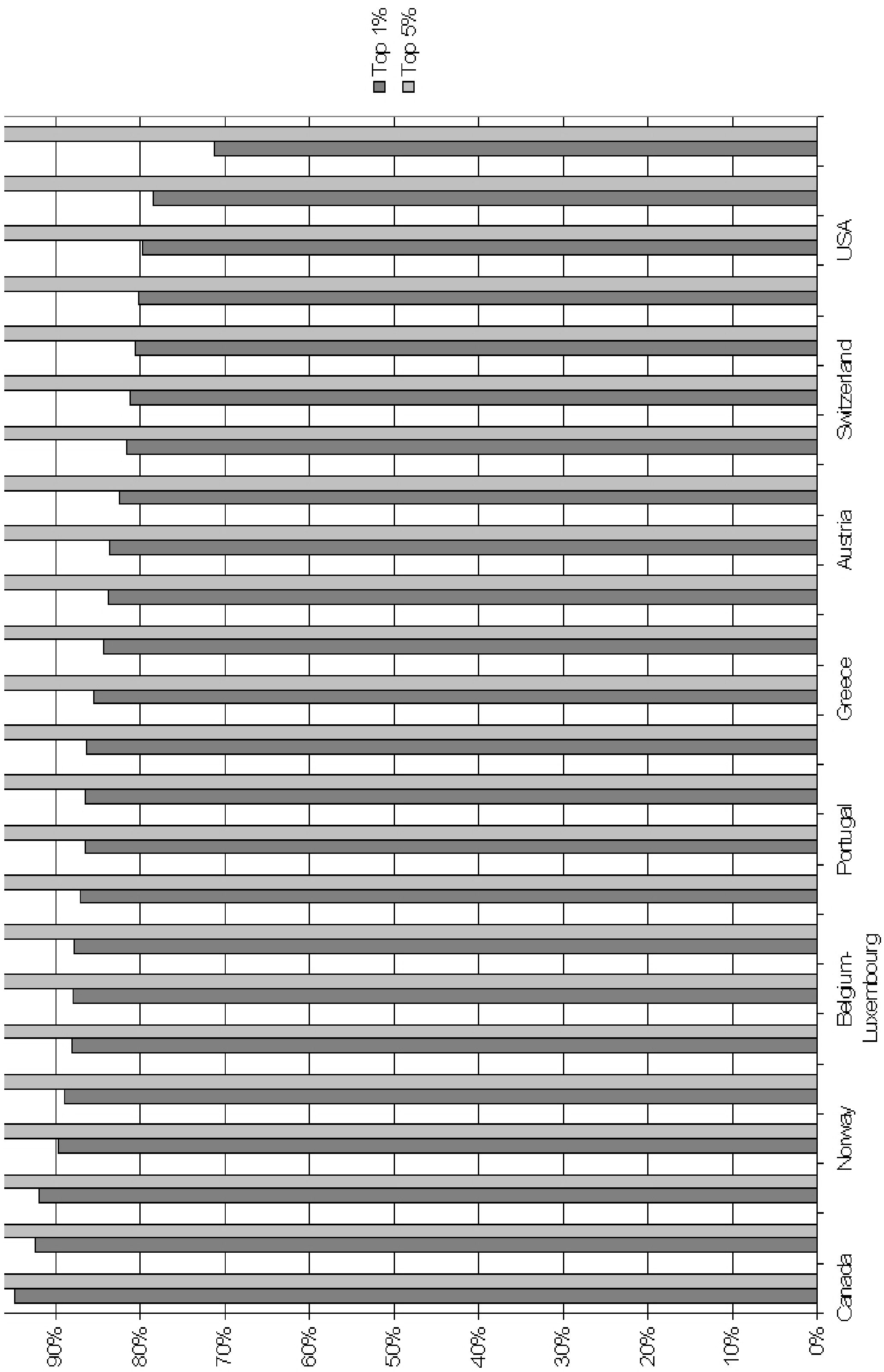


Figure 4: Ratio of Top 1% and Top 5% Bilateral Trade Flows to Total Imports. Source: NBER - UCD - Statistics Canada Trade Data, 1970-1997

Table 1: Concentration Ratios for all Bilateral Trade Flows

| In % | Exports | | | Imports | | |
|---|---|---|---|---|---|---|
| Country | Top 1% | Top 5% | Top 10% | Top 1% | Top 5% | Top 10% |
| Canada | 95.4 | 99.6 | 100.0 | 94.8 | 99.8 | 100.0 |
| USA | 75.0 | 96.0 | 99.3 | 88.1 | 99.5 | 100.0 |
| Mexico | 94.7 | 99.8 | 100.0 | 91.9 | 99.8 | 100.0 |
| Japan | 86.1 | 98.6 | 99.8 | 89.6 | 99.7 | 100.0 |
| South Korea | 90.7 | 99.5 | 100.0 | 92.4 | 99.9 | 100.0 |
| Belgium-Luxembourg | 86.2 | 97.4 | 99.4 | 87.7 | 99.5 | 100.0 |
| Denmark | 79.7 | 97.8 | 99.7 | 79.7 | 99.1 | 100.0 |
| France | 68.3 | 91.9 | 97.6 | 83.6 | 98.9 | 99.9 |
| Germany | 78.5 | 96.9 | 99.2 | 81.1 | 99.1 | 100.0 |
| Greece | 81.9 | 99.0 | 100.0 | 83.8 | 99.4 | 100.0 |
| Ireland | 87.3 | 99.3 | 100.0 | 89.0 | 99.8 | 100.0 |
| Italy | 76.0 | 96.2 | 99.2 | 82.4 | 99.0 | 100.0 |
| Netherlands | 81.2 | 96.2 | 99.0 | 85.5 | 99.3 | 100.0 |
| Portugal | 84.3 | 98.9 | 100.0 | 86.6 | 99.7 | 100.0 |
| Spain | 76.1 | 96.4 | 99.4 | 86.4 | 99.5 | 100.0 |
| United Kingdom | 71.1 | 94.6 | 98.6 | 80.2 | 98.9 | 100.0 |
| Austria | 80.8 | 98.2 | 99.8 | 87.1 | 99.8 | 100.0 |
| Finland | 83.9 | 99.2 | 100.0 | 78.4 | 99.3 | 100.0 |
| Iceland | 83.5 | 99.0 | 100.0 | 71.2 | 98.6 | 100.0 |
| Norway | 88.0 | 99.0 | 99.9 | 80.6 | 99.4 | 100.0 |
| Sweden | 81.8 | 98.5 | 99.9 | 81.6 | 99.4 | 100.0 |
| Switzerland | 77.9 | 97.5 | 99.6 | 87.9 | 99.6 | 100.0 |
| Australia | 86.8 | 99.4 | 100.0 | 86.3 | 99.5 | 100.0 |
| New Zealand | 85.3 | 99.5 | 100.0 | 84.3 | 99.2 | 100.0 |
| Mean | 82.5 | 97.8 | 99.6 | 85.0 | 99.4 | 100.0 |
| Median | 82.7 | 98.5 | 99.8 | 85.9 | 99.5 | 100.0 |

Each cell contains the 1971-1997 average of the proportion of the top 1%, 5%, and 10% of bilateral trade flows with respect to the total flows.
Source: NBER - UCD - Statistics Canada Trade Data, 1970-1997

Table 2: Concentration Ratios for Top 25 and Top 100 Bilateral Trade Flows

| In % | Exports | | Imports | |
|---|---|---|---|---|
| Country | Top 25 | Top 100 | Top 25 | Top 100 |
| Canada | 89.3 | 96.2 | 85.9 | 96.6 |
| USA | 52.1 | 77.0 | 67.5 | 90.0 |
| Mexico | 88.8 | 97.4 | 83.8 | 97.4 |
| Japan | 67.7 | 88.3 | 68.2 | 92.0 |
| South Korea | 75.6 | 92.9 | 79.6 | 96.4 |
| Belgium-Luxembourg | 66.3 | 87.4 | 62.5 | 90.7 |
| Denmark | 52.6 | 82.2 | 58.4 | 89.7 |
| France | 42.8 | 70.3 | 57.5 | 86.1 |
| Germany | 52.1 | 80.1 | 52.2 | 84.0 |
| Greece | 61.6 | 88.3 | 66.2 | 91.1 |
| Ireland | 70.0 | 90.6 | 75.1 | 94.7 |
| Italy | 51.4 | 78.0 | 59.0 | 85.8 |
| Netherlands | 60.0 | 82.7 | 59.6 | 88.3 |
| Portugal | 62.9 | 88.4 | 66.8 | 93.4 |
| Spain | 53.2 | 78.8 | 64.1 | 89.3 |
| United Kingdom | 45.0 | 72.7 | 52.2 | 83.7 |
| Austria | 59.6 | 85.1 | 70.5 | 92.3 |
| Finland | 64.6 | 89.4 | 60.8 | 91.1 |
| Iceland | 90.3 | 99.4 | 67.6 | 95.4 |
| Norway | 74.4 | 92.4 | 59.9 | 92.4 |
| Sweden | 55.7 | 84.9 | 58.0 | 90.3 |
| Switzerland | 55.1 | 81.7 | 65.0 | 91.9 |
| Australia | 65.3 | 90.2 | 68.9 | 92.6 |
| New Zealand | 68.1 | 92.5 | 73.2 | 93.8 |
| Mean | 63.5 | 86.1 | 65.9 | 91.2 |
| Median | 62.2 | 87.8 | 65.6 | 91.5 |

Each cell contains the 1971-1997 average of the proportion for the largest 25 or 100 bilateral trade flows with respect to the total flows.
Source: NBER - UCD - Statistics Canada Trade Data, 1970-1997

Table 3: Herfindhal Index for Industry Flows

| Country | Exports | Imports |
|---|---|---|
| Canada | 0.21 | 0.18 |
| USA | 0.08 | 0.15 |
| Mexico | 0.30 | 0.11 |
| Japan | 0.21 | 0.24 |
| South Korea | 0.25 | 0.17 |
| Belgium-Luxembourg | 0.08 | 0.08 |
| Denmark | 0.06 | 0.092 |
| France | 0.06 | 0.12 |
| Germany | 0.09 | 0.09 |
| Greece | 0.12 | 0.13 |
| Ireland | 0.11 | 0.10 |
| Italy | 0.10 | 0.14 |
| Netherlands | 0.07 | 0.11 |
| Portugal | 0.16 | 0.12 |
| Spain | 0.08 | 0.18 |
| United Kingdom | 0.07 | 0.08 |
| Austria | 0.08 | 0.10 |
| Finland | 0.09 | 0.08 |
| Iceland | 0.57 | 0.10 |
| Norway | 0.27 | 0.08 |
| Sweden | 0.09 | 0.10 |
| Switzerland | 0.08 | 0.08 |
| Australia | 0.09 | 0.10 |
| New Zealand | 0.152 | 0.11 |
| Mean | 0.14 | 0.12 |
| Median | 0.09 | 0.10 |

Each cell contains the 1971-1997 average Herfindahl Index of flows aggregated by industry, computed as:

$$IH_{ct} = \sum_i \theta_{cit}^2 \quad \text{where } \theta_{cit} = \frac{\sum_{c'} S_{cc'it}}{\sum_{c'i} S_{cc'it}}$$

Source: NBER - UCD - Statistics Canada Trade Data, 1970-1997

Table 4: Herfindhal Index for Country Flows

| Country | Exports | Imports |
|---|---|---|
| Canada | 0.64 | 0.53 |
| USA | 0.12 | 0.10 |
| Mexico | 0.49 | 0.53 |
| Japan | 0.18 | 0.08 |
| South Korea | 0.19 | 0.15 |
| Belgium-Luxembourg | 0.13 | 0.11 |
| Denmark | 0.08 | 0.08 |
| France | 0.06 | 0.07 |
| Germany | 0.06 | 0.06 |
| Greece | 0.09 | 0.08 |
| Ireland | 0.20 | 0.23 |
| Italy | 0.08 | 0.07 |
| Netherlands | 0.13 | 0.08 |
| Portugal | 0.09 | 0.08 |
| Spain | 0.08 | 0.08 |
| United Kingdom | 0.06 | 0.06 |
| Austria | 0.13 | 0.20 |
| Finland | 0.09 | 0.09 |
| Iceland | 0.13 | 0.09 |
| Norway | 0.12 | 0.08 |
| Sweden | 0.07 | 0.08 |
| Switzerland | 0.08 | 0.13 |
| Australia | 0.11 | 0.11 |
| New Zealand | 0.10 | 0.11 |
| Mean | 0.15 | 0.14 |
| Median | 0.11 | 0.09 |

Each cell contains the 1971-1997 average Herfindahl Index of flows aggregated by country, computed as:

$$CH_{ct} = \sum_{c'} \theta_{cc't}^2 \quad \text{where } \theta_{cc't} = \frac{\sum_i S_{cc'it}}{\sum_{c'i} S_{cc'it}}$$

Source: NBER - UCD - Statistics Canada Trade Data, 1970-1997

Table 5: Herfindhal Index for Overall Flows

| Country | Exports | Imports |
|---|---|---|
| Canada | 0.19 | 0.15 |
| USA | 0.03 | 0.04 |
| Mexico | 0.14 | 0.08 |
| Japan | 0.08 | 0.05 |
| South Korea | 0.08 | 0.07 |
| Belgium-Luxembourg | 0.03 | 0.03 |
| Denmark | 0.02 | 0.02 |
| France | 0.01 | 0.03 |
| Germany | 0.02 | 0.02 |
| Greece | 0.04 | 0.04 |
| Ireland | 0.06 | 0.05 |
| Italy | 0.02 | 0.03 |
| Netherlands | 0.03 | 0.02 |
| Portugal | 0.03 | 0.03 |
| Spain | 0.02 | 0.04 |
| United Kingdom | 0.01 | 0.02 |
| Austria | 0.03 | 0.05 |
| Finland | 0.04 | 0.04 |
| Iceland | 0.10 | 0.04 |
| Norway | 0.07 | 0.02 |
| Sweden | 0.02 | 0.03 |
| Switzerland | 0.02 | 0.03 |
| Australia | 0.04 | 0.04 |
| New Zealand | 0.05 | 0.05 |
| Mean | 0.05 | 0.04 |
| Median | 0.03 | 0.04 |

Each cell contains the 1971-1997 average Herfindahl of overall, computed as:

$$OH_{ct} = \sum_{c'i} \theta^2_{cc'it} \quad \text{where } \theta_{cit} = \frac{S_{cc'it}}{\sum_{c'i} S_{cc'it}}$$

Source: NBER - UCD - Statistics Canada Trade Data, 1970-1997

Table 6: Median and Weighted Idiosyncratic Shocks to Industry Flows

| In % | Exports | | Imports | |
|---|---|---|---|---|
| Country | Weighted Avg. | Median | Weighted Avg. | Median |
| Canada | 10 | 19 | 10 | 72 |
| USA | 5 | 16 | 6 | 33 |
| Mexico | 14 | 17 | 13 | 32 |
| Japan | 5 | 87 | 7 | 114 |
| South Korea | 11 | 37 | 14 | 125 |
| Belgium-Luxembourg | 9 | 24 | 9 | 9 |
| Denmark | 8 | 71 | 11 | 71 |
| France | 5 | 19 | 8 | 54 |
| Germany | 5 | 22 | 9 | 78 |
| Greece | 9 | 33 | 12 | 29 |
| Ireland | 13 | 23 | 18 | 109 |
| Italy | 5 | 24 | 8 | 22 |
| Netherlands | 8 | 14 | 8 | 74 |
| Portugal | 8 | 12 | 16 | 42 |
| Spain | 6 | 19 | 9 | 24 |
| United Kingdom | 5 | 12 | 6 | 6 |
| Austria | 8 | 26 | 12 | 62 |
| Finland | 12 | 34 | 11 | 34 |
| Iceland | 6 | 30 | 15 | 31 |
| Norway | 11 | 39 | 15 | 33 |
| Sweden | 7 | 47 | 12 | 90 |
| Switzerland | 7 | 34 | 10 | 4 |
| Australia | 9 | 28 | 14 | 10 |
| New Zealand | 12 | 78 | 17 | 98 |
| Mean | 8.4 | 31.9 | 11.2 | 52.2 |
| Median | 8.2 | 25.0 | 11.1 | 37.8 |

For each industry in each country, we compute the standard deviation of the industry flows' growth rate (de-meaned of the overall growth rate) as:

$$\frac{\sum_{i,t}(s_{cit} - s_{cit-1}) - (s_{ct} - s_{ct-1})}{T-1}$$

We report the median and a weighted average (with the weights being equal to the square root of total flows in each industry).
Source: NBER - UCD - Statistics Canada Trade Data, 1970-1997

Table 7: Median and Weighted Indiosyncratic Shocks to Country Flows

| In % | Exports | | Imports | |
|---|---|---|---|---|
| Country | Weighted Avg. | Median | Weighted Avg. | Median |
| Canada | 8 | 3 | 8 | 3 |
| USA | 6 | 2 | 7 | 3 |
| Mexico | 10 | 14 | 9 | 26 |
| Japan | 8 | 2 | 10 | 3 |
| South Korea | 13 | 13 | 15 | 9 |
| Belgium-Luxembourg | 6 | 2 | 8 | 3 |
| Denmark | 8 | 4 | 8 | 6 |
| France | 4 | 2 | 7 | 2 |
| Germany | 5 | 2 | 7 | 2 |
| Greece | 12 | 6 | 12 | 4 |
| Ireland | 13 | 5 | 9 | 3 |
| Italy | 5 | 2 | 8 | 3 |
| Netherlands | 6 | 2 | 8 | 2 |
| Portugal | 6 | 7 | 7 | 3 |
| Spain | 8 | 3 | 10 | 3 |
| United Kingdom | 5 | 1 | 7 | 2 |
| Austria | 10 | 2 | 9 | 3 |
| Finland | 12 | 11 | 11 | 7 |
| Iceland | 9 | 27 | 9 | 11 |
| Norway | 10 | 8 | 8 | 4 |
| Sweden | 8 | 5 | 9 | 10 |
| Switzerland | 8 | 2 | 10 | 9 |
| Australia | 7 | 26 | 7 | 37 |
| New Zealand | 15 | 5 | 10 | 4 |
| Mean | 8.4 | 6.5 | 8.8 | 6.8 |
| Median | 7.8 | 3.1 | 8.7 | 3.3 |

For each country's trading partner, we compute the standard deviation of the trading partner's flows' growth rate (de-meaned of the overall growth rate) as:

$$\frac{\sum_{c',t}(s_{cc't} - s_{cc't-1}) - (s_{ct} - s_{ct-1})}{T-1}$$

We report the median and a weighted average (with the weights being equal to the square root of total flows in each industry).
Source: NBER - UCD - Statistics Canada Trade Data, 1970-1997

Table 8: Lambda Ratio using Industry and Country Dummies

| In % | Exports | | Imports | |
|---|---|---|---|---|
| Country | $\widehat{\Lambda}_c$ | 95% Conf. Int. | $\Lambda_c$ | 95% Conf. Int. |
| Canada | 66 | [33,100] | 51 | [26,100] |
| USA | 13 | [6,100] | 32 | [16,100] |
| Mexico | 44 | [22,100] | 32 | [16,100] |
| Japan | 18 | [9,100] | 40 | [20,100] |
| South Korea | 30 | [15,100] | 76 | [39,100] |
| Belgium-Luxembourg | 27 | [14,100] | 27 | [14,100] |
| Denmark | 21 | [11,100] | 38 | [19,100] |
| France | 6.4 | [3,100] | 15 | [7.8,100] |
| Germany | 8.2 | [4,100] | 10 | [4.8,100] |
| Greece | 48 | [24,100] | 30 | [15,100] |
| Ireland | 127 | [64,100] | 45 | [23,100] |
| Italy | 14 | [7,100] | 39 | [20,100] |
| Netherlands | 16 | [8,100] | 23 | [11,100] |
| Portugal | 21 | [11,100] | 29 | [15,100] |
| Spain | 26 | [13,100] | 35 | [18,100] |
| United Kingdom | 13 | [7,100] | 15 | [7.4,100] |
| Austria | 17 | [9,100] | 33 | [17,100] |
| Finland | 32 | [16,100] | 17 | [8.7,100] |
| Iceland | 54 | [27,100] | 47 | [24,100] |
| Norway | 60 | [30,100] | 23 | [11,100] |
| Sweden | 21 | [10,100] | 25 | [13,100] |
| Switzerland | 10 | [5,100] | 19 | [9.4,100] |
| Australia | 62 | [31,100] | 21 | [11,100] |
| New Zealand | 60 | [30,100] | 46 | [23,100] |
| Median | 24 | | 31 | |

$\widehat{\Lambda}_c$ measures the fraction of the variance of exports/imports growth attributable to idiosyncratic shocks, formally:

$$\widehat{\Lambda}_c = \frac{Var_t\left(\widehat{\eta_{ct}}\right) + Var_t\left(e_{ct}\right)}{Var_t\left(\widehat{\eta_{ct}}\right) + Var_t\left(\widehat{\gamma_{ct}}\right)}$$

Table 9: Lambda Ratio using Mid-Point Growth Rates

| In % | Exports | | Imports | | Trade | |
|---|---|---|---|---|---|---|
| Country | $\widehat{\Lambda}_c$ | 95% Conf Int. | $\widehat{\Lambda}_c$ | 95% Conf Int. | $\widehat{\Lambda}_c$ | 95% Conf Int. |
| Canada | 48 | [24,100] | 37 | [19,100] | 57 | [29,100] |
| USA | 13 | [6,100] | 27 | [14,100] | 48 | [24,100] |
| Mexico | 33 | [17,100] | 18 | [9,100] | 42 | [21,100] |
| Japan | 24 | [12,100] | 40 | [20,100] | 60 | [30,100] |
| South Korea | 37 | [18,100] | 67 | [34,100] | 46 | [23,100] |
| Belgium-Luxembourg | 20 | [10,100] | 20 | [10,100] | 71 | [36,100] |
| Denmark | 17 | [8,100] | 31 | [16,100] | 60 | [30,100] |
| France | 6 | [3,100] | 15 | [8,100] | 63 | [32,100] |
| Germany | 7 | [3,100] | 8 | [4,100] | 57 | [29,100] |
| Greece | 52 | [26,100] | 35 | [18,100] | 67 | [34,100] |
| Ireland | 71 | [36,100] | 52 | [26,100] | 52 | [26,100] |
| Italy | 11 | [5,100] | 34 | [17,100] | 64 | [32,100] |
| Netherlands | 14 | [7,100] | 15 | [8,100] | 55 | [28,100] |
| Portugal | 22 | [11,100] | 24 | [12,100] | 56 | [28,100] |
| Spain | 20 | [10,100] | 33 | [16,100] | 61 | [31,100] |
| United Kingdom | 11 | [6,100] | 17 | [9,100] | 53 | [27,100] |
| Austria | 11 | [6,100] | 26 | [13,100] | 60 | [30,100] |
| Finland | 30 | [15,100] | 15 | [7,100] | 45 | [23,100] |
| Iceland | 156 | [79,100] | 80 | [40,100] | 50 | [25,100] |
| Norway | 48 | [24,100] | 20 | [10,100] | 51 | [26,100] |
| Sweden | 16 | [8,100] | 25 | [13,100] | 54 | [27,100] |
| Switzerland | 7 | [4,100] | 14 | [7,100] | 63 | [32,100] |
| Australia | 56 | [28,100] | 14 | [7,100] | 38 | [19,100] |
| New Zealand | 52 | [26,100] | 102 | [52,100] | 40 | [20,100] |
| Median | 21 | | 26 | | 55 | |

$\widehat{\Lambda}_c$ measures the fraction of the variance of exports/imports growth attributable to idiosyncratic shocks, formally:

$$\widehat{\Lambda}_c = \frac{Var_t\left(\widehat{\eta_{ct}}\right) + Var_t\left(e_{ct}\right)}{Var_t\left(\widehat{\eta_{ct}}\right) + Var_t\left(\widehat{\gamma_{ct}}\right)}$$

Table 10: Cumulative Export Share by Top Firms

| In % | In Sample | | Total Exports | |
|---|---|---|---|---|
| Top | 1983 | 1999 | 1983 | 1999 |
| 1 | 9.5 | 10.6 | 6.7 | 8.7 |
| 2 | 16.8 | 15.3 | 11.8 | 12.6 |
| 3 | 20.7 | 19.5 | 14.6 | 16.1 |
| 4 | 24.5 | 23.6 | 17.2 | 19.5 |
| 5 | 28.2 | 27.7 | 19.8 | 22.9 |
| 10 | 40.7 | 40.6 | 28.6 | 33.5 |
| 15 | 49.5 | 49.0 | 34.8 | 40.4 |
| 20 | 56.5 | 55.0 | 39.8 | 45.4 |
| 25 | 62.2 | 59.5 | 43.8 | 49.1 |
| 50 | 75.7 | 72.5 | 53.3 | 59.8 |

The number in cell each represents the percentage of exports by top firms with respect to total exports. In the first two columns the percentage is with respect to total exports within our sample while in the third and fourth columns it is with respect to total exports as reported by OECD.
Source: DBJ, OECD.

Table 11: Average Growth Rate and Volatility for the Largest Japanese Exporting Firms

| In % | | |
|---|---|---|
| Company | Av. Idiosyncratic Growth Rate | Std. Dev of Idiosyncratic Growth Rates |
| Toyota Motor Corp. | 3.10 | 6.80 |
| Nissan Motor Co., Ltd. | -2.98 | 4.96 |
| Honda Motor Co., Ltd. | 0.63 | 6.04 |
| Matsushita Electric Industrial Co.,Ltd. | 0.32 | 11.94 |
| Mazda Motor Corp. | -1.47 | 7.75 |
| Sony Corp. | 2.09 | 9.09 |
| Hitachi,Ltd. | -2.22 | 7.36 |
| Toshiba Corp. | 1.33 | 11.62 |
| Canon Inc. | 4.40 | 8.18 |
| Nippon Steet Corp. | -0.06 | 6.11 |
| Nec Corp. | 0.43 | 9.57 |
| Mitsubishi Motors Corp. | 0.29 | 5.17 |
| Mitsuboshi Heavy Industries, Ltd. | 1.43 | 10.00 |
| Isuzu Motors Ltd. | 2.29 | 15.96 |
| Sharp Corp. | -0.80 | 7.17 |
| Mitsubishi Electric Corp. | 0.75 | 7.51 |
| Suzuki Motor Corp. | 2.91 | 13.01 |
| Fujitsu Ltd. | 7.94 | 20.24 |
| NKK Corp. | 0.59 | 12.84 |
| Victor Co. of Japan, Ltd. | -4.37 | 9.11 |
| Sumitomo Metal Industries, Ltd. | -0.61 | 6.91 |
| Sanyo Electric Co., Ltd. | -6.28 | 7.65 |
| Kawasaki Steel Corp. | 0.36 | 5.98 |
| Fuji Heavy Industries, Ltd. | 2.72 | 17.79 |
| Kawasaki Heavy Industries, Ltd. | -0.05 | 14.22 |
| | Median (25) | 8.18 |
| | W. Avg (25) | 8.91 |
| | Median (All) | 21.47 |
| | W. Avg. (All) | 37.91 |

For each firm, the idiosyncratic growth rate is defined as $(s_{fit} - s_{it})$, its average as $\frac{1}{T}\sum_t(s_{fit} - s_{it})$, and its standard deviation as $\frac{1}{T-1}\sum_t(s_{fit} - s_{it})$