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Abstract

We develop an empirical framework that allows us to account for producer-country, industry, and demand shocks as drivers of volatility at the industry level in open economies. Our methodology separately accounts for demand shocks originating in the home and foreign markets. Using a panel of manufacturing and trade data, our findings suggest that, independent of the level of aggregation, output volatility is driven primarily by shocks originating in the destination markets for an industry's sales (demand shocks) including home markets. Further, we show that industries more open to trade are more volatile because intra-industry imports increase the uncertainty of 1) domestic demand, and 2) production through greater exposure to foreign shocks.

JEL Classification: F15, F44, F61.

Key Words: Output Volatility, Demand Shocks, Trade, Industry-level Data

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Non-technical summary

In modern theories of economic fluctuations, shocks that drive macroeconomic uncertainty are transformed into business cycles through a propagation mechanism. One such propagation mechanism can be inter-industry linkages: volatility at the industry level can translate into aggregate macroeconomic volatility. For this reason, understanding the sources of risk at the industry level is important. This is even more important in open economies, where industries are exposed to shocks arising in industries located in other countries.

In this paper, we ask the question *what are the key sources of industry-level volatility in open economies?* To do so, we separately identify how producer-country, industry, and demand shocks affect output volatility at the industry level as well as at the aggregate level. That is, we identify shocks that arise primarily at the level of the country where the industry is located, at the level of the industry regardless of location, and shocks arising at the destination markets for the industry's products (which we loosely label demand shocks). Importantly, we explore the role played by international trade in two ways. First, our methodology separately accounts for demand shocks originating in the home and foreign markets. Second, we estimate the effect of trade openness on industrial volatility and its components allowing us to identify the main channels through which international trade affects industrial output volatility.

We exploit a multi-country, multi-industry dataset that is combined with bi-lateral trade statistics such that our unit of analysis is the amount sold in any destination market by an industry located in a particular country at a point in time. We use data for 34 countries, 19 manufacturing sectors, and 85 destination markets from 1980 to 2000. Methodologically, we develop a decomposition of this data structure that allows us to isolate the above mentioned sources of volatility.

Our results suggest that countries that are volatile in one industry tend to be volatile in other industries as well. Put simply, industrial output volatility does not depend substantially on industry-specific factors. It depends mostly on country-specific factors, such as exposure to aggregate shocks, sale diversification patterns, or both. Our decompositions show that demand risks account for most of the volatility of industrial output, with the contribution of trade-related demand risks depending on the composition of export destinations. We find that global demand risks and idiosyncratic risk to industries are very important drivers of volatility. Interestingly, at the aggregate level, idiosyncratic demand shocks appear to reduce volatility. This is because these shocks covary strongly negatively between industries, which we term "diversification through covariance".

Finally, we find evidence that exports and intra-industry imports have opposite effects on industrial output volatility. In particular, exports reduce industrial volatility as they are targeted to countries with lower global demand volatility than the home market's (a diversification effect). Intra-industry imports drive the positive relationship between industrial output volatility and trade at the industry level by increasing uncertainty in both domestic demand and production (competition and supply-chain effects).

1 Introduction

The identification of the sources of macroeconomic fluctuations is at the heart of a large empirical literature on business cycles. Recently, emphasis has shifted towards understanding the role of shocks to disaggregated industries in driving aggregate uncertainty. However, we are still a long way away from understanding the main sources of industrial output volatility in open economies where international trade could be an important transmission mechanism. This is important, as evidence suggests that the volatility of output at the industry level has far-reaching effects on industries' competitive structure and the welfare of various economic agents.[1]

In this paper, we provide new evidence on the main sources of industrial output volatility with special focus on the role of domestic and international demand shocks. We separately identify how producer-country, industry, and demand shocks affect output volatility at the industry level as well as at the aggregate level.[2] Importantly, we explore the role played by international trade in two ways. First, our methodology separately accounts for demand shocks originating in the home and foreign markets. Second, we estimate the effect of trade openness on industrial volatility and its components allowing us to identify the main channels through which international trade affects industrial output volatility. To pursue these goals, we undertake three different, but closely related, exercises.

In the first exercise, we develop and estimate a decomposition of industrial output volatility that accounts for shocks specific to the producer country, industry, and destination markets, respectively. The main feature of our approach is that, contrary to previous studies, our basic unit of analysis is the rate of growth of industry-destination sales by country. By accounting for the country of destination of industry sales, we can separate the sources of risk that are specific to industries, production location, and demand origin (including the home market). This is not possible when one only observes industry output by country.

In order to explicitly account for shocks arising from destination markets, we extend the Koren and Tenreyro (2007) methodology at the industry level. More specifically, we

[1]Mills and Schumann (1985), for instance, show that small firms are more likely to survive in industries with larger demand fluctuations due to their flexibility. Collard-Wexler (2013) finds that lower demand volatility in the U.S. ready-mix concrete industry reduces industry dynamics and increases competition, with lower prices benefitting consumers but not producers. In addition, the firm size distribution shifts toward large firms, potentially increasing the workers' income risk (Comin et al, 2009).

[2]By "demand" shocks we mean sources of risk associated with the destination of an industry's sales. These are demand shocks from the industry's point of view. These shocks, however, could be related to productivity or preference shocks in destination markets and thus should not be interpreted structurally as the traditional distinction in macroeconomics between supply and demand shocks.

start by defining the innovations[3] in the growth rate of an industry's total sales as the weighted average of innovations in the growth rate of its sales to each destination market (home or foreign). We then specify and estimate a factor model for innovations in the growth rate of an industry's sales to each market that separates shocks specific to the producer country, industry, destination market, and a residual term. Next, we derive an expression that decomposes the volatility of industrial output into its components constructed using the estimated shocks.

The first component is termed *global demand risk*. The shocks underlying this risk include any economic or taste changes that affect the consumption of each destination market *globally*, i.e., across all goods independent of their origin. Even though these shocks are global, the risk they generate varies by supplying industry depending on the distribution of each industry's sales across destination markets (including home). The second component, *idiosyncratic demand risk*, is related to demand shocks in destination markets that affect goods of a particular producer country, industry, or both. Changes in sectoral trade policies or bilateral trade arrangements, and changes in preferences for goods of a specific industry, country or both would fall into this category. The more concentrated an industry's sales are in markets with volatile idiosyncratic demands, the higher the output volatility of that industry is. The third component, *producer country risk*, is related to shocks that affect a country's ability to produce independent of the industry and destination market. These shocks are thus specific to the location where production takes place. These can be related, for instance, to country-specific changes in certain policies that affect credit or labor markets.[4] The fourth component, *industry risk*, is related to shocks that affect a particular industry irrespective of its location and the destination market of its products. This type of risk can be associated with changes in production and distribution technologies that are specific to certain industries, or global trade agreements for specific goods. The remaining components are terms related to the covariance between any pair of producer country-, industry-, and demand-specific shocks.

Empirically, we estimate these components by combining production data from CEPII TradeProd and trade data from the CHELEM database for 34 countries, 85 destination markets and 19 industries between 1980 and 2000. There are three main findings. First, we find that countries that have high output volatility in some industries also have high

[3] These are deviations from the mean over time.

[4] As will become clear below, these shocks can be correlated. For instance, if a specific macroeconomic policy affects both the ability of industries to produce and the demand for all goods independent of their origin, then the producer country and global demand shocks will display a positive covariance for this country.

volatility in other industries, while industries that are volatile in some countries are not necessarily volatile in other countries. In other words, industry-specific shocks play a limited role in explaining output volatility at the industry-level. Second, global and idiosyncratic demand risks are the driving determinants of industrial output volatility. Last, demand uncertainty in the home market accounts for more than half of both demand risks. However, there is substantial variation in the contribution of demand risk in the home market across countries, even when one focuses on countries with similar level of trade openness. In other words, the composition of export destinations matters in determining the effect of trade on demand risks, and consequently volatility at the industry level.

In the second exercise, we quantify the contribution of each individual shock by calculating counterfactual innovations in sales growth when one drops each shock in turn. At the industry level, we show that the amount of volatility due to each type of shock depends on the risk it generates as well as its covariance with the other shocks. At the aggregate (manufacturing) level, the amount of volatility due to each type of shock is a function of its effect on each industry's output volatility and the covariance with other industries. Our counterfactual estimates imply that, without global or idiosyncratic demand shocks, industrial risk would be much lower for most countries. But, without producer country or industry shocks, little would change. Similar results hold at the aggregate level, except for idiosyncratic demand shocks. Without idiosyncratic demand shocks, manufacturing volatility would be higher for most countries. This suggests a "diversification through covariance" effect in idiosyncratic demand risk: idiosyncratic demand risk from destination markets covaries negatively between industries, reducing aggregate (manufacturing) volatility.

In the last exercise, we examine the relationship between trade and output volatility at the industry level. More precisely, we estimate the effect of trade openness on industrial output volatility and our estimates of its main components, i.e., global and idiosyncratic demand risks. Trade can affect the volatility of an industry's output through both exports and imports. An industry's exports can hedge its output volatility if global or idiosyncratic demand uncertainty in foreign destination markets is lower than that in the home market, i.e., through their *diversification effect*. Imports in a given industry can instead increase volatility through a *supply-chain effect*, if intra-industry imported inputs expose local production to foreign shocks, or a *competition effect*, if imported varieties make domestic demand more volatile as additional consumption goods become available. Our results suggest that industries that are more open to trade are more volatile mainly because intra-industry imports increase idiosyncratic demand risk through both supply-chain and competition effects. We also find evidence in favor of the diversification effect of exports.

This paper closely relates to the literature that decomposes output volatility at the industry level (Long Jr and Plosser, 1987; Stockman, 1988; Norrbin and Schlagenhauf, 1988; Foerster et al., 2011). These decompositions of output volatility specify factor models for the growth rate of industrial output that include country- and industry- specific shocks as explanatory factors. The findings are consistent across studies, with country- specific shocks dominating industry- specific shocks as determinants of output volatility. In a similar fashion, the empirical literature on international business cycles by Kose, Otrok and Whiteman (2003), Kose et al. (2008), and Hirata et al. (2013) uses this methodology to analyze aggregate (country-level) data and identify global and country factors. These two approaches have been extended by Karadimitropoulou and León-Ledesma (2013). Using data on value added growth by industries and countries, they consider global, country, and industry factors as drivers of international fluctuations. A limitation of these decompositions is that, by considering the growth of a country's output in a given industry as the primary object of analysis, shocks specific to destination markets cannot be separately accounted for. This is an important limitation as some of the volatility due to demand shocks in destination markets might be attributed to country- or industry- specific shocks. For example, if the distribution of a country's sales across destination markets is similar across industries, demand shocks in any market could appear as country-specific shocks. Similarly, if destination markets are equally important in a given industry across countries, demand shocks in any market could appear as industry- specific shocks.[5] We overcome this limitation by taking innovations in the growth rates of sales to all destination markets as the primitive and extending KT's methodology at the industry level. Importantly, we find that demand shocks are primary sources of industrial fluctuations.

Methodologically, our paper extends the approach of Koren and Tenreyro (2007, KT henceforth) to a finer level of disaggregation. The focus in KT is on the relationship between income volatility and development. They take as basic object of analysis the growth of sectoral output by country and decompose income volatility in three components: one related to sectoral shocks, one related to country-specific shocks and the last one related to the covariance between country- and sector-specific shocks. KT conclude that poor countries are more volatile because they specialize in more volatile sectors and

[5] In our data we find evidence for both cases: the rank correlation of each country's sales shares to its destination markets across industries is significant and ranges between 0.45 ad 0.75, independent of whether the domestic market is included. The rank correlation of an industry's sales shares to destinations markets across countries ranges between 0.08 and 0.70.

experience large aggregate shocks frequently. We extend their methodology by focusing on the growth rate of sales by industry to each destination market. This allows us to disentangle the sources of risk for industries at the destination market level, which helps us understand the role of trade and the geographical structure of an industry's sales.

In this sense, our paper is also related to Di Giovanni et al. (2014), who analyze the role of firms in aggregate fluctuations using French data on firm-level sales growth rates to different markets. In the same spirit, we exploit information on sales growth by destination to identify the role of microeconomic shocks on aggregate volatility. Because of data limitations, our level of disaggregation is less granular. However, we examine the sources of volatility in a multi-country multi-sector setting that allows us to distinguish demand from producer country risks, but not to account for firm-level risk.

Finally, our paper contributes to a growing literature that studies the relationship between volatility at the industry level, and financial and trade openness.[6] Raddatz (2006) finds that financial development reduces aggregate volatility because it lowers output volatility to a larger extent in industries with high liquidity needs. More closely related to our paper, Di Giovanni and Levchenko (2009) study the relationship between trade and aggregate volatility, focusing, among other channels, on the effect of trade openness on output volatility at the industry level.[7] Similarly to them, we find that trade openness increases output volatility at the industry-level. In contrast, our objective is to pin down the main channels through which trade openness affects volatility at the industry level.

Our evidence on the supply-chain effect of intra-industry imports is consistent with the findings in Bergin et al. (2009, 2011) of a positive effect of offshoring on volatility in Mexico. Our findings on the diversification effect of exports are also in line with Kurz and Senses (2016), who find that U.S. industry-level volatility associated with employment changes in exporting firms is lower than than that associated with non-trading firms.[8] Recently, Caselli et al. (2015) argue that openness to international trade can lower GDP volatility when country-specific shocks are an important source of uncertainty at the sectoral level as trade reduces exposure to domestic shocks. Our findings suggest that

[6]A large literature analyses the relationship between trade openness and aggregate volatility. See Rodrik (1998), Karras and Song (1996), Kose, Prasad and Terrones (2003), Bekaert et al. (2006), Cavallo (2008), Buch et al. (2005), Calderón et al. (2005) and Loayza and Raddatz (2006) among others.

[7]Di Giovanni and Levchenko (2009) also consider the effect of trade openness on an economy's specialization patterns and the co-movement between its industries. They focus on the role of sectoral vertical linkages to explain the impact of bilateral trade on industry co-movement.

[8]Several recent papers examine the relationship between trade and volatility at the firm-level: Kurz and Senses (2016), Vannoorenberghe (2012), Ngyuen and Schaur (2012), and Buch et al. (2009).

idiosyncratic demand shocks precisely reduce aggregate volatility because of their negative covariance.

The reminder of the paper is organized as follows. Section 2 develops our decomposition of the volatility of industrial output, describes its empirical implementation, and discusses how our empirical framework can be used to quantify the effect of individual shocks on output volatility at different levels of aggregation. Section 3 briefly summarizes the data. Section 4 presents some descriptives on individual shocks. Section 5 discusses our estimates of the volatility of industrial output and its components. Section 6 presents our estimates for the effect of individual shocks on output volatility at industry and manufacturing level. Section 7 discusses our findings on the relationship between output volatility and trade openness at the industry-level. Section 8 concludes.

2 A Decomposition of Industrial Output Volatility

We derive a decomposition of output volatility at the industry level that accounts for shocks in destination markets as a source of output uncertainty. Formally, we define output volatility of industry $i = 1, ..., S$ in country $c = 1, .., C$ as the variance of the innovations in the growth rate of its sales, q_{ic}, where innovations are deviations from the mean over time. By taking q_{ic} as the primary object of their decompositions, previous empirical work studies the effect of only country- and industry-specific factors on industrial output volatility (Long Jr and Plosser, 1987; Stockman, 1988; Norrbin and Schlagenhauf, 1988; Foerster et al., 2011). In contrast, we take innovations in the growth rate of industry i's sales in every market $m = 1, ..., M$ country c sells to, y_m^{ic}, as the primary object of interest. This allows us to account for shocks in destination markets as a source of output volatility. Following the methodology of KT, we specify a factor model for y_m^{ic} that includes, separately, shocks specific to the producer country, industry, and destination market. We then use these shocks to derive quantitative risk measures corresponding to various components of industrial output volatility.

2.1 Analytical Derivation

First, we use the fact that the innovations in the growth rate of country $c = 1, ..., C$'s sales in industry $i = 1, ..., S$, q^{ic}, can be expressed as a weighted sum of the innovations in the growth rate of industry i's sales in markets $m = 1, ..., M$ that country c serves, y_m^{ic}:

$$q^{ic} = \sum_{m=1}^{M} a_m^{ic} * y_m^{ic} \tag{1}$$

where a_m^{ic} is the share of market m in country c's total sales of i.

Second, we represent innovations in the growth rate of industry i's sales from c to m using the following model:

$$y_m^{ic} = \kappa_m + \mu_c + \lambda_i + \epsilon_m^{ic} \tag{2}$$

where the first disturbance, κ_m, is specific to the destination market m; the second disturbance, μ_c, is specific to the producer country; λ_i, is the disturbance specific to industry i; and, ϵ_m^{ic}, is the residual unexplained by the other components.

The market-specific disturbance, κ_m, captures macroeconomic shocks that affect a market's spending on goods independent of their origin, i.e., *global demand* shocks. The producer-specific disturbance, μ_c, represents changes in production conditions and factor markets that affect a country's ability to produce and sell across all sectors and markets. The industry-specific disturbance, λ_i, captures changes in technology and costs, or world-wide sectoral trade policies that affect equally all producers in a given industry irrespective of their location and the markets they serve. The residual disturbance, ϵ_m^{ic}, captures any shock that is industry-producer country-, market-producer country-, industry-market- or producer country-market-industry- specific. For example, changes in a market's preferences that affect a particular producer country's products or changes in discretionary trade policy are captured in this residual term. Importantly, in section 4 we show that the residual term captures mostly shocks related to destination markets, that is, demand shocks. Thus we refer to ϵ_m^{ic} as *idiosyncratic demand* disturbance.

All the disturbances in equation (2) can be correlated. For instance, if aggregate shocks affect the ability of a country to both produce and consume, then μ_c and κ_m will be correlated. μ_c (k_m) and λ_i will be correlated if, for example, aggregate shocks to productivity systematically hit influential producers (consumers) in the world market for particular goods. If, instead, an industry's sales to certain markets are sensitive to either global demand or producer-specific or industry-specific shocks, then ϵ_m^{ic} will be correlated with either k_m or μ_c or λ_i.

Last, we rewrite the model in (2) using matrix notation:

$$\boldsymbol{y^{ic}} = \boldsymbol{\kappa} + \mu_c \mathbf{1} + \lambda_i \mathbf{1} + \boldsymbol{\epsilon^{ic}} \tag{3}$$

where $\boldsymbol{y^{ic}}$ is the $(M\text{x}1)$ vector of innovations y_m^{ic}, $\boldsymbol{\kappa}$ is the $(M\text{x}1)$ vector of market-specific shocks, $\mathbf{1}$ denotes the $(M\text{x}1)$ vector of ones and $\boldsymbol{\epsilon^{ic}}$ is the $(M\text{x}1)$ vector of idiosyncratic demand disturbances. Using matrix algebra, we decompose the variance of q^{ic}, $Var(q^{ic})$, as follows:

$$\begin{aligned} Var(q^{ic}) = \boldsymbol{a^{ic\prime}} E(\boldsymbol{y^{ic}} \boldsymbol{y^{ic\prime}}) \boldsymbol{a^{ic}} = \boldsymbol{a_{ic}}' \boldsymbol{\Omega}_{\kappa} \boldsymbol{a_{ic}} + \boldsymbol{a_{ic}}' \boldsymbol{\Omega}_{\epsilon_m^{ic}} \boldsymbol{a_{ic}} + \omega_{\mu_c}^2 + \varphi_{\lambda_i}^2 + 2\boldsymbol{a_{ic}}' \boldsymbol{\Omega_{\mu\kappa}} + \\ + 2\boldsymbol{a_{ic}}' \boldsymbol{\Omega_{\epsilon\kappa}} \boldsymbol{a_{ic}} + 2\boldsymbol{a_{ic}}' \boldsymbol{\Omega_{\epsilon\mu}} + 2\boldsymbol{a_{ic}}' \boldsymbol{\Omega_{\epsilon\lambda}} + 2\phi_{\lambda\mu} + 2\boldsymbol{a_{ic}}' \boldsymbol{\Omega_{\lambda\kappa}} \end{aligned} \tag{4}$$

where $\boldsymbol{a^{ic}}$ is the $(M\text{x}1)$ vector that collects each market m's share in country c's total sales of i, a_m^{ic}; $\boldsymbol{\Omega}_{\kappa}$ is the variance-covariance matrix of global demand shocks, k_m; $\boldsymbol{\Omega}_{\epsilon_m^{ic}}$ is the variance-covariance matrix of idiosyncratic demand disturbances, ϵ_m^{ic}; $\omega_{\mu_c}^2$ is the variance of producer country shocks; $\varphi_{\lambda_i}^2$ is the variance of industry-specific shocks; $\boldsymbol{\Omega_{\mu\kappa}}$ is the covariance matrix between producer country shocks and global demand shocks; $\boldsymbol{\Omega_{\epsilon\kappa}}$, $\boldsymbol{\Omega_{\epsilon\mu}}$ and $\boldsymbol{\Omega_{\epsilon\lambda}}$ are the covariance matrices between idiosyncratic and global demand shocks, between idiosyncratic demand and producer country shocks, and between idiosyncratic demand and industry shocks, respectively; $\phi_{\lambda\mu}$ is the covariance between industry and producer country shocks; and the term $\boldsymbol{\Omega_{\lambda\kappa}}$ is the covariance matrix between industry and global demand shocks.[9]

The components of industrial volatility in equation (4) have an intuitive interpretation. The first term, $\boldsymbol{a_{ic}}' \boldsymbol{\Omega}_{\kappa} \boldsymbol{a_{ic}}$, captures what we refer to as *global demand risk*. The *global demand risk* relates to destination market-specific shocks that are common for all producer countries and industries. The *global demand risk* varies by producer country and industry only in as much as the structure of sales across destination markets varies. This term is large if country c's sales of i are concentrated in markets with volatile global demand. For example, suppose Vietnam and China have volatile demands towards all products irrespective of their origin. The larger the share of French wine sold to Vietnam and China, the higher the global demand risk of the French wine industry is. Importantly, this term also accounts for the covariance of global demand shocks in destination markets. This implies that the global market risk of the French wine industry is higher if global demand shocks in China and Vietnam covary positively.

The second term, $\boldsymbol{a_{ic}}' \boldsymbol{\Omega}_{\epsilon_m^{ic}} \boldsymbol{a_{ic}}$, is the *idiosyncratic demand risk*. The *idiosyncratic demand risk* relates to shocks that affect the destination market's demand for a particular good, or for all or some goods from a particular producer country. This term is higher if country c's sales of i are concentrated in markets with volatile idiosyncratic demand. For

[9] See Appendix A.1 for the detailed derivation of the decomposition.

instance, suppose Vietnam has a highly volatile demand for French wine but a constant demand for US wine. The larger the share of French wine sold to Vietnam, the higher the idiosyncratic demand risk of the French wine industry is. In contrast, the larger the share of US wine sold to Vietnam, the lower the idiosyncratic demand risk of the US wine industry. This term also accounts for the covariance of idiosyncratic demand shocks in destination markets. For example, the French idiosyncratic demand risk can be moderated if France sells wine to other countries with idiosyncratic demand shocks negatively correlated with Vietnam's.

The *producer country risk*, $\omega^2_{\mu_c}$, is larger in economies that receive large and frequent production shocks, that are common to all industries and markets. The *industry* risk, $\varphi^2_{\lambda_i}$, is larger in industries subject to large and frequent shocks, that are common to all producer countries and markets. Note that both of these risks do not vary across destination markets.

The covariance term $2\boldsymbol{a_{ic}}'\boldsymbol{\Omega_{\mu\kappa}}$ is positive or negative depending on whether sales concentrated in markets with global demand shocks that are positively or negatively correlated with producer country-specific shocks. For instance, consider producers whose main destination is the domestic market. This term would be negative if negative demand shocks lead systematically to policies that stimulate production. A positive correlation could instead be the case if policies stimulated demand to a degree that more than compensated for the initial drop. The covariance terms $2\boldsymbol{a_{ic}}'\boldsymbol{\Omega_{\epsilon\kappa}}\boldsymbol{a_{ic}}$, $2\boldsymbol{a_{ic}}'\boldsymbol{\Omega_{\epsilon\mu}}$ and $2\boldsymbol{a_{ic}}'\boldsymbol{\Omega_{\epsilon\lambda}}$ are positive (negative) if sales are concentrated in goods with idiosyncratic demand disturbances that are positively (negatively) correlated with global demand, producer country, and industry shocks, respectively. For example, if a country adopted expansionary policies in response to negative shocks to critical sectors of the economy the covariance term $2\boldsymbol{a_{ic}}'\boldsymbol{\Omega_{\epsilon\kappa}}\boldsymbol{a_{ic}}$ would be negative.

The last two terms capture industrial risk related to the remaining covariances between industry and producer country shocks, and between industry and global demand shocks, respectively.

2.2 Empirical Implementation

To estimate each of the components in equation (4), we first need estimators for the shocks to the innovations in the growth rate of a country's industry sales. For each producer country, industry, and destination market, we define innovations in sales, y^{ic}_m, as the deviation of the sales growth rate from its mean over time and we estimate the shocks as follows:

$$\hat{\kappa}_{mt} \equiv \frac{1}{CS} \sum_{i}^{S} \sum_{c}^{C} y_{mt}^{ic} \tag{5}$$

$$\hat{\mu}_{ct} \equiv \frac{1}{MS} \sum_{i}^{S} \sum_{m}^{M} (y_{mt}^{ic} - \hat{\kappa}_{mt}) \tag{6}$$

$$\hat{\lambda}_{it} \equiv \frac{1}{MC} \sum_{c}^{C} \sum_{m}^{M} (y_{mt}^{ic} - \hat{\kappa}_{mt}) \tag{7}$$

$$\hat{\epsilon}_{mt}^{ic} = y_{mt}^{ic} - \hat{\kappa}_{mt} - \hat{\mu}_{ct} - \hat{\lambda}_{it} \tag{8}$$

As shown in Appendix A.2 the estimators in (5), (6), (7), and (8) are the same one would obtain from a restricted version the following factor model:

$$y_{m}^{ic} = \kappa_{1t} d_1 + ... + \kappa_{Mt} d_M + \mu_{1t} h_1 + ... + \mu_{Ct} h_C + \lambda_{1t} f_1 + ... + \lambda_{St} f_S + \epsilon_{mt}^{ic} \tag{9}$$

with d_m, h_c, f_i being indicator variables that take the value of 1 only for market m, producer country c and industry i, respectively, and the restrictions imposing both country and industry shocks to have, respectively, a cross-country and a cross-industry average of zero, i.e., $\sum_c^C \mu_{ct} = 0$ and $\sum_i^S \lambda_{it} = 0$. This implies that we identify country shocks relative to their cross-country average, and industry shocks relative to their cross-industry average. Specification (9) includes both producer-country and destination market indicator variables and makes it easier to see that our estimators identify shocks that affect the country's production capacity, common across destination markets and industries, separately from the shocks that affect the same country's ability to spend, common across all producer countries and industries. Controlling for producer country, destination market, and industry indicator variables, the residual term contains shocks to y_m^{ic} that are industry-producer country-, market-producer country-, industry-market- or producer country-market-industry- specific.

We then compute the variance-covariance matrices of estimated shocks as follows: $\hat{\boldsymbol{\Omega}}_{\boldsymbol{k}} = \frac{1}{(T-1)} \sum_{t=1}^{T} \boldsymbol{\Delta} \hat{\boldsymbol{k}}_{\boldsymbol{t}} \boldsymbol{\Delta} \hat{\boldsymbol{k}}_{\boldsymbol{t}}'$, $\hat{\boldsymbol{\Omega}}_{\epsilon_m^{ic}} = \frac{1}{(T-1)} \sum_{t=1}^{T} \boldsymbol{\Delta} \hat{\boldsymbol{\epsilon}}_{\boldsymbol{t}}^{\boldsymbol{ic}} \boldsymbol{\Delta} \hat{\boldsymbol{\epsilon}}_{\boldsymbol{t}}^{\boldsymbol{ic}\prime}$, $\hat{\omega}_{\mu_c}^2 = \frac{1}{(T-1)} \sum_{t=1}^{T} \Delta \hat{\mu}_{ct}^2$, $\hat{\varphi}_{\lambda_i}^2 = \frac{1}{(T-1)} \sum_{t=1}^{T} \Delta \hat{\lambda}_{it}^2$, $\hat{\boldsymbol{\Omega}}_{\boldsymbol{\mu\kappa}} = \frac{1}{(T-1)} \sum_{t=1}^{T} \Delta \hat{\mu}_{ct} \boldsymbol{\Delta} \hat{\boldsymbol{k}}_{\boldsymbol{t}}$, $\hat{\boldsymbol{\Omega}}_{\boldsymbol{\epsilon\kappa}} = \frac{1}{(T-1)} \sum_{t=1}^{T} \boldsymbol{\Delta} \hat{\boldsymbol{\epsilon}}_{\boldsymbol{t}}^{\boldsymbol{ic}} \boldsymbol{\Delta} \hat{\boldsymbol{k}}_{\boldsymbol{t}}'$, $\hat{\boldsymbol{\Omega}}_{\boldsymbol{\epsilon\mu}} = \frac{1}{(T-1)} \sum_{t=1}^{T} \Delta \hat{\mu}_{ct} \boldsymbol{\Delta} \hat{\boldsymbol{\epsilon}}_{\boldsymbol{t}}^{\boldsymbol{ic}}$, $\hat{\boldsymbol{\Omega}}_{\boldsymbol{\epsilon\lambda}} = \frac{1}{(T-1)} \sum_{t=1}^{T} \Delta \hat{\lambda}_{it} \boldsymbol{\Delta} \hat{\boldsymbol{\epsilon}}_{\boldsymbol{t}}^{\boldsymbol{ic}}$, $\phi_{\lambda\mu} = \frac{1}{(T-1)} \sum_{t=1}^{T} \Delta \hat{\lambda}_{it} \boldsymbol{\Delta} \hat{\boldsymbol{\mu}}_{\boldsymbol{ct}}$, $\hat{\boldsymbol{\Omega}}_{\boldsymbol{\lambda\kappa}} = \frac{1}{(T-1)} \sum_{t=1}^{T} \Delta \hat{\lambda}_{it} \boldsymbol{\Delta} \hat{\boldsymbol{k}}_{\boldsymbol{t}}$, where Δ represents deviations from the mean.

Combining the variance-covariance matrices of estimated shocks with observed sales shares at time t, a_m^{ict}, we obtain all the measures of risk that comprise industrial volatility.

More formally, we measure:

$$GDMD_{ict} = \boldsymbol{a_{ict}}'\hat{\boldsymbol{\Omega}}_{\kappa}\boldsymbol{a_{ict}} \tag{10}$$

$$IDMD_{ict} = \boldsymbol{a_{ict}}'\hat{\boldsymbol{\Omega}}_{\epsilon_m^{ic}}\boldsymbol{a_{ict}} \tag{11}$$

$$PCTY_c = \hat{\omega^2_{\mu_c}} \tag{12}$$

$$IND_i = \hat{\varphi^2_{\lambda_i}} \tag{13}$$

$$COV\mu\kappa_{ict} = 2\boldsymbol{a_{ict}}'\hat{\boldsymbol{\Omega}}_{\mu\kappa} \tag{14}$$

$$COV\epsilon\kappa_{ict} = 2\boldsymbol{a_{ict}}'\hat{\boldsymbol{\Omega}}_{\epsilon\kappa}\boldsymbol{a_{ict}} \tag{15}$$

$$COV\epsilon\mu_{ict} = 2\boldsymbol{a_{ict}}'\hat{\boldsymbol{\Omega}}_{\epsilon\mu} \tag{16}$$

$$COV\epsilon\lambda_{ict} = 2\boldsymbol{a_{ict}}'\hat{\boldsymbol{\Omega}}_{\epsilon\lambda}\boldsymbol{a_{ict}} \tag{17}$$

$$COV\lambda\mu_{ic} = 2\hat{\phi_{\lambda\mu}} \tag{18}$$

$$COV\lambda\kappa_{ict} = 2\boldsymbol{a_{ict}}'\hat{\boldsymbol{\Omega}}_{\lambda\kappa} \tag{19}$$

where $GDMD_{ict}$, $IDMD_{ict}$, $PCTY_c$, and IND_i are the components of country c's output volatility in industry i at time t due to global demand shocks, idiosyncratic demand shocks, producer country shocks, and industry shocks, respectively; $COV\mu\kappa_{ict}$ is twice the covariance between global demand and producer country shocks; $COV\epsilon\kappa_{ict}$, $COV\epsilon\mu_{ict}$ and $COV\epsilon\lambda_{ict}$ are twice the covariance between idiosyncratic and global demand shocks, between idiosyncratic demand and producer country shocks, and between idiosyncratic demand and industry shocks at time t, respectively; and $COV\lambda\mu_{ic}$ and $COV\lambda\kappa_{ic}$ are twice the covariance between industry and producer country shocks, and between industry and global demand shocks at time t, respectively.

2.3 Contribution of Shocks: Counterfactuals

While the decomposition proposed above allows us to identify the main sources of industrial risk, it does not directly tell us how the occurrence of individual types of shocks affects output volatility. In fact, shocks with corresponding high risks might or might not generate much volatility depending on their covariance with other types of shocks. The empirical framework underlying our decomposition can be extended to quantify the effect of individual shocks on output volatility by omitting one type of shocks at the time. More formally, in our framework, observed innovations in sales growth rates equal the sum of shocks estimated by equations (5)-(8), i.e., $y_m^{ic} = \hat{\kappa_m} + \hat{\mu_c} + \hat{\lambda}_i + \hat{\epsilon_m^{ic}}$. If global demand shocks did not occur, innovations in sales growth, $(\hat{y^{ic}_m})^{-\hat{\kappa}}$, would only be due to producer country, industry and idiosyncratic shocks as follows: $(\hat{y^{ic}_m})^{-\hat{\kappa}} = \hat{\mu_c} + \hat{\lambda_i} + \hat{\epsilon^{ic}_m}$.[10] The volatility of industrial output, $Var(q^{ic}_t)^{-\hat{\kappa}}$, would only consist of the risk and covariance measures related to all but global demand shocks, and would be estimated as follows:

$$\widehat{Var(q^{ic}_t)}^{-\hat{\kappa}} = IDMD_{ict} + PCTY_c + IND_i + COV\epsilon\mu_{ict} + COV\epsilon\lambda_{ict} + COV\lambda\mu_{ict}$$

Hence, the amount of industrial volatility due to global demand shocks, $Var(q^{ic}_t)^{\hat{\kappa}}$, can be estimated by taking the difference between the observed output volatility, $\widehat{Var(q^{ic}_t)}$, and the counterfactual one, $\widehat{Var(q^{ic}_t)}^{-\hat{\kappa}}$, as follows:

$$\widehat{Var(q^{ic}_t)}^{\hat{\kappa}} = \widehat{Var(q^{ic}_t)} - \widehat{Var(q^{ic}_t)}^{-\hat{\kappa}} = GDMD_{ict} + COV\mu\kappa_{ict} + COV\epsilon\kappa_{ict} + COV\lambda\kappa_{ict} \quad (20)$$

Intuitively, the volatility due to global demand shocks consists of the global demand risk as well as the terms related to the covariance of global demand shocks with producer country, idiosyncratic, and industry shocks. It can be positive or negative, with the latter implying that the occurrence of global demand shocks lowers volatility due to their covariance with other shocks, given the distribution of sales across markets.

If, instead, idiosyncratic shocks were the only ones not occurring, the volatility of industrial output, $Var(q^{ic}_t)^{-\hat{\epsilon}}$, would exclude the risk and covariance measures related to idiosyncratic demand shocks and would be estimated in the following way:

$$\widehat{Var(q^{ic}_t)}^{-\hat{\epsilon}} = GDMD_{ict} + PCTY_c + IND_i + COV\mu\kappa_{ict} + COV\lambda\mu_{ict} + COV\lambda\kappa_{ict}$$

Thus, the amount of industrial volatility due to idiosyncratic demand shocks, $Var(q^{ic}_t)^{\hat{\epsilon}}$, can be estimated by taking the difference between the observed output volatility and the counterfactual, as follows:

$$\widehat{Var(q^{ic}_t)}^{\hat{\epsilon}} = \widehat{Var(q^{ic}_t)} - \widehat{Var(q^{ic}_t)}^{-\hat{\epsilon}} = IDMD_{ict} + COV\mu\kappa_{ict} + COV\epsilon\kappa_{ict} + COV\epsilon\lambda_{ict} \quad (21)$$

Following a similar logic, the amount of industrial volatility due, respectively, to producer country and industry shocks is estimated as follows:

$$\widehat{Var(q^{ic}_t)}^{\hat{\mu}} = \widehat{Var(q^{ic}_t)} - \widehat{Var(q^{ic}_t)}^{-\hat{\mu}} = PCTY_c + COV\mu\kappa_{ict} + COV\epsilon\mu_{ict} + COV\lambda\mu_{ic} \quad (22)$$

[10]Notice that these innovations are not the same as those one would obtain by summing estimated shocks from a factor model like the one in (9) that omitted market specific factors. The latter estimated shocks would not be independent of market specific shocks.

$$\hat{Var(q_t^{ic})}^{\hat{\lambda}} = \hat{Var(q_t^{ic})} - \hat{Var(q_t^{ic})}^{-\hat{\lambda}} = IND_i + COV\epsilon\lambda_{ict} + COV\lambda\mu_{ic} + COV\lambda\kappa_{ict} \quad (23)$$

Our framework also allows us also to analyse the effect of individual shocks for the volatility of aggregate manufacturing output. First, note that in country c with S industries, the volatility of aggregate production growth equals:

$$AV_{ct} = \sum_{i=1}^{S} \alpha_{ict}^2 * Var(q_t^{ic}) + \sum_{i=1}^{S} \sum_{\substack{j=1 \\ j \neq i}}^{S} \alpha_{ict}\alpha_{jct} Cov(q_t^{ic}, q_t^{jc}) \quad (24)$$

where α_{ict} is the share of sector i in country c's total gross output at time t, and $Cov(q_t^{ic}, q_t^{jc}) = \boldsymbol{a_t^{ic}}' Cov(\boldsymbol{y^{ic}}, \boldsymbol{y^{jc}}) \boldsymbol{a_t^{jc}}$ is the covariance between industry i and j in country c. Thus, to calculate the amount of aggregate volatility due to, say, global demand shocks, one would need to estimate the variance of industrial volatility and the covariance between industries due to these shocks. The first quantity is $Var(q_t^{ic})^{\hat{\kappa}}$ and can be estimated by equation (20). The second quantity can be estimated taking the difference between the observed covariance and the counterfactual one when global demand shocks do not occur, i.e., $Cov(q_t^{ic}, q_t^{jc}) - \boldsymbol{a_t^{ic}}' Cov(\hat{\boldsymbol{y^{ic}}}^{-\hat{\kappa}}, \hat{\boldsymbol{y^{jc}}}^{-\hat{\kappa}}) \boldsymbol{a_t^{jc}}$. Formally, the aggregate volatility due to global demand shocks, $AV_{ct}^{\hat{\kappa}}$, can be estimated as follows:

$$\hat{AV_{ct}}^{\hat{\kappa}} = \sum_{i=1}^{S} \alpha_{ict}^2 * \hat{Var(q_t^{ic})}^{\hat{\kappa}} + \sum_{i=1}^{S} \sum_{\substack{j=1 \\ j \neq i}}^{S} \alpha_{ict}\alpha_{jct} (Cov(q_t^{ic}, q_t^{jc}) - \boldsymbol{a_t^{ic}}' Cov(\hat{\boldsymbol{y^{ic}}}^{-\hat{\kappa}}, \hat{\boldsymbol{y^{jc}}}^{-\hat{\kappa}}) \boldsymbol{a_t^{jc}}) \quad (25)$$

where $\hat{\boldsymbol{y^{ic}}}^{-\hat{\kappa}}$ is the $(M$x$1)$ vector of counterfactual innovations in sales growth $(\hat{y_m^{ic}})^{-\hat{\kappa}}$ for i in c. The amount of aggregate volatility due to idiosyncratic, producer-country and industry shocks individually can be estimated in a similar fashion.

3 Data

Our empirical analysis uses annual production and bilateral trade data. Production data are from the CEPII TradeProd database, which is constructed by combining the World Bank dataset "Trade, Production and Protection" (Nicita and Olarreaga, 2006) with data from the OECD and the UNIDO (de Sousa et al., 2012). This dataset covers 26 manufacturing sectors at the International Standard Industrial Classification (ISIC) Revision 2 level and 181 countries from 1980 to 2006. In our efforts to obtain a balanced panel of producer countries and industries, we drop from our sample countries, industries, and years for which gross output data is sparse or missing in many consecutive years and then interpolate the missing values for a small fraction of observations.[11] Trade data are from the CHELEM database, constructed by the CEPII and distributed by the Bureau van Dijk. The bilateral trade data is a balanced panel of 85 exporting and importing destinations at 4-digit ISIC Revision 3 level from 1967 to 2011.[12] We calculate domestic sales as the difference between gross output and exports.[13] All flows are expressed in 1980 constant US dollars using CPI data.[14]

Combining the production and trade data gives us a balanced panel of 34 producer countries, 85 destination markets (including an aggregate rest of the world), 19 ISIC Rev. 2 sectors, and 21 years from 1980 to 2000. In a given year, we have 34x19=646 observations at the industry-country level. Table 1 lists the producer countries and industries included in our sample. Table 2 lists the destination markets in our sample.

Our focus is on the variance of the 1-year innovations in the growth rate of a country's real sales in a given industry by destination market. For each producer country, industry, and destination market, we calculate the innovations in the growth of sales as de-trended growth rates. More formally, we define the growth rate of country c's total sales of good i in market m in year t, g_{mt}^{ic}, as: $g_{mt}^{ic} = 2(X_{mt}^{ic} - X_{mt-1}^{ic})/(X_{mt}^{ic} + X_{mt-1}^{ic})$, where X_{mt}^{ic} represents country c's sales of good i to market m in year t. We then compute innovations in the growth rates of sales as follows: $y_{mt}^{ic} = g_{mt}^{ic} - \overline{g_{m}^{ic}}$, where $\overline{g_{m}^{ic}}$ is the average growth over time.

Our analysis also uses data on countries' real GDP per capita and credit to the private sector (% GDP), both of which are sourced from the World Development Indicators (WDI). Data on industries' output per worker are from the CEPII TradeProd database. Various measures of trade openness are constructed at the industry-level by combining trade data from the CHELEM dataset and output data from the CEPII TradeProd database.

[11] See Appendix B.1. for more details

[12] We prefer the CHELEM trade data to the trade data in the CEPII TradeProd database because their coverage allows us to have a finer disaggregation of destination markets. For the subset of data common to the two datasets we verified a correlation of 0.9.

[13] We adjust all export values to eliminate re-exports following the methodology proposed by GTAP as detailed in Appendix B.1.

[14] The CPI data is from U.S. Department of Labor Bureau of Labor Statistic available at: http://www.usinflationcalculator.com/inflation/consumer-price-index-and-annual-percent-changes-from-1913-to-2008. The CPI is the annual average CPI for 1980-2000.

4 The Shocks: Descriptives

Table 1 reports the standard deviation of producer-country and industry-specific shocks, which are the square root of the producer country risk, $PCTY_c$, and the industry risk, IND_i, respectively. Producer country-specific shocks are the least volatile in France and the most volatile in Hungary. Somewhat surprisingly, Canada, the UK and the US are characterised by a higher than average variance of shocks to production. However, the correlation between the volatility of producer country shocks and income per capita turns out to be negative and significant. The volatility of industry-specific shocks is largest in "Non Ferrous Metals" and smallest in "Glass and its Products".

Table 2 shows, for each market's global demand shocks, their standard deviation and average correlation with other markets' global demand shocks. There are two main findings from this table. First, the volatility of global demand shocks varies substantially across markets, with the Serbian standard deviation more that 4 times the US one. Second, global demand shocks, on average, covary positively across markets, especially for the European markets.

Table 3 summarizes statistics for the elements in the variance-covariance matrix of idiosyncratic market shocks, $\Omega_{\epsilon_m^{ic}}$, aggregated at the producer country level[15] using as weights industries' output shares. More specifically, the first two columns of Table 3 report the standard deviation of home-market idiosyncratic demand shocks and the average standard deviation of foreign idiosyncratic demand shocks, respectively. Compared to the variance of domestic idiosyncratic demand shocks the variance of foreign markets idiosyncratic demand shocks is much higher. This implies, perhaps not surprisingly, that countries face uncertainty on the demand for their products mostly in foreign markets.

Column (3) and (4) of Table 3 summarize the average correlation between idiosyncratic shocks in the home market and each foreign market, and between idiosyncratic demand shocks of any pair of foreign destinations. These correlations would be high if most shocks captured by $\hat{\epsilon}_m^{ic}$ were common to all markets (including the home market). Given that, by construction, $\hat{\epsilon}_m^{ic}$ captures shocks that are industry-producer country-, market-producer country- or producer country-market-industry specific, that could only be the case if most shocks in $\hat{\epsilon}_m^{ic}$ were industry-producer country-specific. In other words, the fact that the correlations between idiosyncratic shocks are low implies that most idiosyncratic shocks are either market-producer country-specific or producer country-market-industry specific. In either case they are dependent on the destination market, thus demand driven. That is

[15] This is the appropriate level of aggregation according to our data as shown in Section 5.

the reason why we refer to the residual terms in equation (2), ϵ_m^{ic}, as *idiosyncratic demand shocks.*

5 Volatility of Industrial Output and Decomposition Estimates

This section first discusses the volatility of industrial output by producer country and industry. Then it analyses the estimated components of industrial volatility. We present the results only for 1992 because, by construction, the time variation in output volatility and its components in equation (4) only depends on changes in a country's industry shares over time.[16]

5.1 Volatility of Industrial Output

Table 4 and Table 5 provide information on the volatility of industrial output at the producer country- and industry-level in 1992 respectively. Column (1) in each Table reports values for the weighted average volatility of each country or industry, where the weights are industries' or countries' shares of gross output, respectively. There are three main findings from these tables.

First, the average output volatility varies significantly across countries. Bulgaria, the country with the highest output volatility has 34 times the volatility of United States, the country with the lowest volatility. The coefficient of variation in column (2) of Table 4 further suggests that output volatility varies across industries, in some countries more than others.

Second, industries that are volatile in one country are not necessarily volatile in other countries. This is supported by the numbers in the last column of Table 4, which show the average Spearman correlation between the ranking of output volatility by industry of each country and the remaining 33 countries. In fact, even though the average Spearman correlations are positive, they are small and generally insignificant. Consistent with these results, the dispersion in the average volatility at the industry-level in column (2) of Table 5 is quite large.

Third, countries that have high output volatility in one industry tend to have high volatility in other industries. In fact, the Spearman correlations between the rankings of countries' volatility in each industry and in the remaining 19 industries, shown in

[16]Results for other years are very similar to those we obtain for 1992 and are available upon request.

column (3) of Table 5, are large averages of significant pairwise correlations. This finding implies that industrial output volatility depends very little on industry-specific factors. In addition, in Figure 1 we find a strong negative relationship between a country's real per-capita GDP and its average volatility at the industry-level. This is consistent with the stylized fact that volatility decreases with development (Lucas, 1988; Koren and Tenreyro, 2007), and justifies why we summarize our decomposition results at the producer country-level.

5.2 Decomposition Estimates

5.2.1 Volatility of Industrial Output

Table 6 shows the results of our decomposition. It reports, for each component estimated using equations (10)-(19), its value and contribution to output volatility aggregated at the producer country-level in 1992. The aggregation uses, as weights, each industry's share in the producer country's total tradable output.

Are countries with higher industrial volatility characterized, on average, by higher values of all its components? Analyzing the results in Table 6, no clear pattern emerges, except for Bulgaria, the most volatile country in our sample. Compared to all other countries, Bulgaria displays the highest average idiosyncratic demand risk ($IDMD$), producer country-global demand covariance ($COV_{\mu\kappa}$), producer country-idiosyncratic demand covariance ($COV_{\epsilon\mu}$) and industry-idiosyncratic demand covariance term ($COV_{\epsilon\lambda}$). It also exhibits the fourth highest producer country risk ($PCTY$).

The main result from Table 6 is that the global and idiosyncratic demand risks are the components that account for most of the volatility at the industry-level for the vast majority of countries in our sample. Consistent with this result, we find that countries with higher idiosyncratic and global demand risks tend to be, on average, more volatile. The rank correlation between countries' average industrial volatility and their average idiosyncratic and global demand risks is significant and positive at 0.6 and 0.3, respectively.

The numbers in columns (3) and (4) of Table 6 imply that the producer country and industry risks account for relatively little of most countries' industrial risk. The average industry risk strikes for being of comparable magnitude across countries. This is due to a combination of factors. Countries' industrial specialization is at most moderate for 31 of the countries in our sample,[17] the variation in industry risks is limited, and the three

[17] 25 countries in our sample have production Herfindahl Indexes (HI) below 0.15, and 6 countries have a HIs that vary between 0.15 and 0.25.

most specialized countries are so in industries with associated risks close to the average.

Column (5) summarizes the average global demand-producer country covariance term, $COV\mu\kappa$, and its percentage contribution for the countries in our sample. Even though, on average, the relative contribution of $COV_{\mu\kappa}$ to many countries' industrial risk is small, a noteworthy pattern emerges. On average, global demand shocks covary with producer country shocks positively in some countries and negatively in others. What could explain this result? For example, suppose negative global demand shocks in the home or foreign markets lead to expansionary macroeconomic policies in order to stimulate domestic production and consumption. The $COV\mu\kappa$ would then be negative unless policy changes stimulated domestic consumption systematically to more than compensate the initial drop in demand. This second scenario is more likely in economies with developed financial systems because, there, macroeconomic policies are more efficient (Bean et al., 2002; Krause and Rioja, 2006). To test this explanation, we regress the estimated $COV\mu\kappa_{ic}$ from equation (14) against the log of each country c's credit to private sector (% of GDP), which is a commonly used measure of financial development in the literature, controlling for the country's real GDP per capita and industry fixed effects. The estimates from this model are statistically significant and imply that a one percent increase in credit to private sector increases the $COV\mu\kappa_{ic}$ by 0.2 percent. The findings provide support for our explanation: countries with more developed financial systems do experience, on average, higher values of $COV\mu\kappa_{ic}$.

Column (6)-(8) of Table 6 report the average values and percentage contributions for the covariance of global and idiosyncratic demand shocks, $COV\epsilon\kappa$, the covariance of producer country and idiosyncratic demand shocks, $COV\epsilon\mu$, and the covariance of industry and idiosyncratic demand shocks, $COV\epsilon\lambda$ respectively. For most countries, these covariance terms are, on average, negative and account for a non-negligible share of output volatility even though none of them drives it.[18] The negative sign of these covariances tells us that countries' sales tend to be concentrated in goods with idiosyncratic demand shocks that are negatively correlated to global demand, producer country and industry shocks. Put simply, industrial volatility is reduced due to the covariance between idiosyncratic and other types of shocks. Whether that is enough to compensate for the positive effect of the idiosyncratic risk on volatility is explored in section 6.

The remaining components in column (9) and (10) depend on the covariance between industry and producer country shocks, and between industry and global demand shocks.

[18] The rank correlation between countries' average industrial volatility and these covariance terms is positive, small and insignificant.

Both account for a negligible share of industrial volatility.

5.2.2 Demand Risks

Given that demand risks are key determinants of industrial volatility we explore their source by further decomposing global and idiosyncratic risks as follows:

$$\boldsymbol{a_{ic}}'\boldsymbol{\Omega}_{\kappa}\boldsymbol{a_{ic}} = a_c^{ic2}\sigma_{k_c}^2 + \sum_{m\neq c} a_m^{ic2}\sigma_{k_m}^2 + 2\sum_m \sum_{m'\neq c,m} a_m^{ic}a_{m'}^{ic}COV(\kappa_m, \kappa_{m'}) \tag{26}$$

$$\boldsymbol{a_{ic}}'\boldsymbol{\Omega}_{\epsilon_m^{ic}}\boldsymbol{a_{ic}} = a_c^{ic2}\sigma_{\epsilon_c^{ic}}^2 + \sum_{m\neq c} a_m^{ic2}\sigma_{\epsilon_m^{ic}}^2 + 2\sum_m \sum_{m'\neq c,m} a_m^{ic}a_{m'}^{ic}COV(\epsilon_m^{ic}, \epsilon_{m'}^{ic}) \tag{27}$$

where $\sigma_{k_f}^2$ is the variance of global demand shocks in $f = c, m$; $COV(\kappa_m, \kappa_{m'})$ is the covariance between global demand shocks of any pair of destination markets (including the home market); $\sigma_{\epsilon_f^{ic}}^2$ is the variance of idiosyncratic demand shocks in f and $COV(\epsilon_m^{ic}, \epsilon_{m'}^{ic})$ is the covariance between global demand shocks of any pair of destination markets.

In each expression, the first term reflects the contribution of the variance of shocks in the home market to total risk. Thus, we refer to $a_c^{ic2}\sigma_{k_c}^2$ as *home market global demand risk* ($GDMD^h$) and to $a_c^{ic2}\sigma_{\epsilon_c^{ic}}^2$ as *home market idiosyncratic demand risk ($IDMD^h$)*. The remaining two terms in equations (26) and (27) reflect the variance of foreign markets shocks, and the covariance of shocks between any pair of destination markets, respectively. As these terms are non-zero because the producer country is engaged in international trade, we refer to their sum in equation (26) as *trade-related global demand risk* ($GDMD^*$) and to their sum in equation (27) as *trade-related idiosyncratic demand risk* ($IDMD^*$).

Table 7 reports the decomposition results for the global and idiosyncratic demand risk together with the export share at the producer country level. The home market components of both demand risks dominate the trade-related ones in all cases with the exception of Ireland. There is, however, a lot of variation in the relative importance of the home-market and trade-related components across countries even for countries with a similar level of export openness. For countries with an average export openness between 0.25 and 0.30, highlighted in the shaded rows of Table 7, the home market component, on average, accounts for 59 to 95 percent of the global demand risk and for 68 to 90 percent of the idiosyncratic demand risk. This suggests that the composition of export destinations matters in determining the role of trade to explain demand risks and, ultimately, industrial volatility.

In conclusion, our decomposition results suggest that demand risks are the key determinants of the volatility of industrial output. The producer country and industry risks, and the covariance terms explain some industrial volatility but do not drive it. The distribution of a country's sales across markets matters for both demand and output risks.

6 Counterfactuals: Results

In this section we use our decomposition results to quantify how individual types of shocks affect the volatility of output at the industry-level and at a more aggregate level.

Table 8 summarizes the share of industrial volatility due to global demand, idiosyncratic demand, producer country and industry shocks, respectively, aggregated at producer country level. Equations (20)-(23) underlie these estimates. Thus, the numbers in each column are just the sum of the percentage contribution to output volatility of the components included in equations (20)-(23) and reported individually in Table 6. In principle, the occurrence of a type of shock can lower the volatility of an industry's output. That is possible if the risk corresponding to these shocks is more than compensated by the covariance between these shocks and other types of shocks.

According to column (1) of Table 8, because of global demand shocks, most countries, on average, experience a higher industrial volatility than they would otherwise. The share of volatility due to global demand shocks varies across countries and it is, on average, 40%. For the countries that experience a lower volatility due to global demand shocks, the reduction is, on average, by 38%. This average drops to 10% if observations for Canada, Colombia and the US are omitted. Column (2) shows that idiosyncratic demand shocks also lead most countries to experience, on average, a higher industrial volatility. This occurs despite the fact that covariance terms related to idiosyncratic demand shocks are, on average, negative as shown in Table 6. The share of volatility due to idiosyncratic demand shocks varies across countries and it is, on average, 41%. For the countries that, due to idiosyncratic demand shocks, experience a lower volatility, the reduction is, on average, of 90%. This average drops to 26% if Canada, Colombia and the US are excluded.

Producer country shocks imply, on average, a lower volatility of industrial output for most countries. In other words, the risk associated to these shocks tends to be compensated by the negative covariance with, mainly, idiosyncratic shocks. The decrease in volatility due to producer country shocks is, on average, 44%, or 21% if outliers are ignored. Countries that tend to experience a higher volatility because of producer country shocks do so by, on average, 13%. Even though industry shocks reduce the volatility of industrial output for most countries, their effect is always very small.

These findings imply that, without global or idiosyncratic shocks, industrial risk would be much different, i.e., lower for most countries. That is, perhaps, not surprising given that global and idiosyncratic risks are relatively large and the main drivers of industrial volatility.

Our data include 19 industries that account for an average of 84 percent of each producer country's manufacturing production during the sample period.[19] Thus, we are able to estimate the effect of individual shocks on the volatility of aggregate manufacturing output growth using equation (25) and adapted versions of it for idiosyncratic demand, producer country and industry shocks. We must note that our analysis only considers the covariances between the 19 sectors in our sample. If production data on all sectors of an economy were available, one could calculate the effect of individual shocks on the volatility of aggregate production growth.

Table 9 shows our estimates for the share of volatility of manufacturing production growth due to global demand, idiosyncratic demand, producer country and industry shocks, respectively. Global demand shocks lead to higher aggregate manufacturing volatility for the vast majority of countries (53% on average). Only five countries experience lower volatility due to global demand shocks. Producer country shocks reduce volatility in manufacturing for most countries by, on average, 49% (23% excluding the outliers). Industry shocks have a very small effect for all countries. All these results are consistent with our findings at the industry-level. This implies that either the effect of these shocks on industries' volatilities dominates the one on the covariances between sectors, or both have the same sign.

Idiosyncratic demand shocks are an exception. In contrast to the results at the industry-level, we find that they reduce manufacturing risk for most countries by, on average, 80% (23% without Canada, Colombia and the US). In other words, for some countries, idiosyncratic demand shocks lead to much lower covariances between sectors, which damp the higher volatilities they induce at the industry level. This is what we term "diversification by covariance". Idiosyncratic demand risk reduces aggregate volatility because, given the structure of destination markets, it tends to display a strong negative covariation between industries. As a result, higher idiosyncratic risk at the industry level reduces aggregate manufacturing volatility.

In conclusion, the main result of these counterfactual exercises is that demand shocks are major sources of industrial fluctuations, while industry shocks are not.

[19] Table B.1 provides the exact average for each producer country.

7 Industry Volatility, Demand Risks and Trade

How and through which channels does trade affect volatility of industrial output? Recent evidence suggests that industries more open to trade experience higher output volatility (Di Giovanni and Levchenko, 2009). However, there is still much to know about what drives this relationship. There are three potential channels through which international trade can affect the volatility of industrial output. An industry's exports can reduce the volatility of its output if demand in foreign destination markets is less volatile than the domestic demand through a *diversification* effect. In contrast, an industry's imports can increase the volatility of that industry as imported inputs expose local production to foreign shocks (i.e., *supply-chain* effect) or imported varieties increase the volatility of demand at home by increasing consumers' substitution opportunities (i.e., *competition* effect), or both.

Here, we aim at providing new insights on the relationship between trade and volatility at the industry level. Accordingly, the first subsection estimates the empirical relationship between trade and volatility of industrial output. The second subsection uncovers the empirical underpinnings of this relationship by focussing on the effect of trade on both global and idiosyncratic demand risks.

7.1 Volatility of Industrial Output and Trade

In order to examine the relationship between international trade and industrial output volatility, we use industry-level data for 1992. More specifically, we estimate the following model:

$$logVar(q^{ic}) = \beta_0 + \beta_1 * log(Trade\,Openness)_{ic} + \beta_2 * log(Productivity)_{ic} + \boldsymbol{\gamma}_i + \boldsymbol{\gamma}_c + \epsilon_{ic} \quad (28)$$

where $Var(q^{ic})$ is the volatility of industry i's output in country c that we estimated in section 5.1, $Trade\ Openness_{ic}$ is exports plus imports divided by gross output within sector i of country c, $Productivity_{ic}$ is industry i's output per worker in c, and $\boldsymbol{\gamma}_c$ and $\boldsymbol{\gamma}_i$ are producer country and industry fixed effects, respectively.

Our baseline specification includes $Productivity$ and fixed effects to partially control for factors that simultaneously affect trade and volatility in an industry. The inclusion of country effects allows us to control for producer country-specific characteristics as a country's income, institutional quality, financial development, terms of trade volatility, or political system. Industry fixed effects control for industry-specific characteristics including intrinsic output volatility, factor and R&D intensity, and reliance on external finance.

Column (1) of Table 10 reports the ordinary least squares (OLS) estimates of the baseline specification in equation (28).[20] Consistent with Di Giovanni and Levchenko (2009), we find that trade positively affects volatility at the industry-level.[21] Specifically, an increase of 1% in an industry's trade openness significantly increases the volatility of its output, on average, by 0.25%.

A potential concern is that our estimate is biased as trade openness and volatility are jointly determined. To address this concern, we follow Do and Levchenko (2007) and construct an instrument for trade openness. We first predict bilateral trade shares of output at the industry-level using a gravity model that only includes geographic variables such as bilateral distance, size, common border and whether either trade partner is landlocked. Summing up these shares across all trade partners, yields, for each country-industry, the share of trade to output predicted by geography, i.e., our instrument for trade openness.[22] Column (2) of Table 10 reports the instrumental variable (IV) estimate of the effect of trade on industrial volatility for our baseline specification. In the bottom panel of Table 10 the Kleibergen-Paap rk Wald test suggests the instrument is strong with a F-statistics well above 10.[23] The positive effect of trade on volatility is robust, but, as reported in the second panel of Table 10, we do not find evidence in favor of the endogeneity of trade openness and prefer the OLS over the IV estimate.

To explore further the relationship between trade and volatility, we estimate the model in equation (28) splitting the trade openness variable into the industry's export share of output and the share of imports to output (i.e., import penetration). OLS and IV estimates for this specification are reported in columns (3) and (4) of Table 10, respectively. While industries with higher import penetration experience higher output volatility, industries with larger shares of exports do not experience lower volatility. In other words, intra-industry imports drive the positive effect of trade on volatility.

[20]The number of observations in all our estimated models in 638 instead of 646 because of missing information on the output per worker variable.

[21]Differently from us, Di Giovanni and Levchenko (2009) analyze the volatility of annual output growth per worker.

[22]The details of this approach can be found in both Do and Levchenko (2007) and Di Giovanni and Levchenko (2009). The instrument we use in this section does not sum up bilateral trade shares with the ROW predicted by the gravity model. That is because obtaining these shares requires us to impute some of the gravity variables. We did construct the instrument summing up bilateral trade shares with the ROW and our results are hardly any different.

[23]We use "rule of thumb" of (Staiger and Stock, 1997) that the F-statistic should be at least 10 for weak identification not to be a problem because the (Stock and Yogo, 2005) critical values (maximal IV size) are only available for the i.i.d. case (Baum et al., 2007).

Table C.1 in Appendix C shows that the baseline estimates in Table 10 are robust to the inclusion of the following control variables, which could simultaneously affect trade and volatility in an industry: the industry's size, the country's terms of trade volatility interacted with the industry-level trade openness and the country's credit to private sector (% of GDP) interacted with the Raddatz (2006) industry-level measure of liquidity needs.

7.2 Demand Risks and Trade

To pin down the channels through which trade affects volatility of industrial output, in this subsection, we estimate a model identical to the one in equation (28) but instead of using output volatility as the dependent variable, we use global and idiosyncratic demand risks. More specifically, we estimate:

$$Y_{ic} = \beta_0 + \beta_1 * log(Trade\ Openness)_{ic} + \beta_2 * log(Productivity)_{ic} + \boldsymbol{\gamma}_i + \boldsymbol{\gamma}_c + \epsilon_{ic} \quad (29)$$

where Y_{ic} is one of the demand risks from section 5.2: $GDMD_{ic}, GDMD^h_{ic}, GDMD^*_{ic}$, $IDMD_{ic}, IDMD^h_{ic}$, or $IDMD^*_{ic}$. We choose to express the dependent variables in levels so that the estimated effect of trade on the components of each demand risk sum up to the effect on total demand risk. The implications of our analysis are robust to expressing demand risks in logs.[24] As in the previous subsection, we also estimate alternative specifications where we split the trade openness variable in the industry's exports and imports share of output.

Tables 11 and 12 report OLS and IV estimates of our models for the global demand risk and its components. Tables 13 and 14 report OLS and IV estimates for the idiosyncratic demand risk and its components. In what follows, we mainly discuss the OLS estimates as they are always robust when trade, exports, and imports are found to be endogenous and instrumented for.

In Table 11 we find evidence that industries more open to trade face lower home market and total global demand risks. In particular, our estimates imply that a one standard deviation increase in log of trade openness decreases the home market and total global demand risks by 0.14 and 0.12 of a standard deviation, respectively. The estimates in Table 12 imply that this result is driven by industries' share of exports. In particular, we find that industries with a larger share of exports face a smaller home market global demand risk, but a larger trade-related global demand risk. That is exactly what one would expect given that the way in which sale shares in the home and international

[24]Results are available upon request.

markets enter the calculation of these components. However, the fact that industries with a larger share of exports also face a lower global demand risk suggests that they export to foreign markets with a less volatile demand (in the global sense) than the home market, i.e., exports have a *diversification* effect.

The estimates in Table 13 imply that industries more open to trade experience higher idiosyncratic demand risks. In particular, a one standard deviation increase in an industry's trade openness increase its home market, trade-related, and overall idiosyncratic demand risks by 0.43, 0.21 and 0.45 of a standard deviation, respectively. Table 14 reveals that industries' import penetration drives this result. Both the home market and trade-related idiosyncratic demand risks are higher in industries with a high share of intra-industry imports. This finding is consistent with the *supply-chain* effect of imports as intra-industry imported inputs increase the exposure to foreign shocks and make production more volatile. In fact, idiosyncratic demand risks are determined, even if in small part according to section 4, by industry-country specific shocks, which include shocks to the supply-chain. In addition, the effect of intra-industry imports on the home market idiosyncratic demand risk is three times larger than the one on the trade-related risk. That can only be the case if intra-industry imports affect domestic demand in addition to production by making it more volatile due to increased substitution opportunities for consumers, i.e. if *competition* effects are at work. Table C.2-C.5 in Appendix C show our estimates in Tables 11- 14, respectively, are robust to the inclusion of additional control variables.

The results of this section are novel and deepen our understanding of the relationship between trade and volatility at the industry-level. First, they show that trade increases volatility because imports have a large impact on one of its largest components, the idiosyncratic demand risk, through both *supply-chain* and *competition* effects. Second, exports reduce output volatility through their *diversification* effect on global demand risk.

8 Conclusion

We develop and estimate a decomposition of output volatility at the industry-level which accounts for producer-country, industry, demand shocks, and their interaction in the context of an open economy. This allows us to explore the effects of trade and exposure to international markets on industrial volatility. Our results suggest that countries that are volatile in one industry tend to be volatile in other industries as well. Put simply, industrial output volatility does not depend substantially on industry-specific factors. It depends mostly on country-specific factors, such as exposure to aggregate shocks, sale diversification patterns, or both. The decompositions developed confirm these results and imply that demand risks account for most of the volatility of industrial output, with the contribution of trade-related demand risks depending on the composition of export destinations.

Furthermore, we quantify the effect of individual shocks on output volatility at the industry-level and at the aggregate manufacturing level. We find that, without global or idiosyncratic shocks, industrial risk would be much lower for most countries. However, without producer-country or industry shocks little would change. Similar results hold at the aggregate manufacturing level, except for idiosyncratic demand shocks. Without idiosyncratic demand shocks, manufacturing volatility would be higher for most countries. This is because these shocks covary strongly negatively between industries, which we term "diversification through covariance".

Finally, we use estimates of industrial output volatility and its demand components to shed light on the relationship between trade and output volatility at the industry level. We find evidence that exports and intra-industry imports have opposite effects on industrial output volatility. In particular, exports reduce industrial volatility as they are targeted to countries with lower global demand volatility than the home market's (a diversification effect). Intra-industry imports drive the positive relationship between industrial output volatility and trade at the industry level by increasing uncertainty in both domestic demand and production (competition and supply-chain effects).

The implications of our findings for aggregate welfare are complex. While exports improve aggregate welfare as they hedge some volatility at the industry-level, we cannot conclude that imports reduce it. Intra-industry imports' potential negative effect on welfare due to increased industrial output volatility might be compensated by gains in production efficiency, lower prices and access to a wider set of product varieties for consumers. Determining the net effect of trade on aggregate welfare through the volatility channel is a promising avenue for future research.

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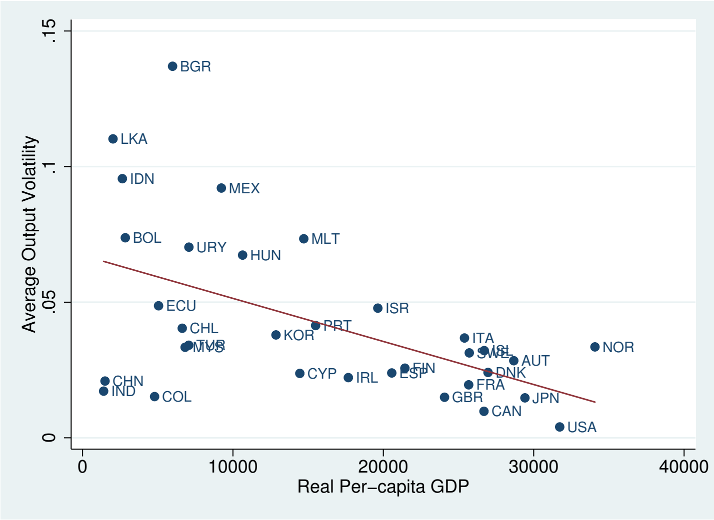

Figure 1: Average Volatility of industrial Output in 1992

Note. Table 1 matches the country labels in the Figure to the corresponding country.

Table 1: Standard Deviation of Producer Country- and Industry-specific Shocks

Producer Country	$\sqrt{\omega^2_{\mu_c}}$	Industry	$\sqrt{\varphi^2_{\lambda_i}}$
Austria, AUT	0.0599	Apparel	0.0371
Bulgaria, BGR	0.0965	Beverages	0.0284
Bolivia, BOL	0.0621	Chemicals, Industrial	0.0380
Canada, CAN	0.0995	Chemicals, Other	0.0236
Chile, CHL	0.0594	Fabricated Metal Products	0.0288
China, CHN	0.0940	Food	0.0290
Colombia, COL	0.0757	Glass and its Products	0.0139
Cyprus, CYP	0.0772	Iron and Steel	0.0416
Denmark, DNK	0.0555	Leather and its Products	0.0388
Ecuador, ECU	0.0598	Machinery, Electric	0.0286
Finland, FIN	0.0740	Machinery, Other	0.0253
France, FRA	0.0455	Non-ferrous Metals	0.0416
Germany, DEU	0.0599	Paper and its products	0.0207
Hungary, HUN	0.1359	Plastic Products	0.0204
India, IND	0.0542	Printing, Publishing, and Allied Industries	0.0272
Indonesia, IDN	0.0853	Rubber Products	0.0238
Iceland, ISL	0.0669	Textiles	0.0191
Ireland, IRL	0.0537	Transport Equipment	0.0283
Israel, ISR	0.0581	Wood Products except Furniture	0.0323
Italy, ITA	0.0556		
Japan, JPN	0.0557		
Korea, KOR	0.1121		
Malaysia, MYS	0.0720		
Malta, MLT	0.0749		
Mexico, MEX	0.0802		
Norway, NOR	0.0491		
Portugal, PRT	0.0672		
Spain, ESP	0.0510		
Sri Lanka, LKA	0.0905		
Sweden, SWE	0.0637		
Turkey, TUR	0.0692		
United Kingdom, GBR	0.0871		
United States, USA	0.0813		
Uruguay, URY	0.0522		

Table 2: Standard Deviation and Correlations of Global Demand Shocks, 1992

Destination Market	σ_κ	$\overline{\rho}$	Market	σ_κ	$\overline{\rho}$
Albania	0.107	0.052	Kyrgyzstan	0.133	0.159
Algeria	0.119	0.046	Latvia	0.160	0.162
Argentina	0.285	0.271	Libya	0.143	0.022
Australia	0.108	0.271	Lithuania	0.234	0.137
Austria*	0.115	0.348	Luxembourg	0.137	0.237
Bangladesh	0.087	0.179	Macedonia	0.311	0.077
Belgium	0.112	0.396	Malta*	0.103	0.341
Bolivia*	0.175	0.297	Malaysia*	0.156	0.197
Bosnia & Herzegovina	0.228	0.159	Mexico*	0.270	0.139
Brazil	0.208	0.361	Morocco	0.097	0.326
Brunei Darussalam	0.087	0.147	Netherlands	0.106	0.424
Belarus	0.134	0.274	New Zealand	0.112	0.255
Bulgaria*	0.147	0.073	Nigeria	0.193	0.172
Cameroon	0.092	0.053	Norway*	0.118	0.330
Canada*	0.116	0.135	Pakistan	0.073	0.277
Chile*	0.207	0.337	Paraguay	0.154	0.354
China*	0.125	0.161	Peru	0.190	0.257
Colombia*	0.156	0.271	Philippines	0.166	0.279
Cote D'Ivoire	0.113	0.227	Poland	0.151	0.293
Croatia	0.220	0.190	Portugal*	0.137	0.354
Cyprus*	0.108	0.254	Romania	0.171	0.311
Czech Republic	0.144	0.271	Russian Fed.	0.199	0.229
Denmark*	0.185	0.178	Saudi Arabia	0.107	0.100
Ecuador*	0.155	0.159	Serbia	0.327	0.137
Egypt	0.075	0.147	Singapore	0.138	0.233
Estonia	0.171	0.246	Slovakia	0.132	0.352
Finland*	0.135	0.325	Slovenia	0.247	0.159
France*	0.113	0.393	Spain*	0.163	0.354
Gabon	0.119	0.099	Sri Lanka*	0.079	0.336
Germany*	0.114	0.390	Sweden*	0.134	0.309
Greece	0.102	0.386	Switzerland	0.122	0.393
Hong Kong	0.105	0.346	Taiwan	0.143	0.295
Hungary*	0.125	0.204	Thailand	0.157	0.286
Iceland	0.107	0.283	Tunisia	0.083	0.310
India*	0.108	0.140	Turkey*	0.153	0.205
Indonesia*	0.170	0.199	Ukraine	0.146	0.218
Ireland*	0.089	0.398	United Kingdom*	0.098	0.407
Israel*	0.116	0.177	United States*	0.075	0.105
Italy*	0.158	0.365	Uruguay*	0.184	0.360
Japan*	0.118	0.321	Venezuela	0.211	0.161
Kazakhstan	0.219	0.024	Viet Nam	0.135	0.347
Kenya	0.107	0.395	Rest of the World	0.076	0.378
Korea*	0.204	0.097			

Note. σ_κ and $\overline{\rho}$ are a market's global demand shocks standard deviation and their average correlation with other markets' global demand shocks. The * identifies markets that are also producing countries in our sample.

Table 3: Standard Deviation and Correlations of Idiosyncratic Demand Shocks, 1992

Producer Country	$\sigma_{\epsilon_{cc}}$ (1)	$\overline{\sigma_{\epsilon_{m\neq c}}}$ (2)	$\overline{\rho_{\epsilon_c\epsilon_m}}$ (3)	$\overline{\rho_{\epsilon_m\epsilon_{m'}}}$ (4)
Austria	0.156	0.575	0.098	0.033
Bolivia	0.350	0.683	-0.012	0.030
Bulgaria	0.435	0.837	0.027	0.021
Canada	0.151	0.779	0.054	0.018
Chile	0.199	0.831	0.028	0.010
China	0.187	0.575	0.024	0.032
Colombia	0.174	0.928	0.032	0.018
Cyprus	0.161	0.993	0.008	0.006
Denmark	0.150	0.535	0.035	0.028
Ecuador	0.218	0.851	0.010	0.022
Finland	0.140	0.713	0.076	0.041
France	0.083	0.421	0.068	0.030
Germany	0.137	0.289	0.078	0.057
Hungary	0.300	0.804	0.082	0.048
Iceland	0.312	0.869	0.033	0.019
India	0.128	0.725	0.005	0.017
Indonesia	0.334	0.797	0.016	0.026
Ireland	0.179	0.745	0.073	0.034
Israel	0.275	0.712	0.017	0.020
Italy	0.163	0.388	0.097	0.039
Japan	0.105	0.467	0.112	0.039
Korea	0.186	0.682	0.044	0.029
Malaysia	0.206	0.735	0.055	0.041
Malta	0.223	0.950	0.085	0.011
Mexico	0.268	0.931	0.020	0.022
Norway	0.140	0.812	0.056	0.026
Portugal	0.152	0.845	0.058	0.026
Spain	0.101	0.623	0.009	0.012
Sri Lanka	0.346	0.815	0.091	0.052
Sweden	0.134	0.544	0.012	0.040
Turkey	0.193	0.898	-0.006	0.015
United Kingdom	0.119	0.400	0.106	0.044
United States	0.098	0.466	0.097	0.048
Uruguay	0.227	0.814	0.016	0.014

Note. All the standard deviations and average correlations have been aggregated at the producer country level using as weights each industry's share in the producer country's total gross output. $\sigma_{\epsilon_{cc}}$ is the average standard deviation of home market idiosyncratic demand shocks. $\overline{\sigma_{\epsilon_{m\neq c}}}$ is the average standard deviation of foreign idiosyncratic shocks. $\overline{\rho_{\epsilon_c\epsilon_m}}$ is the average correlation of home market with foreign markets' idiosyncratic shocks. $\overline{\rho_{\epsilon_m\epsilon_{m'}}}$ is the average correlation between idiosyncratic demand shocks of any pair of foreign destinations.

Table 4: Volatility of Industrial Output by Producer Country

Producer Country	Average (1)	CV (2)	Average Spearman ρ (3)
Austria	0.028	0.408	0.138
Bulgaria	0.137	0.536	0.120
Bolivia	0.074	0.906	0.272
Canada	0.010	0.559	0.245
Chile	0.040	0.721	0.361
China	0.021	0.438	0.264
Colombia	0.015	0.763	0.343
Cyprus	0.024	1.483	0.098
Denmark	0.024	0.423	0.153
Ecuador	0.049	1.050	0.156
Finland	0.026	0.378	0.295
France	0.020	0.334	0.302
Germany	0.024	0.529	0.056
Hungary	0.067	1.267	0.095
India	0.017	0.669	0.298
Indonesia	0.096	0.395	0.248
Iceland	0.032	1.754	0.224
Ireland	0.022	0.801	0.196
Israel	0.048	0.695	0.045
Italy	0.037	0.409	0.243
Japan	0.015	0.185	0.163
Korea	0.038	0.486	0.345
Malaysia	0.033	0.925	0.240
Malta	0.073	0.914	0.178
Mexico	0.092	0.373	0.031
Norway	0.034	0.832	0.272
Portugal	0.041	0.449	0.185
Spain	0.024	0.307	0.362
Sri Lanka	0.110	0.587	0.203
Sweden	0.031	0.264	0.200
Turkey	0.034	0.551	0.283
United Kingdom	0.015	0.279	0.301
United States	0.004	0.893	0.288
Uruguay	0.070	1.454	0.300

Note. The average is weighted using each industry's gross output share. CV stands for coefficient of variation. The Spearman ρ is the simple average of all pairwise correlations between the rankings of output volatility by industry of each country and the remaining 33 countries.

Table 5: Volatility of Industrial Output by Industry

Industry	Average (1)	CV (2)	Average Spearman ρ (3)
Apparel	0.020	1.036	0.606
Beverages	0.020	0.776	0.555
Chemicals, Industrial	0.017	0.987	0.629
Chemicals, Other	0.016	1.599	0.629
Fabricated Metal Products	0.021	0.943	0.675
Food	0.012	0.973	0.665
Glass and its Products	0.015	0.832	0.519
Iron and Steel	0.021	0.715	0.485
Leather and its Products	0.029	0.808	0.648
Machinery, Electric	0.018	0.774	0.689
Machinery, Other	0.019	0.963	0.643
Non-ferrous Metals	0.026	0.558	0.611
Paper and its Products	0.014	0.750	0.627
Plastic Products	0.018	1.156	0.639
Printing, Publishing, and Allied Industries	0.014	1.023	0.639
Rubber Products	0.020	1.000	0.511
Textiles	0.017	0.906	0.589
Transport Equipment	0.018	1.017	0.616
Wood products, except furniture	0.027	1.141	0.600

Note. The average is weighted using each country's share in the industry's total gross output. CV stands for coefficient of variation. The Spearman ρ is the simple average of all pairwise correlations between the rankings of countries' output volatility in each industry and the remaining 19 industries.

Table 6: Industrial Output Volatility: Decomposition Results by Producer Country, 1992

Producer Country	$GDMD$	$IDMD$	$PCTY$	IND	$COV_{\mu\kappa}$	$COV_{\epsilon\kappa}$	$COV_{\epsilon\mu}$	$COV_{\epsilon\lambda}$	$COV_{\lambda\mu}$	$COV_{\lambda\kappa}$
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Austria	0.012	0.017	0.004	0.001	0.002	0.000	-0.006	0.000	0.000	0.000
	47.6%	57.4 %	14.2%	3.3%	6.3%	-2.2%	-26.0%	-0.7%	0.0%	0.0%
Bulgaria	0.013	0.101	0.009	0.001	0.009	-0.003	0.006	0.001	0.000	0.000
	10.7%	76.7%	8.6%	0.9%	7.4%	-7.0%	2.6%	0.3%	0.4%	-0.5%
Bolivia	0.027	0.083	0.004	0.001	-0.009	-0.029	-0.002	-0.001	0.000	-0.001
	56.8%	124.0%	7.7%	1.6%	-19.0%	-67.5%	-1.9%	-0.7%	0.9%	-2.0%
Canada	0.010	0.020	0.010	0.001	0.003	-0.013	-0.020	-0.002	0.001	0.000
	185.0%	359.5%	171.9%	14.5%	62.3%	-327.0%	-343.7%	-34.4%	8.0%	3.8%
Chile	0.034	0.029	0.004	0.001	-0.002	-0.017	-0.007	-0.000	0.000	-0.001
	111.1%	71.8%	11.4%	3.5%	-5.6%	-67.9%	-21.1%	-0.7%	0.4%	-2.9%
China	0.013	0.028	0.009	0.001	0.007	-0.018	-0.017	-0.001	0.000	0.000
	72.3%	153.6%	51.4%	4.9%	37.6%	-112.7%	-100.9%	-5.5%	-1.2%	0.5%
Colombia	0.022	0.026	0.006	0.001	-0.001	-0.027	-0.011	-0.001	0.000	0.000
	181.8%	203.6%	47.7%	6.5%	-5.1%	-231.3%	-97.1%	-4.6%	2.9%	-4.5%
Cyprus	0.011	0.024	0.006	0.001	-0.004	-0.002	-0.011	-0.002	0.000	0.000
	95.6%	143.0%	68.2%	17.2%	-52.8%	-33.8%	-100.0%	-24.4%	1.0%	-13.8%
Denmark	0.019	0.012	0.003	0.001	0.002	-0.011	-0.001	-0.000	0.000	-0.001
	91.1%	46.4%	14.7%	4.0%	10.8%	-54.4%	-6.1%	0.9%	-1.9%	-5.4%
Ecuador	0.018	0.035	0.004	0.001	-0.007	0.005	-0.003	-0.002	0.000	-0.001
	55.6%	64.5%	12.4%	2.7%	-24.0%	8.9%	-11.8%	-5.0%	-0.8%	-2.4%
Finland	0.015	0.015	0.005	0.001	0.003	-0.003	-0.010	0.000	0.000	0.000
	66.9%	61.6%	24.3%	3.9%	12.8%	-20.0%	-47.2%	-1.3%	0.2%	-1.1%
France	0.012	0.006	0.002	0.001	0.003	-0.001	-0.001	-0.001	0.000	0.000
	65.6%	26.5%	11.6%	4.7%	17.2%	-10.7%	-8.2%	-5.8%	0.3%	-1.2%
Germany	0.012	0.013	0.004	0.001	0.003	-0.006	-0.002	-0.001	0.000	0.000
	54.5%	53.8%	16.9%	3.8%	14.3%	-29.0%	-11.3%	-4.3%	-0.2%	1.6%
Hungary	0.011	0.065	0.018	0.001	-0.007	-0.007	-0.015	0.000	0.000	0.000
	34.6%	113.5%	57.9%	2.6%	-22.0%	-15.4%	-64.5%	-6.4%	0.0%	-0.4%
Iceland	0.009	0.027	0.004	0.001	-0.008	0.012	-0.010	-0.002	0.001	-0.001
	55.1%	88.7%	34.0%	6.0%	-59.5%	37.8%	-44.0%	-16.9%	-0.2%	-1.0%
India	0.010	0.015	0.003	0.001	0.000	-0.009	-0.001	-0.001	0.000	0.000
	83.2%	101.0%	24.3%	7.1%	0.5%	-88.1%	-16.2%	-6.4%	-4.1%	-1.3%
Indonesia	0.019	0.068	0.007	0.001	-0.005	0.009	-0.003	-0.001	0.000	0.000
	23.7%	72.9%	8.8%	1.1%	-5.5%	5.1%	-3.2%	-2.1%	-0.4%	-0.4%
Ireland	0.008	0.022	0.003	0.001	0.002	-0.003	-0.007	-0.002	0.000	0.000
	46.3%	96.3%	17.7%	4.8%	11.8%	-18.7%	-43.1%	-14.1%	2.2%	-3.1%

Continues on the next page

Table 6 (cont'd): Industrial Output Volatility: Decomposition Results by Country, 1992

Producer Country	$GDMD$	$IDMD$	$PCTY$	IND	$COV_{\mu\kappa}$	$COV_{\epsilon\kappa}$	$COV_{\epsilon\mu}$	$COV_{\epsilon\lambda}$	$COV_{\lambda\mu}$	$COV_{\lambda\kappa}$
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Israel	0.010	0.054	0.003	0.001	0.001	-0.020	-0.001	-0.001	0.000	0.000
	28.7%	118.0%	9.1%	2.0%	2.8%	-54.5%	-5.0%	-2.7%	0.5%	1.1%
Italy	0.020	0.019	0.003	0.001	0.003	-0.006	-0.003	-0.001	0.000	0.000
	63.9%	48.0%	9.8%	2.7%	8.5%	-22.8%	-8.2%	-1.9%	0.3%	-0.4%
Japan	0.012	0.010	0.003	0.001	-0.006	-0.004	0.001	-0.002	0.000	0.000
	85.2%	66.8%	21.7%	5.9%	-43.5%	-31.2%	6.1%	-12.7%	-2.0%	3.6%
Korea	0.029	0.025	0.012	0.001	0.000	-0.005	-0.024	-0.001	0.000	0.000
	101.2%	82.0%	41.9%	3.1%	0.5%	-41.9%	-82.1%	-3.5%	0.8%	-2.0%
Malaysia	0.014	0.025	0.005	0.001	-0.003	-0.007	-0.001	-0.001	0.000	0.000
	55.9%	72.0%	20.9%	3.5%	-11.5%	-28.4%	-8.5%	-3.6%	-1.5%	-1.6%
Malta	0.010	0.075	0.006	0.001	-0.004	0.002	-0.014	-0.002	-0.001	0.001
	28.1%	111.6%	16.2%	2.7%	-11.3%	-3.9%	-38.6%	-4.7%	-1.3%	1.1%
Mexico	0.049	0.048	0.006	0.001	-0.006	-0.003	-0.004	0.000	0.000	0.000
	66.4%	52.3%	8.1%	1.2%	-8.5%	-15.6%	-3.9%	0.5%	-0.4%	0.0%
Norway	0.012	0.019	0.002	0.001	0.004	-0.002	-0.003	-0.000	0.000	0.000
	58.1%	49.9%	11.4%	4.3%	19.8%	-24.2%	-14.7%	-0.3%	-0.9%	-3.4%
Portugal	0.016	0.020	0.005	0.001	-0.001	0.005	-0.006	0.001	0.000	0.000
	48.3%	48.7%	13.2%	2.3%	-1.5%	6.0%	-18.5%	2.4%	0.1%	-1.0%
Spain	0.023	0.008	0.003	0.001	-0.002	-0.004	-0.004	-0.001	0.000	0.000
	108.2%	36.2%	11.9%	3.9%	-7.7%	-26.7%	-17.7%	-4.4%	-0.7%	-3.1%
Sri Lanka	0.005	0.098	0.008	0.001	0.001	-0.005	0.003	-0.000	0.000	0.000
	5.8%	89.0%	10.4%	1.0%	0.1%	-7.2%	2.4%	-0.7%	-0.7%	-0.1%
Sweden	0.014	0.010	0.004	0.001	0.001	0.002	0.000	-0.001	0.000	0.000
	48.2%	31.2%	13.8%	3.0%	4.9%	3.0%	-0.7%	-2.4%	-0.3%	-0.5%
Turkey	0.019	0.032	0.005	0.001	0.000	-0.013	-0.009	-0.001	0.000	0.000
	71.1%	102.7%	17.8%	3.4%	0.8%	-58.6%	-31.4%	-3.3%	0.1%	-2.6%
United	0.009	0.012	0.008	0.001	0.006	-0.004	-0.015	-0.001	0.000	0.000
Kingdom	65.4%	84.8%	55.3%	6.0%	43.9%	-35.4%	-109.4%	-6.8%	-1.4%	-2.6%
United	0.005	0.009	0.007	0.001	-0.003	-0.002	-0.010	-0.002	0.000	0.000
States	325.9%	534.2%	417.1%	49.2%	-236.8%	-230.2%	-649.6%	-119.9%	43.1%	-32.9%
Uruguay	0.028	0.050	0.003	0.001	-0.008	-0.001	-0.002	0.000	0.000	0.000
	76.9%	69.5%	7.9%	2.3%	-23.5%	-28.6%	-4.0%	0.5%	1.9%	-2.9%

Note: Columns (1)-(10) report, for each country, the average level and contribution of the components of industrial volatility estimated according to equations (10)-(19), respectively. The aggregation uses as weights each industry's share in the producer country's total gross output. For each country, the sum of all components equals the average total output volatility reported in Table 4.

Table 7: Export Openness, and Home Market and Foreign Demand Risks, 1992

Producer Country	Export Share	$GDMD^h$ level	$GDMD^h$ %	$GDMD^*$ level	$GDMD^*$ %	$IDMD^h$ level	$IDMD^h$ %	$IDMD^*$ level	$IDMD^*$ %
Austria	0.284	0.007	59.24	0.005	40.76	0.013	78.06	0.004	21.94
Bolivia	0.158	0.023	84.62	0.004	15.38	0.075	95.02	0.008	4.98
Bulgaria	0.169	0.011	85.82	0.002	14.18	0.094	96.15	0.007	3.85
Canada	0.267	0.008	78.77	0.002	21.23	0.014	67.94	0.006	32.06
Chile	0.185	0.030	87.01	0.004	12.99	0.026	94.31	0.002	5.69
China	0.140	0.012	92.34	0.001	7.66	0.026	92.72	0.002	7.28
Colombia	0.068	0.021	94.41	0.001	5.59	0.026	99.68	0.000	0.32
Cyprus	0.122	0.010	89.26	0.001	10.74	0.022	93.61	0.002	6.39
Denmark	0.371	0.014	67.68	0.006	32.32	0.010	92.16	0.002	7.84
Ecuador	0.182	0.017	91.93	0.001	8.07	0.038	126.59	-0.003	-26.59
Finland	0.274	0.010	68.88	0.004	31.12	0.011	74.51	0.004	25.49
France	0.218	0.008	67.36	0.004	32.64	0.005	80.27	0.001	19.73
Germany	0.253	0.007	64.31	0.004	35.69	0.011	84.62	0.002	15.38
Hungary	0.226	0.009	77.10	0.002	22.90	0.055	94.44	0.010	5.56
Iceland	0.547	0.004	35.59	0.005	64.41	0.019	59.43	0.008	40.57
India	0.096	0.010	94.12	0.000	5.88	0.015	98.06	0.000	1.94
Indonesia	0.269	0.017	85.32	0.002	14.68	0.059	87.56	0.008	12.44
Ireland	0.378	0.003	38.08	0.005	61.92	0.013	55.59	0.009	44.41
Israel	0.184	0.010	89.88	0.001	10.12	0.049	93.97	0.005	6.03
Italy	0.239	0.016	75.58	0.005	24.42	0.018	87.34	0.002	12.66
Japan	0.128	0.011	88.38	0.001	11.62	0.009	88.28	0.001	11.72
Korea	0.236	0.027	90.30	0.002	9.70	0.021	81.47	0.004	18.53
Malaysia	0.396	0.010	66.95	0.004	33.05	0.020	71.30	0.005	28.70
Malta	0.304	0.005	51.87	0.005	48.13	0.028	46.83	0.047	53.17
Mexico	0.266	0.048	95.15	0.002	4.85	0.041	89.95	0.007	10.05
Norway	0.183	0.009	76.81	0.003	23.19	0.017	86.25	0.003	13.75
Portugal	0.219	0.012	73.53	0.004	26.47	0.016	80.37	0.004	19.63
Spain	0.169	0.019	83.02	0.004	16.98	0.007	90.55	0.001	9.45
Sri Lanka	0.284	0.003	64.42	0.001	35.58	0.085	84.21	0.012	15.79
Sweden	0.305	0.010	67.85	0.004	32.15	0.009	95.01	0.000	4.99
Turkey	0.149	0.018	93.52	0.001	6.48	0.032	102.37	-0.000	-2.37
United Kingdom	0.202	0.006	70.97	0.003	29.03	0.009	76.84	0.003	23.16
United States	0.094	0.005	90.46	0.000	9.54	0.008	88.76	0.001	11.24
Uruguay	0.247	0.022	75.08	0.006	24.92	0.044	87.32	0.006	12.68

Note. All the values in the table are aggregated at the producer country level using as weights each industry's share in the producer country's total tradable output. $GDMD^h$ and $GDMD^*$ are the home market and trade-related global demand risks, respectively. $IDMD^h$ and $IDMD^*$ are the home market and trade-related idiosyncratic demand risks, respectively.

Table 8: Individual Shocks and Industrial Volatility, 1992

Producer Country	$\frac{\hat{Var(q_t^{ic})}^{\hat{\kappa}}}{\hat{Var(q_t^{ic})}}\%$ (1)	$\frac{\hat{Var(q_t^{ic})}^{\hat{\epsilon}}}{\hat{Var(q_t^{ic})}}\%$ (2)	$\frac{\hat{Var(q_t^{ic})}^{\hat{\mu}}}{\hat{Var(q_t^{ic})}}\%$ (3)	$\frac{\hat{Var(q_t^{ic})}^{\hat{\lambda}}}{\hat{Var(q_t^{ic})}}\%$ (4)
Australia	51.68	29.21	-5.40	2.66
Bulgaria	10.64	72.37	18.90	1.06
Bolivia	-31.70	54.42	-12.25	-0.05
Canada	-75.88	-311.4	-101.4	-8.03
Chile	34.61	-17.27	-14.97	0.39
China	-2.36	-60.15	-13.07	-1.28
Colombia	-59.09	-124.87	-51.51	0.34
Cyprus	-4.91	9.04	-83.69	-20.09
Denmark	42.03	-14.18	17.43	-2.41
Ecuador	38.04	61.42	-24.21	-5.59
Finland	58.58	-5.57	-9.89	1.64
France	70.92	7.48	20.87	-1.96
Germany	41.39	13.41	19.62	0.88
Hungary	-3.15	33.66	-28.59	-4.20
Iceland	32.43	82.25	-69.76	-12.11
India	-5.67	-3.49	4.50	-4.66
Indonesia	22.92	74.68	-0.27	-1.78
Ireland	36.25	34.24	-11.42	-10.21
Israel	-21.90	58.32	7.44	0.93
Italy	49.19	16.93	10.38	0.78
Japan	14.16	41.54	-17.73	-5.22
Korea	57.79	-42.09	-38.94	-1.61
Malta	14.08	68.91	-34.99	-2.18
Malaysia	14.34	35.01	2.25	-0.29
Mexico	42.26	32.80	-4.80	1.25
Norway	50.31	10.99	15.62	-0.30
Portugal	51.77	36.39	-6.67	3.76
Spain	70.75	-8.27	-14.17	-4.31
Sri Lanka	-1.37	84.19	12.28	-0.51
Sweden	55.54	33.34	17.67	-0.34
Turkey	10.78	12.63	-12.73	-2.44
United Kingdom	71.41	-60.07	-11.51	-4.74
United States	-174.0	-345.8	-426.3	-60.53
Uruguay	21.93	36.92	-17.75	1.78

Note. $\hat{Var(q_t^{ic})}^{\hat{\kappa}}$, $\hat{Var(q_t^{ic})}^{\hat{\epsilon}}$, $\hat{Var(q_t^{ic})}^{\hat{\mu}}$, and $\hat{Var(q_t^{ic})}^{\hat{\lambda}}$ are estimated according to equations (20)-(23), respectively. The table reports values aggregated at the producer country level using as weights each industry's share in the producer country's total gross output. So, the numbers in each column are just the sum of the percentage contribution to output volatility of the components included in each corresponding equation, which are individually reported in Table 6.

Table 9: Individual Shocks and Aggregate Volatility of Manufacturing Output, 1992

Producer Country	$\frac{AV_{ct}^{\hat{\kappa}}}{AV_{ct}}$ %	$\frac{AV_{ct}^{\hat{\epsilon}}}{AV_{ct}}$ %	$\frac{AV_{ct}^{\hat{\mu}}}{AV_{ct}}$ %	$\frac{AV_{ct}^{\hat{\lambda}}}{AV_{ct}}$ %
Australia	88.20	-10.52	-8.83	0.64
Bulgaria	18.31	67.34	26.80	1.55
Bolivia	-50.14	13.40	-28.33	3.59
Canada	2.73	-521.1	-150.2	-2.25
Chile	62.19	-58.84	-21.45	-2.13
China	7.08	-110.15	-13.72	3.81
Colombia	-76.25	-239.68	-73.34	-1.34
Cyprus	41.35	-11.76	-66.49	2.12
Denmark	56.53	-32.30	23.58	-2.27
Ecuador	72.96	38.80	-32.72	-2.93
Finland	82.85	-29.05	-10.13	2.12
France	86.01	-8.93	24.05	0.05
Germany	52.51	-11.80	27.35	0.69
Hungary	-16.26	-13.13	-16.26	-3.40
Iceland	67.94	75.84	-69.75	-11.02
India	15.88	-29.60	14.18	-1.86
Indonesia	38.83	63.77	-0.46	-0.71
Ireland	69.54	-46.52	-21.11	-4.42
Israel	-35.32	38.39	13.10	0.64
Italy	72.74	-12.33	12.97	1.75
Japan	17.44	27.05	-19.87	-0.92
Korea	83.95	-40.16	-37.24	0.07
Malta	23.49	65.68	-40.42	-1.16
Malaysia	25.88	-2.73	7.05	-1.16
Mexico	62.99	32.42	-6.02	0.37
Norway	79.55	-5.66	22.84	-2.02
Portugal	72.57	29.16	-6.29	2.25
Spain	89.05	-19.42	-16.16	-1.40
Sri Lanka	0.34	57.96	37.76	-1.29
Sweden	66.46	25.67	22.54	0.97
Turkey	30.61	-17.06	-21.70	-0.43
United Kingdom	89.34	-87.13	-11.84	-0.94
United States	-30.54	-447.5	-439.1	-1.58
Uruguay	62.41	17.85	-25.24	1.99

Table 10: Volatility of industrial Output and Trade, 1992

	Log Var(q^{ic})	Log Var(q^{ic})	Log Var(q^{ic})	Log Var(q^{ic})
	OLS	IV	OLS	IV
	(1)	(2)	(3)	(4)
Log Trade Openness$_{ic}$	0.255***	0.384***		
	(0.040)	(0.109)		
Log Export Share of Output$_{ic}$			0.029	-0.050
			(0.033)	(0.123)
Log Import Penetration$_{ic}$			0.184***	0.303***
			(0.028)	(0.079)
Log Output per Worker$_{ic}$	-0.103	-0.050	-0.076*	0.020
	(0.075)	(0.081)	(0.076)	(0.086)
Constant	-3.349***	-3.458***	-3.380***	-3.773***
	(0.416)	(0.409)	(0.426)	(0.513)
R^2	0.68	0.68	0.68	0.66
Observations	638	638	638	638
H_0: Variables are exogenous:				
Robust score χ^2		1.543		5.675
p-value		0.214		0.059
First stage regression:				
KP rk Wald F-test		59.91		14.75
F-test excl. instr. for Log ESO$_{ic}$				16.68
F-test excl. instr. for Log IP$_{ic}$				53.76

Note. Robust standard errors are in parentheses. $Var(q^{ic})$ is the volatility of industry i's output in country c we estimated in section 5.1. All specifications include country- and industry- fixed effects. The KP rk Wald F-test and F-test excl. instr. are the Kleibergen-Paap rk Wald F-statistic and the F-statistic of excluded instruments, respectively. ESO and IP stand for Export Share of Output and Import Penetration, respectively. In column (4), the KP rk Wald F-test allows us to test the null of jointly weak instruments. *, **, *** significant at 10, 5 and 1 percent, respectively.

Table 11: Global Demand Risk and Trade, 1992

	$GDMD_{ic}$		$GDMD^h_{ic}$		$GDMD^*_{ic}$	
	OLS	IV	OLS	IV	OLS	IV
Log Trade Openness$_{ic}$	-0.001***	-0.001	-0.001***	0.000	0.000	-0.001
	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)	(0.000)
Log Output per Worker$_{ic}$	-0.000	-0.000	-0.001	-0.000	0.001**	0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)
Constant	0.013***	0.013***	0.012***	0.011***	0.001	0.002*
	(0.003)	(0.003)	(0.004)	(0.004)	(0.001)	(0.001)
R^2	0.82	0.82	0.76	0.76	0.50	0.45
Observations	638	638	638	638	638	638
H_0: Variables are exogenous:						
Robust score χ^2		0.161		1.943		4.745
p-value		0.689		0.163		0.029

Note. Robust standard errors are in parentheses. All specifications include country- and industry-fixed effects. *, **, *** significant at 10, 5 and 1 percent, respectively.

Table 12: Global Demand Risk, Exports and Imports, 1992

	$GDMD_{ic}$		$GDMD^h_{ic}$		$GDMD^*_{ic}$	
	OLS	IV	OLS	IV	OLS	IV
Log Export Share of Output$_{ic}$	-0.003***	-0.002***	-0.004***	-0.003***	0.001***	0.001***
	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)	(0.000)
Log Import Penetration$_{ic}$	-0.000	0.000	-0.000	0.001*	-0.000	-0.001*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Log Output per Worker$_{ic}$	0.000	0.001	-0.000	0.001	0.000*	0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)
Constant	0.006*	0.007*	0.001	0.002	0.005***	0.005***
	(0.003)	(0.004)	(0.003)	(0.004)	(0.001)	(0.001)
R^2	0.86	0.86	0.86	0.85	0.70	0.67
Observations	638	638	638	638	638	638
H_0: Variables are exogenous:						
Robust score χ^2		1.707		4.617		6.391
p-value		0.426		0.099		0.041

Note. Robust standard errors are in parentheses. All specifications include country- and industry- fixed effects. *, **, *** significant at 10, 5 and 1 percent, respectively.

Table 13: Idiosyncratic Demand Risk and Trade, 1992

	$IDMD_{ic}$		$IDMD_{ic}^h$		$IDMD_{ic}^*$	
	OLS	IV	OLS	IV	OLS	IV
Log Trade Openness$_{ic}$	0.026***	0.041***	0.021***	0.030***	0.005***	0.011
	(0.005)	(0.009)	(0.004)	(0.007)	(0.002)	(0.008)
Log Output per worker$_{ic}$	-0.013*	-0.007	-0.008	-0.005	-0.004	-0.002
	(0.007)	(0.007)	(0.006)	(0.006)	(0.004)	(0.003)
Constant	0.098**	0.086**	0.071**	0.063**	0.027	0.023
	(0.038)	(0.037)	(0.032)	(0.031)	(0.022)	(0.018)
R^2	0.46	0.44	0.45	0.44	0.15	0.13
Observations	638	638	638	638	638	638
H_0: Variables are exogenous:						
Robust score χ^2		3.255		2.337		0.684
p-value		0.071		0.126		0.408

Note. Robust standard errors are in parentheses. All specifications include country- and industry-fixed effects. *, **, *** significant at 10, 5 and 1 percent, respectively.

Table 14: Idiosyncratic Demand Risk, Exports and Imports, 1992

	$IDMD_{ic}$		$IDMD_{ic}^h$		$IDMD_{ic}^*$	
	OLS	IV	OLS	IV	OLS	IV
Log Export Share of Output$_{ic}$	0.005	-0.002	-0.005*	-0.015	0.009***	0.013*
	(0.004)	(0.013)	(0.003)	(0.010)	(0.003)	(0.008)
Log Import Penetration$_{ic}$	0.017***	0.029***	0.012***	0.022***	0.004***	0.007
	(0.003)	(0.008)	(0.002)	(0.006)	(0.001)	(0.005)
Log Output per worker$_{ic}$	-0.012	-0.002	-0.007	0.001	-0.004	-0.003
	(0.007)	(0.008)	(0.006)	(0.007)	(0.004)	(0.004)
Constant	0.103**	0.065	0.055*	0.014	0.047*	0.051*
	(0.042)	(0.048)	(0.034)	(0.039)	(0.026)	(0.031)
R^2	0.44	0.40	0.44	0.38	0.20	0.18
Observations	638	638	638	638	638	618
H_0: Variables are exogenous:						
Robust score χ^2		5.843		6.034		0.508
p-value		0.054		0.049		0.776

Note. Robust standard errors are in parentheses. All specifications include country- and industry-fixed effects. *, **, *** significant at 10, 5 and 1 percent, respectively.

Online Appendix for "Industry Volatility and International Trade"

A Derivation and Estimation of the Decomposition

A.1 Derivation of Decomposition

According to equation (3) $\boldsymbol{y^{ic}}$ is represented by the following model:

$$\boldsymbol{y^{ic}} = \boldsymbol{\kappa} + \mu_c \mathbf{1} + \lambda_i \mathbf{1} + \boldsymbol{\epsilon^{ic}} \tag{A1}$$

From equation (A1), the product of $\boldsymbol{y^{ic}}$ with its transpose is:

$$\begin{aligned} \boldsymbol{y^{ic}}\boldsymbol{y^{ic\prime}} &= (\boldsymbol{\kappa} + \mu_c \mathbf{1} + \lambda_i \mathbf{1} + \boldsymbol{\epsilon^{ic}})(\boldsymbol{\kappa'} + \mu_c \mathbf{1'} + \lambda_i \mathbf{1'} + \boldsymbol{\epsilon^{ic\prime}}) \\ &= \boldsymbol{\kappa}\boldsymbol{\kappa'} + \mu_c \mathbf{1}\boldsymbol{\kappa}' + \lambda_i \mathbf{1}\boldsymbol{\kappa}' + \boldsymbol{\epsilon^{ic}}\boldsymbol{\kappa}' + \mu_c \boldsymbol{\kappa}\mathbf{1}' + \mu_c^2 \mathbf{1}\mathbf{1}' + \lambda_i \mu_c \mathbf{1}\mathbf{1}' + \mu_c \boldsymbol{\epsilon^{ic}}\mathbf{1}' + \\ &+ \lambda_i \boldsymbol{\kappa}\mathbf{1'} + \mu_c \lambda_i \mathbf{1}\mathbf{1'} + \lambda_i^2 \mathbf{1}\mathbf{1'} + \lambda_i \boldsymbol{\epsilon^{ic}}\mathbf{1'} + \boldsymbol{\kappa}\boldsymbol{\epsilon^{ic\prime}} + \mu_c \mathbf{1}\boldsymbol{\epsilon^{ic\prime}} + \lambda_i \mathbf{1}\boldsymbol{\epsilon^{ic\prime}} + \boldsymbol{\epsilon^{ic}}\boldsymbol{\epsilon^{ic\prime}} \end{aligned} \tag{A2}$$

Taking expectations in equation (A2) and defining: $\boldsymbol{\Omega}_\kappa = E(\boldsymbol{\kappa}\boldsymbol{\kappa'})$, $\boldsymbol{\Omega}_{\epsilon^{ic}_m} = E(\boldsymbol{\epsilon^{ic}}\boldsymbol{\epsilon^{ic\prime}})$, $\omega^2_{\mu_c} = E(\mu_c^2)$, $\varphi^2_{\lambda_i} = E(\lambda_i^2)$, $\boldsymbol{\Omega_{\epsilon\kappa}} = E[\mu_c \boldsymbol{\kappa}]$, $\boldsymbol{\Omega_{\epsilon\kappa}} = E[\boldsymbol{\epsilon^{ic}_m}\boldsymbol{\kappa'}]$, $\boldsymbol{\Omega_{\epsilon\mu}} = E[\mu_c \boldsymbol{\epsilon^{ic}}]$, $\boldsymbol{\Omega_{\epsilon\lambda}} = E[\lambda_i \boldsymbol{\epsilon^{ic}}]$, $\phi_{\lambda\mu} = E[\lambda_i \mu_c]$, and $\boldsymbol{\Omega_{\lambda\kappa}} = E[\lambda_i \boldsymbol{\kappa}]$ we obtain:

$$\begin{aligned} E(\boldsymbol{y^{ic}}\boldsymbol{y^{ic\prime}}) = \boldsymbol{\Omega}_\kappa + \boldsymbol{\Omega}_{\epsilon^{ic}_m} + \omega^2_{\mu_c}\mathbf{1}\mathbf{1'} + \varphi^2_{\lambda_i}\mathbf{1}\mathbf{1'} + \boldsymbol{\Omega_{\mu\kappa}}\mathbf{1'} + \mathbf{1}\boldsymbol{\Omega'_{\mu\kappa}} + \boldsymbol{\Omega_{\epsilon\kappa}} + \boldsymbol{\Omega_{\epsilon\kappa}}' + \\ + \boldsymbol{\Omega_{\epsilon\mu}}\mathbf{1'} + \mathbf{1}\boldsymbol{\Omega'_{\epsilon\mu}} + \boldsymbol{\Omega_{\epsilon\lambda}}\mathbf{1'} + \mathbf{1}\boldsymbol{\Omega'_{\epsilon\lambda}} + 2\phi_{\lambda\mu}\mathbf{1}\mathbf{1'} + \mathbf{1}\boldsymbol{\Omega'_{\lambda\kappa}} + \boldsymbol{\Omega_{\lambda\kappa}}\mathbf{1'} \end{aligned} \tag{A3}$$

The variance of q^{ic} can then be expressed as follows:

$$\begin{aligned} Var(q^{ic}) = \boldsymbol{a^{ic\prime}}E(\boldsymbol{y^{ic}}\boldsymbol{y^{ic\prime}})\boldsymbol{a^{ic}} = \boldsymbol{a_{ic}}'\boldsymbol{\Omega}_\kappa \boldsymbol{a_{ic}} + \boldsymbol{a_{ic}}'\boldsymbol{\Omega}_{\epsilon^{ic}_m}\boldsymbol{a_{ic}} + \omega^2_{\mu_c} + \varphi^2_{\lambda_i} + 2\boldsymbol{a_{ic}}'\boldsymbol{\Omega_{\mu\kappa}} + \\ + 2\boldsymbol{a_{ic}}'\boldsymbol{\Omega_{\epsilon\kappa}}\boldsymbol{a_{ic}} + 2\boldsymbol{a_{ic}}'\boldsymbol{\Omega_{\epsilon\mu}} + 2\boldsymbol{a_{ic}}'\boldsymbol{\Omega_{\epsilon\lambda}} + 2\phi_{\lambda\mu} + 2\boldsymbol{a_{ic}}'\boldsymbol{\Omega_{\lambda\kappa}} \end{aligned} \tag{A4}$$

A.2 Equivalence of Estimators

This section shows the equivalence between the cross-sectional mean estimators (8)-(7) and the regression estimator (9).

The coefficients from estimating model (9) solve the following least-squares problem:

$$\begin{aligned} \min_{\kappa,\mu,\lambda} \quad & \left[\boldsymbol{Y} - \boldsymbol{D} \begin{pmatrix} \kappa \\ \mu \\ \lambda \end{pmatrix} \right] \\ \text{subject to} \quad & 1'_C \boldsymbol{\mu} = 0 \\ & 1'_S \boldsymbol{\lambda} = 0 \end{aligned} \tag{A5}$$

where $\boldsymbol{Y}$ is the $((MCS)\text{x}1)$ vector of shocks to sales. The matrix $\boldsymbol{D}$ is the $(MCS\text{x}(M + C+S))$ matrix of market, country and industry indicators. Accounting for the constraints, $\boldsymbol{D}$ can be written as follows:

$$\boldsymbol{D} = \left[\mathbf{1}_{SC} \otimes \boldsymbol{I}_M \quad (\boldsymbol{I}_C - \frac{1}{C}\mathbf{1}_C\mathbf{1}'_C) \otimes \mathbf{1}_{MS} \quad (\boldsymbol{I}_S - \frac{1}{S}\mathbf{1}_S\mathbf{1}'_S) \otimes \mathbf{1}_{MC} \right]$$

The minimization problem (A5) gives the following first order conditions:

$$\boldsymbol{D}'\boldsymbol{D} \begin{pmatrix} \kappa \\ \mu \\ \lambda \end{pmatrix} = \boldsymbol{D}'\boldsymbol{Y} \tag{A6}$$

$$\mathbf{1}'_C \boldsymbol{\mu} = 0 \tag{A7}$$

$$\mathbf{1}'_S \boldsymbol{\lambda} = 0 \tag{A8}$$

Now, let $\boldsymbol{l} = \sum_i \sum_c y^{ic}_m$, $\boldsymbol{f} = \sum_i \sum_m y^{ic}_m$, $\boldsymbol{p} = \sum_c \sum_m y^{ic}_m$, and $g = \mathbf{1}'\boldsymbol{l} \equiv \sum_i \sum_c \sum_m y^{ic}_m$. Then, we can rewrite estimated shocks as follows:

$$\hat{\boldsymbol{\kappa}} = \frac{\boldsymbol{l}}{SC} \tag{A9}$$

$$\hat{\boldsymbol{\mu}} = \frac{1}{MS}(\boldsymbol{f} - \frac{1}{C}\mathbf{1}g) \tag{A10}$$

$$\hat{\boldsymbol{\lambda}} = \frac{1}{MC}(\boldsymbol{p} - \frac{1}{S}\mathbf{1}g) \tag{A11}$$

Also, given the definition of $\boldsymbol{D}$:

$$\boldsymbol{D}'\boldsymbol{D} = \begin{bmatrix} (SC)\boldsymbol{I}_M & 0 & 0 \\ 0 & (MS)(\boldsymbol{I}_C - \frac{1}{C}\mathbf{1}'_C\mathbf{1}_C) & 0 \\ 0 & 0 & (MC)(\boldsymbol{I}_S - \frac{1}{S}\mathbf{1}'_S\mathbf{1}_S) \end{bmatrix}$$

Thus,

$$\boldsymbol{D}'\boldsymbol{D}\begin{pmatrix} \hat{\kappa} \\ \hat{\mu} \\ \hat{\lambda} \end{pmatrix} = \begin{pmatrix} \boldsymbol{l} \\ \boldsymbol{f} - \frac{1}{C}\mathbf{1}g \\ \boldsymbol{p} - \frac{1}{S}\mathbf{1}g \end{pmatrix} \begin{pmatrix} \sum_i \sum_c y_m^{ic} \\ \sum_i \sum_m y_m^{ic} - \frac{1}{C}\sum_i \sum_c \sum_m y_m^{ic} \\ \sum_c \sum_m y_m^{ic} - \frac{1}{S}\sum_i \sum_c \sum_m y_m^{ic} \end{pmatrix} \tag{A12}$$

At the same time,

$$\boldsymbol{D}'\boldsymbol{Y} = \begin{pmatrix} \sum_i \sum_c y_m^{ic} \\ \sum_i \sum_m y_m^{ic} - \frac{1}{C}\sum_i \sum_c \sum_m y_m^{ic} \\ \sum_c \sum_m y_m^{ic} - \frac{1}{S}\sum_i \sum_c \sum_m y_m^{ic} \end{pmatrix} = \begin{pmatrix} \boldsymbol{l} \\ \boldsymbol{f} - \frac{1}{C}\mathbf{1}g \\ \boldsymbol{p} - \frac{1}{S}\mathbf{1}g \end{pmatrix} \tag{A13}$$

The FOCs of problem (A5) are all satisfied, noticing that $\mathbf{1}'_C\hat{\boldsymbol{\mu}} = 0$ and $\mathbf{1}'_S\hat{\boldsymbol{\lambda}} = 0$.

B Data

B.1 Computing Production and Domestic Sales at the Industry Level

Data on production are from the TradeProd database. In our efforts to obtain a balanced panel of producer countries and industries, we restrict our sample by dropping countries, industries, and years for which gross output data is sparse or missing in many consecutive years. As a consequence, our sample contains 34 producer countries, 19 3-digit ISIC Rev. 2 sectors, and 21 years from 1980 to 2000, which yields 646 observations in any given year. This panel contains 0.6% missing gross output data. Among the 34 countries in our sample, 24 countries do not have missing gross output data. The remaining 10 countries report missing gross output data for a small fraction of years and sectors which ranges between 0.25% (i.e. 1 observation)to 4.76% (i.e.19 observations) of the total number of observations for each country. We interpolate the logarithm of gross output for these remaining missing values.

We compute domestic sales at the industry-level by taking the difference between a country's gross output and exports at the industry-level. To reduce the incidence of negative domestic sales we eliminate re-exports from exports. More precisely, we adjust all export values following the methodology proposed by GTAP and calculate country c's re-exports in industry i, RX_{it}^c, as follows: $RX_{it}^c = \frac{M_{it}^c}{M_{it}^c + GO_{it}^c} * X_{it}^c$, where M_{it}^c are country c's imports of good i; GO_{it}^c is country c's gross output of good i; and X_{it}^c are country c's exports of good i. Intuitively, a country can either export its production or its imports. So, if no information is available, the best guess is that a given unit of good i's exports is a re-export with probability equal to share of imports of good i in the total availability of good i in the country.

Table B.1: Share of Manufacturing Production: Average 1980-2000 by Producer Country

Producer Country	Average Share of Manufacturing Production
Austria	0.8354
Bulgaria	0.7901
Bolivia	0.6869
Canada	0.8742
Chile	0.8364
China	0.8469
Colombia	0.8634
Cyprus	0.7113
Denmark	0.8572
Ecuador	0.0598
Finland	0.8062
France	0.8677
Germany	0.8611
Hungary	0.7944
India	0.8592
Indonesia	0.8335
Iceland	0.8974
Ireland	0.9521
Israel	0.8938
Italy	0.8318
Japan	0.8887
Korea	0.8390
Malaysia	0.8773
Malta	0.8233
Mexico	0.9269
Norway	0.8715
Portugal	0.7930
Spain	0.8433
Sri Lanka	0.6586
Sweden	0.9056
Turkey	0.7674
United Kingdom	0.8538
United States	0.8557
Uruguay	0.8065

C Additional Results

The specification in equation (28) includes *Productivity*, and country and industry fixed effects to partially control for factors that simultaneously affect trade and volatility in an industry. Including these factors may still not be enough to resolve simultaneity problems at the country-industry level. Thus, following Di Giovanni and Levchenko (2009), in Table C.1 we show how robust our baseline estimates in Table 10 are to the inclusion of the following control variables: the industry's size, the country's terms of trade volatility interacted with the industry-level trade openness and the country's credit to private sector (% of GDP) interacted with the Raddatz (2006) industry-level measure of liquidity needs.

More specifically, existing literature has found that larger industries are less volatile and more open to trade. To make sure our trade estimates do not capture the effect of the industry's size, in column (2) of Table C.1 we augment the baseline specification by including an industry's share in each country's total manufacturing output (in logs).

In addition, industries more open to trade might be more sensitive to fluctuations in the country's terms of trade (TOT). To make sure a the volatility of TOT is not behind our baseline trade estimates we include its interaction with the industry's trade openness in column (3) of Table C.1 . All the variables are in logs. Data for the variance of terms of trade during 1980-1992 are from the Penn World Tables 8.1. Note also that the country fixed effect controls for the volatility of each country's TOT.

Finally, Raddatz (2006) finds that in countries with developed financial systems industries with high liquidity needs experience reduced output volatility. Industries more more open to trade typically rely more on credit relative to other industries. To avoid our baseline trade estimate captures the effect of financial development in industries with high liquidity needs in column (4) of table C.1 we control for the interaction between a country's credit to private sector (% of GDP) and Raddatz's (2006) industry-level measure of liquidity needs, which is inventories over sales calculated using COMPUSTAT data. Independent of the controls added to the baseline specification, our estimates for the effect of trade on industrial volatility are robust.

Table C.2-C.5 show how robust our baseline estimates in Tables 11 -14, respectively, are robust to the inclusion of the same additional controls discussed above for table C.1. In the interest of space the estimates reported are OLS. These are always robust when trade, imports and exports are endogenous and instrumented for. Full IV estimates are available upon request.

Table C.1: Volatility of Industrial Output and Trade, 1992: robustness checks

Panel A. Volatility of Industrial Output and Trade				
	Log Var(q^{ic})	Log Var(q^{ic})	Log Var(q^{ic})	Log Var(q^{ic})
	(1)	(2)	(3)	(4)
Log Trade Openness$_{ic}$	0.255***	0.160***	0.291***	0.254***
	(0.040)	(0.049)	(0.089)	(0.040)
Log Output per Worker$_{ic}$	-0.103	-0.027	-0.101	-0.104
	(0.075)	(0.082)	(0.076)	(0.075)
Log Share of Tradable Output$_{ic}$		-0.118***		
		(0.041)		
Log Var(TOT)$_c$ x Log Trade Open.$_{ic}$			0.006	
			(0.015)	
Liq. needs$_i$ x (Credit/GDP)$_c$				-0.004
				(0.011)
R^2	0.68	0.69	0.68	0.68

Panel B. Volatility of Industrial Output, Exports and Imports				
	Log Var(q^{ic})	Log Var(q^{ic})	Log Var(q^{ic})	Log Var(q^{ic})
	(1)	(2)	(3)	(4)
Log Export Share of Output$_{ic}$	0.029	0.026	0.083	0.029
	(0.033)	(0.032)	(0.115)	(0.033)
Log Import Penetration$_{ic}$	0.184***	0.098**	0.239***	0.184***
	(0.028)	(0.043)	(0.075)	(0.028)
Log Output per Worker$_{ic}$	-0.076	-0.016	-0.073	-0.078
	(0.076)	(0.083)	(0.077)	(0.076)
Log Share of Tradable Output$_{ic}$		-0.126**		
		(0.055)		
Log Var(TOT)$_c$ x Log Exp. Share$_{ic}$			0.008	
			(0.017)	
Log Var(TOT)$_c$ x Log Imp. Penetr.$_{ic}$			0.009	
			(0.012)	
Liq. needs$_i$ x (Credit/GDP)$_c$				-0.007
				(0.011)
R^2	0.68	0.68	0.68	0.68

Note. Robust standard errors are in parentheses. $Var(q^{ic})$ is the volatility of industry i's output in country c we estimated in section 4. All specifications include country- and industry- fixed effects, and a constant. *, **, *** significant at 10, 5 and 1 percent, respectively. TOT stands for terms of trade. The number of observations is 638 in all specifications. All specifications are estimated using OLS.

Table C.2: Global Demand Risk and Trade, 1992: robustness checks

Panel A. Dependent Variable: Global Demand Risk, $GDMD_{ic}$				
Log Trade Openness$_{ic}$	-0.001***	-0.003***	-0.002	-0.001***
	(0.000)	(0.000)	(0.001)	(0.000)
Log Output per Worker$_{ic}$	-0.000	0.001**	-0.000	-0.000
	(0.001)	(0.001)	(0.001)	(0.001)
Log Share of Tradable Output$_{ic}$		-0.002***		
		(0.000)		
Log Var(TOT)$_c$ x Log Trade Open.$_{ic}$			-0.000	
			(0.000)	
Liq. needs$_i$ x (Credit/GDP)$_c$				0.000***
				(0.000)
R^2	0.82	0.83	0.82	0.82
Panel B. Dependent Variable: Home-market Global Demand Risk, $GDMD^h_{ic}$				
Log Trade Openness$_{ic}$	-0.001***	-0.004***	-0.001	-0.001***
	(0.000)	(0.000)	(0.001)	(0.000)
Log Output per Worker$_{ic}$	-0.001	0.001**	-0.001	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)
Log Share of Tradable Output$_{ic}$		-0.003***		
		(0.000)		
Log Var(TOT)$_c$ x Log Trade Open.$_{ic}$			0.000	
			(0.000)	
Liq. needs$_i$ x (Credit/GDP)$_c$				0.000**
				(0.000)
R^2	0.76	0.79	0.76	0.76
Panel C. Dependent Variable: Trade-related Global Demand Risk, $GDMD^*_{ic}$				
Log Trade Openness$_{ic}$	0.000	0.001***	-0.001***	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Log Output per Worker$_{ic}$	0.001**	-0.000	0.001**	0.001**
	(0.000)	(0.000)	(0.000)	(0.000)
Log Share of Tradable Output$_{ic}$		0.001***		
		(0.000)		
Log Var(TOT)$_c$ x Log Trade Open.$_{ic}$			-0.000***	
			(0.000)	
Liq. needs$_i$ x (Credit/GDP)$_c$				0.000
				(0.000)
R^2	0.50	0.56	0.52	0.50

Note. Robust standard errors are in parentheses. All specifications include country- and industry- fixed effects, and a constant. *, **, *** significant at 10, 5 and 1 percent, respectively. TOT stands for terms of trade. The number of observations is 638 in all specifications. All specifications are estimated using OLS.

Table C.3: Global Demand Risk, Exports and Imports, 1992: robustness checks

Panel A. Dependent Variable: Global Demand Risk, $GDMD_{ic}$				
Log Export Share of Output$_{ic}$	-0.003***	-0.003***	-0.006***	-0.003***
	(0.000)	(0.000)	(0.001)	(0.000)
Log Import Penetration$_{ic}$	-0.000	-0.001	-0.001	-0.000
	(0.000)	(0.000)	(0.001)	(0.000)
Log Output per Worker$_{ic}$	0.000	0.001	0.000	0.000
	(0.001)	(0.001)	(0.001)	(0.001)
Log Share of Tradable Output$_{ic}$		-0.000		
		(0.000)		
Log Var(TOT)$_c$ x Log Exp. Share$_{ic}$			-0.000**	
			(0.000)	
Log Var(TOT)$_c$ x Log Imp. Penetr.$_{ic}$			-0.000	
			(0.000)	
Liq. needs$_i$ x (Credit/GDP)$_c$				0.000***
				(0.000)
R^2	0.86	0.86	0.87	0.86
Panel B. Dependent Variable: Home-market Global Demand Risk, $GDMD_{ic}^h$				
Log Export Share of Output$_{ic}$	-0.004***	-0.004***	-0.007***	-0.004***
	(0.000)	(0.000)	(0.001)	(0.000)
Log Import Penetration$_{ic}$	-0.000	-0.000	-0.001	-0.000
	(0.000)	(0.000)	(0.001)	(0.000)
Log Output per Worker$_{ic}$	0.000	0.000	-0.000	0.000
	(0.001)	(0.001)	(0.001)	(0.001)
Log Share of Tradable Output$_{ic}$		-0.000		
		(0.000)		
Log Var(TOT)$_c$ x Log Exp. Share$_{ic}$			-0.000***	
			(0.000)	
Log Var(TOT)$_c$ x Log Imp. Penetr.$_{ic}$			-0.000	
			(0.000)	
Liq. needs$_i$ x (Credit/GDP)$_c$				0.000**
				(0.000)
R^2	0.86	0.86	0.86	0.86
Panel C. Dependent Variable: Trade-related Global Demand Risk, $GDMD_{ic}^*$				
Log Export Share of Output$_{ic}$	0.001***	0.001***	0.002	0.001***
	(0.000)	(0.000)	(0.001)	(0.000)
Log Import Penetration$_{ic}$	-0.000	-0.000	-0.001	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Log Output per Worker$_{ic}$	0.000*	0.000	0.000	0.000*
	(0.000)	(0.000)	(0.000)	(0.000)
Log Share of Tradable Output$_{ic}$		0.000		
		(0.000)		
Log Var(TOT)$_c$ x Log Exp. Share$_{ic}$			0.000	
			(0.000)	
Log Var(TOT)$_c$ x Log Imp. Penetr.$_{ic}$			-0.000	
			(0.000)	
Liq. needs$_i$ x (Credit/GDP)$_c$				0.000
				(0.000)
R^2	0.70	0.70	0.70	0.70

Note. Robust standard errors are in parentheses. All specifications include country- and industry- fixed effects, and a constant. *, **, *** significant at 10, 5 and 1 percent, respectively. TOT stands for terms of trade. The number of observations is 638 in all specifications. All specifications are estimated using OLS.

Table C.4: Idiosyncratic Demand Risk and Trade, 1992: robustness checks

Panel A. Dependent Variable: Idiosyncratic Demand Risk, $IDMD_{ic}$				
Log Trade Openness$_{ic}$	0.026***	0.018***	0.037***	0.026***
	(0.005)	(0.005)	(0.011)	(0.005)
Log Output per Worker$_{ic}$	-0.013*	-0.006	-0.012*	-0.013*
	(0.007)	(0.007)	(0.007)	(0.007)
Log Share of Tradable Output$_{ic}$		-0.010***		
		(0.003)		
Log Var(TOT)$_c$ x Log Trade Open.$_{ic}$			0.002	
			(0.002)	
Liq. needs$_i$ x (Credit/GDP)$_c$				-0.002**
				(0.001)
R^2	0.46	0.47	0.46	0.46
Panel B. Dependent Variable: Home-market Idiosyncratic Demand Risk, $IDMD^h_{ic}$				
Log Trade Openness$_{ic}$	0.021***	0.014**	0.034***	0.021***
	(0.004)	(0.005)	(0.012)	(0.004)
Log Output per Worker$_{ic}$	-0.008	-0.002	-0.008	-0.009
	(0.006)	(0.006)	(0.006)	(0.006)
Log Share of Tradable Output$_{ic}$		-0.009***		
		(0.003)		
Log Var(TOT)$_c$ x Log Trade Open.$_{ic}$			0.002	
			(0.002)	
Liq. needs$_i$ x (Credit/GDP)$_c$				-0.001
				(0.001)
R^2	0.45	0.45	0.45	0.45
Panel C. Dependent Variable: Trade-related Idiosyncratic Demand Risk, $IDMD^*_{ic}$				
Log Trade Openness$_{ic}$	0.005***	0.005***	0.003	0.005***
	(0.002)	(0.001)	(0.003)	(0.002)
Log Output per Worker$_{ic}$	-0.004	-0.004	-0.004	-0.004
	(0.004)	(0.003)	(0.004)	(0.004)
Log Share of Tradable Output$_{ic}$		-0.000		
		(0.002)		
Log Var(TOT)$_c$ x Log Trade Open.$_{ic}$			-0.000	
			(0.000)	
Liq. needs$_i$ x (Credit/GDP)$_c$				-0.001
				(0.001)
R^2	0.15	0.15	0.15	0.15

Note. Robust standard errors are in parentheses. All specifications include country- and industry- fixed effects, and a constant. *, **, *** significant at 10, 5 and 1 percent, respectively. TOT stands for terms of trade. The number of observations is 638 in all specifications. All specifications are estimated using OLS.

Table C.5: Idiosyncratic Demand Risk, Exports and Imports, 1992: robustness checks

Panel A. Dependent Variable: Idiosyncratic Demand Risk, $IDMD_{ic}$				
Log Export Share of Output$_{ic}$	0.005	0.004	0.001	0.004
	(0.004)	(0.004)	(0.012)	(0.004)
Log Import Penetration$_{ic}$	0.017***	0.005	0.031***	0.017***
	(0.003)	(0.004)	(0.010)	(0.003)
Log Output per Worker$_{ic}$	-0.012	-0.004	-0.011	-0.012*
	(0.007)	(0.007)	(0.007)	(0.007)
Log Share of Tradable Output$_{ic}$		-0.017***		
		(0.005)		
Log Var(TOT)$_c$ x Log Exp. Share$_{ic}$			-0.001	
			(0.002)	
Log Var(TOT)$_c$ x Log Imp. Penetr.$_{ic}$			0.002	
			(0.001)	
Liq. needs$_i$ x (Credit/GDP)$_c$				-0.002**
				(0.001)
R^2	0.44	0.45	0.44	0.44
Panel B. Dependent Variable: Home-market Idiosyncratic Demand Risk, $IDMD^h_{ic}$				
Log Export Share of Output$_{ic}$	-0.005*	-0.005**	-0.015	-0.005*
	(0.003)	(0.003)	(0.012)	(0.003)
Log Import Penetration$_{ic}$	0.012***	0.004	0.027***	0.012***
	(0.003)	(0.003)	(0.010)	(0.002)
Log Output per Worker$_{ic}$	-0.007	-0.002	-0.007	-0.008
	(0.006)	(0.007)	(0.006)	(0.006)
Log Share of Tradable Output$_{ic}$		-0.012***		
		(0.004)		
Log Var(TOT)$_c$ x Log Exp. Share$_{ic}$			-0.002	
			(0.002)	
Log Var(TOT)$_c$ x Log Imp. Penetr.$_{ic}$			0.002*	
			(0.001)	
Liq. needs$_i$ x (Credit/GDP)$_c$				-0.001**
				(0.001)
R^2	0.44	0.45	0.45	0.44
Panel C. Dependent Variable: Trade-related Idiosyncratic Demand Risk, $IDMD^*_{ic}$				
Log Export Share of Output$_{ic}$	0.009***	0.009***	0.016***	0.009***
	(0.003)	(0.003)	(0.006)	(0.003)
Log Import Penetration$_{ic}$	0.004***	0.001	0.003	0.004***
	(0.001)	(0.001)	(0.003)	(0.001)
Log Output per Worker$_{ic}$	-0.004	-0.002	-0.004	-0.005
	(0.004)	(0.003)	(0.004)	(0.004)
Log Share of Tradable Output$_{ic}$		-0.005*		
		(0.003)		
Log Var(TOT)$_c$ x Log Exp. Share$_{ic}$			0.001	
			(0.001)	
Log Var(TOT)$_c$ x Log Imp. Penetr.$_{ic}$			-0.000	
			(0.000)	
Liq. needs$_i$ x (Credit/GDP)$_c$				-0.001*
				(0.001)
R^2	0.20	0.20	0.20	0.20

Note. Robust standard errors are in parentheses. All specifications include country- and industry- fixed effects, and a constant. *, **, *** significant at 10, 5 and 1 percent, respectively. TOT stands for terms of trade. The number of observations is 638 in all specifications. All specifications are estimated using OLS.

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