Volatility of Industrial Output, Demand Fluctuations, and International Trade*

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Abstract

Output volatility of an industry has been shown to affect substantially the welfare of its firms, consumers, and workers and to contribute to the aggregate output volatility. While country and industry factors have been considered as sources of volatility at the industry level, the uncertainty related to demand in destination markets has been neglected. Using a panel of manufacturing and trade data, this paper fills this gap in the literature by deriving and estimating the components of output volatility due to producer country-, industry- and demand-specific shocks, as well as their interaction. Our estimates suggest that industrial output volatility is a country's rather than an industry's characteristic and that demand shocks in destination markets are the main determinants of output volatility at the industry level. In addition, this paper examines the effect of trade openness on output and demand volatility. We find that industries more open to trade are more volatile because intra-industry imports make domestic demand and production more uncertain. We also find evidence suggesting that exports reduce demand volatility through their diversification effect.

JEL Classification: F15, F61

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

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1 Introduction

The degree to which an industry is exposed to shocks affects its production organization as well as the welfare of its producers, consumers and workers. According Mills and Schumann (1985), small and large firms are more likely to coexist in industries more prone to demand fluctuations. In these industries, in fact, small firms have a flexibility advantage that allows them to survive by absorbing a disproportionate share of the industry's output fluctuations. Moreover, 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).

Output fluctuations at the industry level have also important effects on aggregate volatility. Atalay (2015) shows that industry-specific shocks account for more than half of aggregate volatility due to cross-industry supply linkages and complementarities among inputs. di Giovanni and Levchenko (2009) find that trade openness increases output volatility at the industry-level and, as a result, at the aggregate level.

A number of questions are still open: What are the main sources of output volatility at the industry level? Do fluctuations in demand contribute at all? Does international trade hedge or amplify the volatility of industrial output? If so, through which channels? This paper provides answers to these questions by undertaking two different, but interrelated exercises.

In the first exercise, we develop and estimate a decomposition of industrial output volatility that identifies the role of producer country-, industry- and demand- specific shocks separately. In order to explicitly account for demand shocks in destination markets as a source of output volatility, we extend Koren and Tenreyro's (2007) methodology at the industry level. More specifically, we start by noting the relationship that aggregates innovations in the growth rate of an industry's sales to all its destination markets (domestic or foreign) into the growth rate of its total sales. We specify a factor model for innovations in the growth rate of an industry's sales to each market that includes shocks specific to the producer country, industry, destination market, and a residual term. We then derive an expression that decomposes the volatility of industrial output into several components.

The first component is related to demand shocks in destination markets that affect all goods independent of their origin, such as changes in saving and spending behavior, monetary and fiscal policies, i.e., *global demand risk*. The second component is related to demand shocks in destination markets that affect goods of a particular producer country or industry or both, such as changes in exchange rate, multilateral and discretionary trade policy, i.e., *residual demand risk*. The more concentrated an industry's sales are in markets with volatile global or residual demands, the higher is the output volatility of that industry's output. The third component is related to shocks that affect a country's ability to produce independent of the industry and destination market such as changes in economic policies, credit availability, political and social environments, i.e., *producer country risk*. The fourth component is related to shocks that affect firms in a particular industry irrespective of their location and the destination market of their products, i.e., *industry risk*. The remaining components are covariances between any pair of producer country-, industry-, and demand-specific shocks.

Empirically, we combine production data from the CEPII TradeProd and trade data from the CHELEM database for 34 countries, 85 destination markets and 19 industries between 1980 and 2000 to estimate volatility of industrial output and its components. There are three main findings. First, we find that countries that have high output volatility in some industries also have high volatility in other industries, while industries that are volatile in some countries are not necessarily volatile in other countries. Put simply, industrial output volatility seems to be a country's rather than an industry's characteristic. Second, global and residual demand risks are the driving determinants of industrial output volatility. Last, demand uncertainty in domestic markets account for more than half of both demand risks. However, there is a lot of variation in the contribution of domestic demand risk to industrial volatility across countries, even when one focuses on countries with similar level of trade openness. Put it another way, 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 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, global and residual 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 residual demand uncertainty in destination markets is lower than the domestic one, 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 options become available. Our results suggest that industries more open to trade are more volatile mainly because intra-industry imports increase residual demand risk through both supply-chain and competition effects. We also find evidence in favor of the diversification effect of exports.

This paper relates and contributes to two strands of the literature. First, we contribute to the literature that decomposes output volatility at the industry level (Stockman, 1987; Helg et al., 1995). Existing 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, both industry- and country- specific shocks are important determinants of output volatility. A limitation of past decompositions is that, by considering the growth of total country's sales 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.[1] We overcome this limitation by taking innovations in the growth rates of sales to all destination markets as the primitive and extending Koren and Tenreyro's (2007) methodology at the industry level. Importantly, we find that shocks specific to the producer country and industry play a small role in explaining the volatility of industrial output.

Second, this paper relates to a recent and growing literature that studies output volatility at the industry level. Raddatz (2006) finds that financial system 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, focussing, among other channels, on the effect of trade openness on output volatility at the industry level. We contribute by examining more closely the relationship between trade and output volatility at the industry level and by providing insights on the empirical underpinnings of this relationship. Our evidence on the supply-chain effect of intra-industry imports is consistent with the positive effect of offshoring on employment volatility in Mexico found and explained by Bergin et al. (2009, 2011).

The reminder of the paper is organized as follows. Section 2 develops our decomposition of the volatility of industrial output and describes its empirical implementation.

[1]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. Using 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.

Section 3 briefly summarizes the data. Section 4 discusses our estimates of the volatility of industrial output and its components. Section 5 provides a detailed analysis of our estimated demand risks, distinguishing their domestic component from the trade-related one. Section 6 discusses our findings on the relationship between output volatility and trade openness at the industry-level. Section 7 concludes.

2 A Decomposition of the Volatility of Industrial Output

In this section, 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 (Stockman, 1987; Helg et al., 1995) . 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 Koren and Tenreyro (2007), we specify a factor model for y_m^{ic} that includes, separately, shocks specific to the producer country, industry , and destination market. Next, we use these shocks to derive quantitative risk measures corresponding to various components of industrial output volatility.

2.1 Analytical Derivation

To begin, we notice that 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.

Next, 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 changes in spending and saving behavior, monetary and fiscal policies, standards and regulations that affect a market's consumption of goods independent of their origin, i.e., *global demand* shocks. The producer-specific disturbance, μ_c, represents changes in national economic policies, credit availability, business, political, and social environment 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, input prices, competitive environment that affects 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 exchange rate or preferences that are stronger for a particular producer country's products or changes in multilateral or discretionary trade policy are captured in this residual term. In section 5, we find that the residual term captures mostly shocks related to destination markets, that is demand shocks, and thus we refer to ϵ_m^{ic} as *residual demand* disturbance.

All the disturbances in equation (2) can be correlated. For instance, if producer-specific 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 of particular goods. If, instead, sales to certain markets in particular industries 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 (Mx1) vector of innovations y_m^{ic}, $\boldsymbol{\kappa}$ is the (Mx1) vector of market-specific shocks, $\mathbf{1}$ denotes the (Mx1) vector of ones and $\boldsymbol{\epsilon^{ic}}$ is the (Mx1) vector of residual demand disturbances; and, using matrix algebra, we decompose the variance of q^{ic}, $Var(q^{ic})$, as follows:

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

where $\boldsymbol{a^{ic}}$ is the (Mx1) 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 residual 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; $\boldsymbol{\Omega_{\epsilon\kappa}}$ and $\boldsymbol{\Omega_{\epsilon\mu}}$ are the covariance matrices between residual and global demand shocks, and between residual demand and producer country shocks, respectively; and the term $\boldsymbol{\Gamma^{ic}}$ is a matrix that aggregates all the remaining covariances between shocks.[2]

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*. 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 global demands. 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 *residual demand risk*. This term is higher if country c's sales of i are concentrated in markets with volatile residual demand. For instance, suppose Vietnam has a particularly volatile demand for French wine. The larger the share of French wine sold to Vietnam, the higher the residual demand risk of the French wine industry is. This term also accounts for the covariance of residual demand shocks in destination markets. For example, the French residual demand risk can be moderated if France sells wine to other countries with residual demand shocks negatively correlated with Vietnam's.

The *producer country*, $\omega_{\mu_c}^2$, is larger in economies that receive large and frequent production shocks, that are common to all industries and markets. The *industry* risk, $\varphi_{\lambda_i}^2$, 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 markets.

The covariance term $2\boldsymbol{a_{ic}}' \boldsymbol{\Omega_{\mu\kappa}}$ is positive or negative depending on whether sales con-

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

centrated in markets whose global demand shocks are positively or negatively correlated with producer country-specific shocks. For instance, consider producers whose main destination is the domestic market. In this case, if negative demand shocks lead systematically to expansionary policies that stimulate production, this term would be negative. A positive correlation could be observed in similar instances if the implemented expansionary policies stimulated demand to a degree that more than compensated for the initial negative shocks.

The covariance terms $2\boldsymbol{a_{ic}}'\boldsymbol{\Omega_{\epsilon\kappa}}\boldsymbol{a_{ic}}$ and $2\boldsymbol{a_{ic}}'\boldsymbol{\Omega_{\epsilon\mu}}$ are positive or negative depending on whether sales are concentrated in goods whose residual demand disturbances are positively or negatively correlated to global market and producer country shocks, respectively. For instance, if a country adopts expansionary policies in response to negative shocks to critical sectors of the economy these terms are negative. In fact, expansionary policies stimulate both the country's production and (global) demand.

The last term captures industrial risk related to the remaining covariances between industry shocks and destination market-, producer country- and residual shocks, and between producer country- and destination market-specific shocks. For expositional purposes, this term collapses together covariance terms that empirically play a very small role in explaining industrial risk.

2.2 Empirical Implementation

To empirically 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:

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

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

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

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

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

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

where d_m, h_c, f_i are indicator variables that take the value of 1 only for market m, country c and industry i, respectively, and 0 otherwise. We restrict 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.

We then compute the variance-covariance matrices of estimated shocks as follows: $\hat{\boldsymbol{\Omega}}_{\boldsymbol{k}} = 1/T\sum_{t=1}^{T} \boldsymbol{\Delta}\hat{\boldsymbol{k}}_{\boldsymbol{t}}\boldsymbol{\Delta}\hat{\boldsymbol{k}}_{\boldsymbol{t}}'$, $\hat{\boldsymbol{\Omega}}_{\epsilon_m^{ic}} = 1/T\sum_{t=1}^{T} \boldsymbol{\Delta}\hat{\boldsymbol{\epsilon}}_{\boldsymbol{t}}^{\boldsymbol{ic}}\boldsymbol{\Delta}\hat{\boldsymbol{\epsilon}}_{\boldsymbol{t}}^{\boldsymbol{ic}\prime}$, $\hat{\omega}_{\mu_c}^2 = 1/T\sum_{t=1}^{T} \Delta\hat{\mu}_{ct}^2$, $\hat{\varphi}_{\lambda_i}^2 = 1/T\sum_{t=1}^{T} \Delta\hat{\lambda}_{it}^2$, x $\hat{\boldsymbol{\Omega}}_{\boldsymbol{\mu\kappa}} = 1/T\sum_{t=1}^{T} \Delta\hat{\mu}_{ct}\boldsymbol{\Delta}\hat{\boldsymbol{k}}_{\boldsymbol{t}}'$, $\hat{\boldsymbol{\Omega}}_{\boldsymbol{\epsilon\kappa}} = 1/T\sum_{t=1}^{T} \boldsymbol{\Delta}\hat{\boldsymbol{\epsilon}}_{\boldsymbol{t}}^{\boldsymbol{ic}}\boldsymbol{\Delta}\hat{\boldsymbol{k}}_{\boldsymbol{t}}'$, $\hat{\boldsymbol{\Omega}}_{\boldsymbol{\epsilon\mu}} = 1/T\sum_{t=1}^{T} \Delta\hat{\mu}_{ct}\boldsymbol{\Delta}\hat{\boldsymbol{\epsilon}}_{\boldsymbol{t}}^{\boldsymbol{ic}}$, and $\hat{\boldsymbol{\Gamma}}^{\boldsymbol{ic}} = 2\sum_{s_1} 1/T\sum_{t=1}^{T} \Delta\hat{\lambda}_{it}\boldsymbol{1}\boldsymbol{\Delta}\hat{\boldsymbol{s}}_{\boldsymbol{1t}}$, where $\boldsymbol{s}_1 = \hat{\boldsymbol{k}}, \boldsymbol{\epsilon}^{\boldsymbol{ic}}, \hat{\mu}_c\boldsymbol{1}'$ and 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 compose industrial volatility. More formally, we measure:

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

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

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

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

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

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

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

$$RCOV_{ict} = \boldsymbol{a_{ic}}'\hat{\boldsymbol{\Gamma}}^{\boldsymbol{ic}}\boldsymbol{a_{ic}} \tag{17}$$

where $GDMD_{ict}$, $RDMD_{ict}$, $PCTY_c$, and IND_i are the components of country c's output volatility in industry i at time t due to global demand shocks, residual demand shocks, producer country shocks, and industry shocks, respectively; $COV\mu\kappa_{ict}$, $COV\epsilon\kappa_{ict}$ and $COV\epsilon\kappa_{ict}$ are twice the covariance between global demand and producer country shocks, residual and global demand shocks, and residual demand and producer country shocks at time t, respectively; and $RCOV_{ict}$ is the term that collects all the remaining covariance terms at time t. $RCOV_{ict}$ empirically plays a negligible role in explaining industrial volatility.[3] For this reason, our discussion in section 4.2 does not focus on it.

3 Data

To estimate the components of output volatility derived in section 2.2, we employ 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.[4]

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 84 exporting and importing countries at 4-digit ISIC Revision 3 level from 1967 to 2011.[5] We calculate domestic sales as the difference between gross output and exports.[6] All flows are expressed in 1980 constant US dollars using CPI data.[7]

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 and 2 list the producer countries and industries included in our sample, respectively.

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,

[3] See column (8) in table 3.

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

[5] Appendix B.2 lists all the 84 countries covered by CHELEM. 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.

[6] We adjust all export values to eliminate re-exports following the methodology proposed by GTAP as detailed in Appendix B.3.

[7] 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.

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^{ic}_{mt}, as: $g^{ic}_{mt} = 2(X^{ic}_{mt} - X^{ic}_{mt-1})/(X^{ic}_{mt} + X^{ic}_{mt-1})$, where X^{ic}_{mt} 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: $y^{ic}_{mt} = g^{ic}_{mt} - \overline{g^{ic}_{mt}}$, where $\overline{g^{ic}_{mt}}$ 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.

4 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.[8]

4.1 Volatility of Industrial Output

Table 1 and Table 2 provide information on the volatility of industrial output at the producer country- and industry-level for 1992, respectively. Column (1) in each Table reports values for the 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 1 further suggests that output volatility varies across industries, in some countries more than others.

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

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 1, which shows the average Spearman correlation between the ranking of output volatility by industry of each country and the remaining 33 countries being small. In fact, even though the average Spearman correlations are positive, they summarise insignificant correlations. Consistent with these results, the dispersion in the average volatility at the industry-level in column (2) of Table 2 is quite large.

Third, countries that have high output volatility in one industry also 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 column (3) of Table 2, are large averages of significant pairwise correlations. This finding implies that volatility seems to be a country's rather than an industry's characteristic. 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 stylised fact that volatility decreases with development (Lucas, 1988; Koren and Tenreyro, 2007), and leads us to summarize our decomposition results at the producer country-level.

4.2 Decomposition Estimates

Table 3 shows the results of our decomposition. It reports for each component, estimated using equations (10)-(17), 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 numbers in Table 3, no clear pattern emerges, except for Bulgaria, the most volatile country in our sample. Compared to all other countries, Bulgaria displays the highest average residual demand risk ($RDMD$), producer country-global demand covariance ($COV_{\mu\kappa}$), producer country-residual demand covariance ($COV_{\epsilon\mu}$) and residual covariance term ($RCOV$). It also exhibits the fourth highest producer country risk ($PCTY$).

Eyeballing the results in Table 3, we find that the global and residual demand risks are the components which account for most of the volatility at the industry-level for the vast majority of countries in our sample. Consistently with this result, we find that countries with higher residual and global demand risks tend to be more volatile, on average. The rank correlation between countries' average industrial volatility and their average residual and global demand risks is significant and positive at 0.6 and 0.3, respectively.

From columns (3) and (4) of Table 3, one can conclude that the producer country and industry risks account for relatively little of industrial output volatility. Somewhat surprisingly, Canada, the UK, and the US have producer country risks that are above the sample average. But, once we verify the correlation between producer risk and income per capita, it turns out negative and significant. The average industry risk, instead, 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[9], the variation in industry risks is limited[10] and the three 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 industrial volatility 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 domestic or foreign negative global demand shocks lead to expansionary monetary policies in order to stimulate domestic production and consumption. The $COV\mu\kappa$ would then be negative, unless policy changes stimulated consumption systematically to more than compensate the initial demand shocks. This second scenario is more likely in economies with developed financial systems because there monetary policy is more efficient (Bean et al., 2002; Krause and Rioja, 2006). To test this explanation, we regress the estimated $COV\mu\kappa_{ict}$ 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 reported in the first column of Table 4. The findings provide support to our explanation: Countries with more developed financial systems do experience, on average, higher values of $COV\mu\kappa_{ict}$.

Column (6) and (7) of Table 3 report the average values and percentage contributions for the covariance of global and residual demand shocks, $COV\epsilon\kappa$, and the covariance of producer country and residual demand shocks, $COV\epsilon\mu$, respectively. For most countries these covariance terms are, on average, negative and account for a non-negligible share of output volatility, even though they are not driving it.[11] The negative sign of these covari-

[9] 25 and 6 of the countries in our sample have production Herfindahl Indexes below 0.15, and between 0.15 and 0.25, respectively.

[10] The coefficient of variation for the distribution of estimated industry risks is 0.57.

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

ances tells us that, on average, countries' sales are concentrated in goods whose residual demand shocks are negatively correlated to global demand and producer country shocks. Since the domestic market is the main destination for all industries, this result could be explained by policy responses to idiosyncratic shocks to critical industries. Expansionary policies in response to negative shocks to highly productive sectors of a country simultaneously increase the economy's demand and production. To verify whether the data supports this explanation, we regress the estimated $COV\epsilon\kappa_{ict}$ and $COV\epsilon\mu_{ict}$ from equation (15) and (16), respectively, against industry's output per worker , controlling for country fixed effects. The estimates are reported in column (2) and (3) of Table 4, and support the link between policy responses and a industry's productivity. More productive industries, indeed, have significantly lower values for $COV\epsilon\kappa$ and $COV\epsilon\mu$.

In sum, 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 only some of the volatility. Even though the covariance terms turn out to play only a minor role in explaining output volatility, the fact that they correlate sensibly with economic observables gives us confidence in our decomposition estimates.

5 Zooming in on Demand Risks

Since global and residual demand risks are the main determinants of countries' industrial volatility, understanding them becomes key to the design of effective risk management strategies. Thus, in this section, we study more closely the elements in the variance-covariance matrices underlying their calculation. In addition, we undertake a simple decomposition of both global and residual demand risks distinguishing their domestic component from that due to international trade.

Table 5 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. First, the variance of global demand shocks varies substantially across markets, with the Serbian variance almost 20 times the American one. Second, global demand shocks, on average, covary positively across markets, especially for the European markets.

Table 6 summarizes statistics for the elements in the variance-covariance matrix of residual market shocks, $\Omega_{\epsilon_m^{ic}}$, aggregated at the producer country level using as weights industries' output shares. More specifically, the first two columns of Table 6 report the standard deviation of domestic residual demand shocks and the average standard deviation of foreign residual demand shocks, respectively. Compared to the variance of domestic residual demand shocks the variance of foreign markets residual demand shocks is much higher. This implies, perhaps not surprisingly, that countries face uncertainty on their products demand mostly in foreign markets.

Column (3) and (4) of Table 6 summarize the average correlation between domestic and foreign residual shocks, and between residual demand shocks of any pair of foreign destinations. The fact that these correlations are low implies that most residual shocks are market related and they are not specific to the industry-country pair. That is why we refer to the residual terms in equation 2, ϵ_m^{ic}, as residual demand shocks.

Next, we identify the source of demand risks by decomposing the global and residual demand risks as follows:

$$\boldsymbol{a_{ic}}'\boldsymbol{\Omega}_{\kappa}\boldsymbol{a_{ic}} = a_c^{ic2}\sigma_{k_c}^2 + \sum_{m\neq c} a_m^{ic2}\sigma_{k_m}^2 + 2\sum_m \sum_{m'\neq c,m} a_m^{ic}a_{m'}^{ic}COV(\kappa_m,\kappa_{m'}) \tag{18}$$

$$\boldsymbol{a_{ic}}'\boldsymbol{\Omega}_{\epsilon_m^{ic}}\boldsymbol{a_{ic}} = a_c^{ic2}\sigma_{\epsilon_c^{ic}}^2 + \sum_{m\neq c} a_m^{ic2}\sigma_{\epsilon_m^{ic}}^2 + 2\sum_m \sum_{m'\neq c,m} a_m^{ic}a_{m'}^{ic}COV(\epsilon_m^{ic},\epsilon_{m'}^{ic}) \tag{19}$$

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 domestic one); $\sigma_{\epsilon_f^{ic}}^2$ is the variance of residual 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 domestic shocks to total risk. Thus, we refer to $a_c^{ic2}\sigma_{k_c}^2$ as *domestic global demand risk* ($GDMD^d$) and to $a_c^{ic2}\sigma_{\epsilon_c^{ic}}^2$ as *domestic residual demand risk ($RDMD^d$)*. The remaining two terms in equations (18) and (19) 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 of international trade, we refer to their sum in equation (18) as *trade-related global demand risk* ($GDMD^*$) and to their sum in equation (19) as *trade-related residual demand risk* ($RDMD^*$).

Table 7 reports the decomposition results for the global and residual demand risk together with the export share at the producer country level. The domestic 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 domestic 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 domestic component, on average, accounts for 59 to 95 percent of the global demand risk and for 68 to 90 percent of the residual demand risk. This suggests that the composition of export destinations matters in determining the role of trade in explaining demand risks and, ultimately, industrial volatility.

6 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), but we still do not know what drives this relationship. There are three potential channels through which international trade can affect the volatility of industrial output. First, an industry's exports can reduce the volatility of its output if demand in foreign destination markets is less volatile than the domestic one, i.e., 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 (*supply-chain* effect) or imported varieties make domestic demand more volatile by increasing consumers' substitution opportunities (*competition* effect), or both.

The aim of this section is to provide 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 residual demand risks.

6.1 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:

$$logVar(q^{ic}) = \beta_0 + \beta_1 * log(Trade\,Openness)_{ic} + \beta_2 * log(Productivity)_{ic} + \boldsymbol{\gamma}_i + \boldsymbol{\gamma}_c + \epsilon_{ic} \quad (20)$$

where $Var(q^{ic})$ is the volatility of industry i's output in country c that we estimated in section 4, $Trade\ Openness_{ic}$ is the share of exports plus imports to industry i's gross output in 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 8 reports the ordinary least squares (OLS) estimates of the baseline specification in equation (20).[12] Consistent with di Giovanni and Levchenko (2009), we find that trade positively affects volatility at the industry-level.[13] Specifically, an increase of 1% in an industry's trade openness significantly increases the volatility of its output, on average, by 0.25%.[14]

A potential concern is that our estimate is biased as trade openness and volatility are jointly determined in a two-way causal relationship. 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.[15] Column (2) of Table 8 reports the instrumental variable (IV) estimate of the effect of trade on industrial volatilty for our baseline specification. The positive effect of trade on volatility is robust, but, as reported in the last row of Table 8, we do not find evidence in favor of the endogeneity of trade and prefer the OLS over the IV estimate.

To explore further the relationship between trade and volatility, we estimate the model in equation (20) splitting the trade openness variable in the industry's export share of output and the share of imports to output (import penetration). OLS and IV estimates

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

[13]Differently from us, di Giovanni and Levchenko (2009) analyse the volatility of annual output growth per worker.

[14]Table C.1 in Appendix C show that our baseline estimate is robust to the inclusion of the following potentially confounding factors: 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.

[15]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. 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 though and our results are hardly different.

for this specification are reported in columns (3) and (4) of Table 8, respectively.[16] While industries with higher import penetration experience higher output volatility, industries with larger shares of exports, instead, do not experience lower volatility. In other words, intra-industry imports drive the positive effect of trade on volatility.

6.2 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 (20) but instead of using output volatility as the dependent variable, we use global and residual demand risks. More specifically, we estimate:

$$Y_{ic} = \beta_0 + \beta_1 * log(Trade\ Openness)_{ic} + \beta_2 * log(Productivity)_{ic} + \boldsymbol{\gamma}_i + \boldsymbol{\gamma}_c + \epsilon_{ic} \quad (21)$$

where Y_{ic} is one of the demand risks from sections 4 and 5: $GDMD_{ic}, GDMD^d_{ic}, GDMD^*_{ic}$, $RDMD_{ic}, RDMD^d_{ic}$, or $RDMD^*_{ic}$. 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 the total demand risk. The implications of our analysis are robust to expressing demand risks in logs.[17] 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 9 and 10 report OLS and IV estimates of our models for the total global demand risk and its components. Tables 11 and 12, instead, report OLS and IV estimates for the total residual demand risk and its components. In what follows we mostly discuss the OLS estimates as they are always robust when trade, exports and imports are found endogenous and instrumented for.[18]

In Table 9 we find some evidence that industries more open to trade face lower domestic and total global demand risk. In particular, our estimates imply that a one standard deviation increase in log trade openness decreases domestic and total global demand risks by 0.14 and 0.12 of a standard deviation, respectively. The estimates in Table 10 imply that this result is driven by industries' exports. In particular, we find that industries with a larger share of exports face a smaller domestic global demand risk, but a larger trade-related global demand risk. That is exactly what one would expect given

[16] Table C.2 shows these finding are robust to the inclusion of additional controls.

[17] Results are available upon request to the authors.

[18] Tables C.3-C.6 in Appendix C show that the main conclusions we draw from tables 9 -12 are robust to the inclusion of additional controls.

that domestic and international sale shares enter the calculation of these components. However, industries with a larger share of exports face a lower total global risk, which can only be the case if these industries export to foreign markets with a less volatile demand (in the global sense) than the domestic one, i.e. if exports have a *diversification* effect.

The estimates in Table 11 imply that industries more open to trade experience higher residual demand risks. In particular, a one standard deviation increase in an industry's trade openness increase, its domestic, trade-related, and total residual demand risk by 0.43, 0.21 and 0.45 of a standard deviation, respectively. Table 12 reveals that industries' import penetration drives this result. Both domestic and trade-related residual 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 exposure to foreign shocks and make production more volatile. In fact, residual demand risks are determined, even if in small part according to section 5, by industry-country specific shocks, which include include shocks to the supply-chain. In addition, the effect of intra-industry imports on the domestic 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.

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 residual demand risk, through both *supply-chain* and *competition* effects. Second, exports hedge some output volatility through their *diversification* effect on global demand risk.

7 Conclusion

This paper develops and estimates a decomposition of output volatility at the industry-level, which accounts for producer country, industry and demand shocks, and their interaction. Our estimates suggest that countries that are volatile in one industry tend to be volatile in other industries as well. Put simply, output volatility at the industry level is a country's characteristic. That is consistent with the negative relationship between aggregate output volatility and development, and it is consistent with Atalay's (2015) findings that industry-specific shocks have a large effect on aggregate volatility due to cross-industry supply-chain linkages and complementarities among inputs. We also find that demand shocks account for most of the volatility of industrial output, with the contribution of trade-related demand risks depending on the composition of export destinations.

Further, this paper uses the estimates for 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 have opposite effects on output volatility. In particular, exports reduce industrial volatility as exports are directed to countries with a global demand volatility lower than the domestic one. Intra-industry imports drive the positive relationship between output volatility and trade at the industry level by increasing uncertainty in both domestic demand and production.

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. Their potential negative effect on welfare due to increased industrial output volatility might be compensated by gains in production efficiency and consumers' access to additional varieties. Determining the net effect of trade on aggregate welfare is a promising avenue for future research.

References

Enghin Atalay. How Important Are Sectoral Shocks? University of Wisconsin- Madison, Mimeo, 2015.

Charles Richard Bean, Jens D.J. Larsen, and Kalin Nikolov. Financial Frictions and the Monetary Transmission Mechanism: Theory, Evidence and Policy Implications. *ECB Working Paper* No. 113, 2002.

Paul R. Bergin, Robert C. Feenstra, and Gordon H. Hanson. Offshoring and Volatility: Evidence from Mexico's Maquiladora Industry *American Economic Review*, 99(4):1664-1671, 2009.

Paul R. Bergin, Robert C. Feenstra, and Gordon H. Hanson. Volatility due to offshoring: Theory and evidence *Journal of International Economics*, 85(2):163-173, 2011.

Allan Collard-Wexler. Demand fluctuations in the ready-mix concrete industry. *Econometrica*, 81:1003–1037, 2013.

Diego Comin, Erica L. Groshen, and Bess Rabin. Turbulent firms, turbulent wages? *Journal of Monetary Economics*, 56:109–133, 2009.

Jose de Sousa, Thierry Mayer, and Soledad Zignago. Market access in global and regional trade. *Regional Science and Urban Economics*, 42(6):1037–1052, 2012.

Julian di Giovanni and Andrei Levchenko. Trade openness and volatility. *Review of Economics and Statistics*, 91(3):558–585, 2009.

Quy-Toan Do and Andrei Levchenko. Comparative Advantage, Demand for External Finance, and Financial Development. *Journal of Financial Economics*, 86(3):796-834, 2007.

Rodolfo Helg, Paolo Manasse, Tommaso Monacelli, and Riccardo Rovelli. How much (a)symmetry in europe? evidence from industrial sectors. *European Economic Review*, 39:1017–1041, 1995.

Miklos Koren and Silvana Tenreyro. Volatility and development. *Quarterly Journal of Economics*, 122:243–287, 2007.

Stefan Krause and Felix Rioja. Financial Development and Monetary Policy Efficiency *Working Paper, 2006*

Robert E. Lucas. On the mechanics of economic development. *Journal of Monetary Economics*, 22:3–42, 1988.

David E. Mills and Laurence Schumann. Industry structure with fluctuating demand. *The American Economic Review*, 75(4):758–767, 1985.

Alessandro Nicita and Marcelo Olarreaga. Trade, production and protection 1976-2004. *World Bank Economic Review*, 21(1), 2006.

Claudio Raddatz. Liquidity needs and vulnerability to financial underdevelopment *Journal of Financial Economics*, 80(3):677-722, 2006.

Alan C. Stockman. Sectoral and national aggregate disturbances to industrial output in seven european countries. *Journal of Monetary Economics*, 21:387–409, 1987.

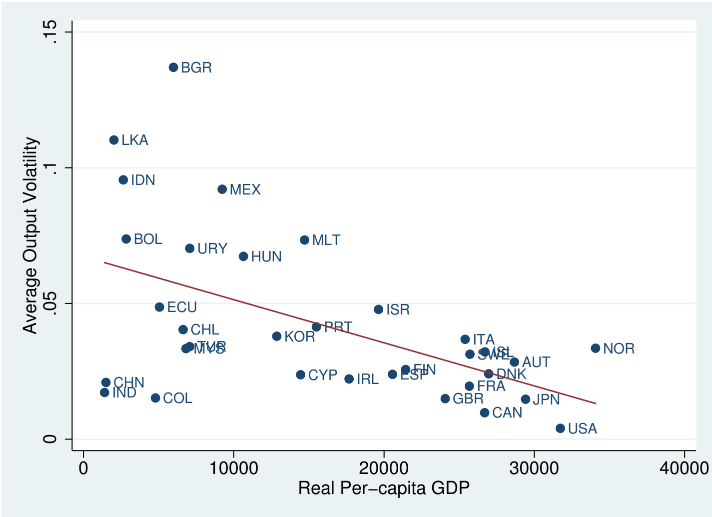

Figure 1: Average Volatility of industrial Output in 1992

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

Table 1: Volatility of Industrial Output by Producer Country

Country, ISO code	Average (1)	CV (2)	Average Spearman ρ (3)
Austria, AUT	0.028	0.408	0.138
Bulgaria, BGR	0.137	0.536	0.120
Bolivia, BOL	0.074	0.906	0.272
Canada, CAN	0.010	0.559	0.245
Chile , CHL	0.040	0.721	0.361
China, CHN	0.021	0.438	0.264
Colombia, COL	0.015	0.763	0.343
Cyprus, CYP	0.024	1.483	0.098
Germany, DEU	0.024	0.529	0.056
Denmark, DNK	0.024	0.423	0.153
Ecuador, ECU	0.049	1.050	0.156
Spain, ESP	0.024	0.307	0.362
Finland, FIN	0.026	0.378	0.295
France, FRA	0.020	0.334	0.302
Great Britain, GBR	0.015	0.279	0.301
Hungary, HUN	0.067	1.267	0.095
Indonesia, IDN	0.096	0.395	0.248
India , IND	0.017	0.669	0.298
Ireland, IRL	0.022	0.801	0.196
Iceland, ISL	0.032	1.754	0.224
Israel, ISR	0.048	0.695	0.045
Italy, ITA	0.037	0.409	0.243
Japan, JPN	0.015	0.185	0.163
Korea, KOR	0.038	0.486	0.345
Sri Lanka, LKA	0.110	0.587	0.203
Mexico, MEX	0.092	0.373	0.031
Malta, MLT	0.073	0.914	0.178
Malaysia, MYS	0.033	0.925	0.240
Norway, NOR	0.034	0.832	0.272
Portugal, PRT	0.041	0.449	0.185
Sweden, SWE	0.031	0.264	0.200
Turkey, TUR	0.034	0.551	0.283
Uruguay, URY	0.070	1.454	0.300
United States, USA	0.004	0.893	0.288

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 2: Volatility of Industrial Output by Industry

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

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 3: Industrial Output Volatility: Decomposition Results by Country, 1992

Country	$GDMD$ (1)	$RDMD$ (2)	$PCTY$ (3)	IND (4)	$COV_{\mu\kappa}$ (5)	$COV_{\epsilon\kappa}$ (6)	$COV_{\epsilon\mu}$ (7)	$RCOV$ (8)
Austria	0.012	0.017	0.004	0.001	0.002	0.000	-0.006	0.000
	47.6%	57.4 %	14.2%	3.3%	6.3%	-2.2%	-26.0%	-0.7%
Bulgaria	0.013	0.101	0.009	0.001	0.009	-0.003	0.006	0.001
	10.7%	76.7%	8.6%	0.9%	7.4%	-7.0%	2.6%	0.2%
Bolivia	0.027	0.083	0.004	0.001	-0.009	-0.029	-0.002	-0.001
	56.8%	124.0%	7.7%	1.6%	-19.0%	-67.5%	-1.9%	-1.7%
Canada	0.010	0.020	0.010	0.001	0.003	-0.013	-0.020	-0.001
	185.0%	359.5%	171.9%	14.5%	62.3%	-327.0%	-343.7%	-22.5%
Chile	0.034	0.029	0.004	0.001	-0.002	-0.017	-0.007	-0.001
	111.1%	71.8%	11.4%	3.5%	-5.6%	-67.9%	-21.1%	-3.2%
China	0.013	0.028	0.009	0.001	0.007	-0.018	-0.017	-0.001
	72.3%	153.6%	51.4%	4.9%	37.6%	-112.7%	-100.9%	-6.2%
Colombia	0.022	0.026	0.006	0.001	-0.001	-0.027	-0.011	-0.001
	181.8%	203.6%	47.7%	6.5%	-5.1%	-231.3%	-97.1%	-6.2%
Cyprus	0.011	0.024	0.006	0.001	-0.004	-0.002	-0.011	-0.001
	95.6%	143.0%	68.2%	17.2%	-52.8%	-33.8%	-100.0%	-37.3%
Germany	0.012	0.013	0.004	0.001	0.003	-0.006	-0.002	-0.001
	54.5%	53.8%	16.9%	3.8%	14.3%	-29.0%	-11.3%	-2.9%
Denmark	0.019	0.012	0.003	0.001	0.002	-0.011	-0.001	-0.001
	91.1%	46.4%	14.7%	4.0%	10.8%	-54.4%	-6.1%	-6.4%
Ecuador	0.018	0.035	0.004	0.001	-0.007	0.005	-0.003	-0.002
	55.6%	64.5%	12.4%	2.7%	-24.0%	8.9%	-11.8%	-8.3%
Spain	0.023	0.008	0.003	0.001	-0.002	-0.004	-0.004	-0.002
	108.2%	36.2%	11.9%	3.9%	-7.7%	-26.7%	-17.7%	-8.2 %
Finland	0.015	0.015	0.005	0.001	0.003	-0.003	-0.010	0.000
	66.9%	61.6%	24.3%	3.9%	12.8%	-20.0%	-47.2%	-2.2%
France	0.012	0.006	0.002	0.001	0.003	-0.001	-0.001	-0.001
	65.6%	26.5%	11.6%	4.7%	17.2%	-10.7%	-8.2%	-6.7%
United Kingdom	0.009	0.012	0.008	0.001	0.006	-0.004	-0.015	-0.001
	65.4%	84.8%	55.3%	6.0%	43.9%	-35.4%	-109.4%	-10.8%
Hungary	0.011	0.065	0.018	0.001	-0.007	-0.007	-0.015	0.000
	34.6%	113.5%	57.9%	2.6%	-22.0%	-15.4%	-64.5%	-6.8%
Indonesia	0.019	0.068	0.007	0.001	-0.005	0.009	-0.003	-0.001
	23.7%	72.9%	8.8%	1.1%	-5.5%	5.1%	-3.2%	-2.9%
India	0.010	0.015	0.003	0.001	0.000	-0.009	-0.001	-0.001
	83.2%	101.0%	24.3%	7.1%	0.5%	-88.1%	-16.2%	-11.7%
Average	0.016	0.033	0.005	0.001	-0.001	-0.006	-0.006	-0.001
	75.7%	103.3%	37.9%	5.6%	-8.1%	-48.1%	-56.7%	-9.7%

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Table 3 (cont'd): Industrial Output Volatility: Decomposition Results by Country, 1992

Country	$GDMD$	$RDMD$	$PCTY$	IND	$COV_{\mu\kappa}$	$COV_{\epsilon\kappa}$	$COV_{\epsilon\mu}$	$RCOV$
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Ireland	0.008	0.022	0.003	0.001	0.002	-0.003	-0.007	-0.002
	46.3%	96.3%	17.7%	4.8%	11.8%	-18.7%	-43.1%	-15.0%
Iceland	0.009	0.027	0.004	0.001	-0.008	0.012	-0.010	-0.003
	55.1%	88.7%	34.0%	6.0%	-59.5%	37.8%	-44.0%	-18.1%
Israel	0.010	0.054	0.003	0.001	0.001	-0.020	-0.001	-0.001
	28.7%	118.0%	9.1%	2.0%	2.8%	-54.5%	-5.0%	-1.1%
Italy	0.020	0.019	0.003	0.001	0.003	-0.006	-0.003	-0.000
	63.9%	48.0%	9.8%	2.7%	8.5%	-22.8%	-8.2%	-1.97%
Japan	0.012	0.010	0.003	0.001	-0.006	-0.004	0.001	-0.002
	85.2%	66.8%	21.7%	5.9%	-43.5%	-31.2%	6.1%	-11.2%
Korea	0.029	0.025	0.012	0.001	0.000	-0.005	-0.024	-0.001
	101.2%	82.0%	41.9%	3.1%	0.5%	-41.9%	-82.1%	-4.7%
Sri Lanka	0.005	0.098	0.008	0.001	0.001	-0.005	0.003	-0.000
	5.8%	89.0%	10.4%	1.0%	0.1%	-7.2%	2.4%	-1.5%
Mexico	0.049	0.048	0.006	0.001	-0.006	-0.003	-0.004	0.000
	66.4%	52.3%	8.1%	1.2%	-8.5%	-15.6%	-3.9%	0.1%
Malta	0.010	0.075	0.006	0.001	-0.004	0.002	-0.014	-0.002
	28.1%	111.6%	16.2%	2.7%	-11.3%	-3.9%	-38.6%	-4.9%
Malaysia	0.014	0.025	0.005	0.001	-0.003	-0.007	-0.001	-0.001
	55.9%	72.0%	20.9%	3.5%	-11.5%	-28.4%	-8.5%	-3.8%
Norway	0.012	0.019	0.002	0.001	0.004	-0.002	-0.003	-0.001
	58.1%	49.9%	11.4%	4.3%	19.8%	-24.2%	-14.7%	-4.6%
Portugal	0.016	0.020	0.005	0.001	-0.001	0.005	-0.006	0.001
	48.3%	48.7%	13.2%	2.3%	-1.5%	6.0%	-18.5%	1.5%
Sweden	0.014	0.010	0.004	0.001	0.001	0.002	0.000	-0.001
	48.2%	31.2%	13.8%	3.0%	4.9%	3.0%	-0.7%	-3.3%
Turkey	0.019	0.032	0.005	0.001	0.000	-0.013	-0.009	-0.001
	71.1%	102.7%	17.8%	3.4%	0.8%	-58.6%	-31.4%	-5.8%
Uruguay	0.028	0.050	0.003	0.001	-0.008	-0.001	-0.002	0.000
	76.9%	69.5%	7.9%	2.3%	-23.5%	-28.6%	-4.0%	-0.5%
USA	0.005	0.009	0.007	0.001	-0.003	-0.002	-0.010	-0.002
	325.9%	534.2%	417.1%	49.2%	-236.8%	-230.2%	-649.6%	-109.7%
Average	0.016	0.033	0.005	0.001	-0.001	-0.006	-0.006	-0.001
	75.7%	103.3%	37.9%	5.6%	-8.1%	-48.1%	-56.7%	-9.7%

Note: Columns (1)-(8) report, for each country, the average level and contribution of the components of industrial volatility estimated according to equations (10)-(17), respectively. The aggregation uses as weights each industry's share in the producer country's total tradable output. For each country, the sum of all components equals the average total output volatility reported in Table 1.

Table 4: Correlation of Covariance Terms with Economic Observables, 1992

	$COV\mu\kappa_{ic}$ (1)	$COV\epsilon\kappa_{ic}$ (2)	$COV\epsilon\mu_{ic}$ (3)
Log real GDP_c	0.000		
	(0.000)		
Log credit/GDP_c	0.002***		
	(0.000)		
Output per worker$_{ic}$		-0.028***	-0.007**
		(0.005)	(0.003)
Country fixed effects	No	Yes	Yes
Industry fixed effects	Yes	No	No
N	646	638	638
R^2	0.076	0.258	0.432

Note. Robust standard errors are reported in parentheses. ***, ** indicate significance at the 1 and 5 percent level, respectively.

Table 5: Standard Deviation and Correlations of Global Demand Shocks, 1992

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 6: Standard Deviation and Correlations of Residual Demand Shocks, 1992

Producer	$\sigma_{\epsilon_{cc}}$	$\overline{\sigma_{\epsilon_{m\neq c}}}$	$\overline{\rho_{\epsilon_c \epsilon_m}}$	$\overline{\rho_{\epsilon_m \epsilon_{m'}}}$
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 tradable output. $\sigma_{\epsilon_{cc}}$ is the average standard deviation of domestic residual demand shocks. $\overline{\sigma_{\epsilon_{m\neq c}}}$ is the average standard deviation of foreign residual shocks. $\overline{\rho_{\epsilon_c \epsilon_m}}$ is the average correlation of domestic with foreign residual shocks. $\overline{\rho_{\epsilon_m \epsilon_{m'}}}$ is the average correlation between residual demand shocks of any pair of foreign destinations.

Table 7: Export Openness, and Domestic and Foreign Demand Risks, 1992

	Export	$GDMD^d$		$GDMD^*$		$RDMD^d$		$RDMD^*$	
	Share	level	%	level	%	level	%	level	%
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. $GDMD^d$ and $GDMD^*$ are the domestic and trade-related global demand risks, respectively. $RDMD^d$ and $RDMD^*$ are the domestic and trade-related residual demand risks, respectively.

Table 8: 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
N	638	638	638	638
H_0: Variables are exogenous	Not Rejected		Rejected	

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. *, **, *** significant at 10, 5 and 1 percent, respectively.

Table 9: Global Demand Risk and Trade, 1992

	$GDMD_{ic}$		$GDMD^d_{ic}$		$GDMD^*_{ic}$	
	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
N	638	638	638	638	638	638
H_0: Variables are exogenous	Not Rejected		Not Rejected		Rejected	

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

Table 10: Global Demand Risk, Exports and Imports, 1992

	$GDMD_{ic}$		$GDMD^d_{ic}$		$GDMD^*_{ic}$	
	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
N	638	638	638	638	638	638
H_0: Variables are exogenous	Not Rejected		Not Rejected		Rejected	

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

Table 11: Residual Demand Risk and Trade, 1992

	$RDMD_{ic}$		$RDMD^d_{ic}$		$RDMD^*_{ic}$	
	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
N	638	638	638	638	638	638
H_0: Variables are exogenous	Rejected		Not Rejected		Not Rejected	

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: Residual Demand Risk, Exports and Imports, 1992

	$RDMD_{ic}$		$RDMD^d_{ic}$		$RDMD^*_{ic}$	
	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
N	638	638	638	638	638	618
H_0: Variables are exogenous	Rejected		Rejected		Not Rejected	

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

A Appendix: Derivation and Estimation of the Decomposition of Output Volatility

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:

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

Taking expectations in equation (A2) and defining: $\boldsymbol{\Omega}_\kappa = E(\boldsymbol{\kappa\kappa'})$, $\boldsymbol{\Omega}_{\epsilon_m^{ic}} = E(\boldsymbol{\epsilon^{ic}}\boldsymbol{\epsilon^{ic\prime}})$, $\omega_{\mu_c}^2 = E(\mu_c^2)$, $\varphi_{\lambda_i}^2 = E(\lambda_i^2)$, $\Omega_{\epsilon\kappa} = E[\mu_c\boldsymbol{\kappa}]$, $\Omega_{\epsilon\kappa} = E[\boldsymbol{\epsilon_m^{ic}}\boldsymbol{\kappa'}]$, $\Omega_{\epsilon\mu} = E[\mu_c\boldsymbol{\epsilon^{ic}}]$, $\boldsymbol{\Gamma^{ic}} = E[\lambda_i(\mathbf{1}\boldsymbol{\epsilon^{ic\prime}} + \boldsymbol{\epsilon^{ic}}\mathbf{1}') + 2\lambda_i\mu_c\mathbf{1}\mathbf{1}' + \lambda_i\mathbf{1}\boldsymbol{\kappa}' + \lambda_i\boldsymbol{\kappa}\mathbf{1}']$ we obtain:

$$\begin{aligned}E(\boldsymbol{y^{ic}}\boldsymbol{y^{ic\prime}}) = \boldsymbol{\Omega}_\kappa + \boldsymbol{\Omega}_{\epsilon_m^{ic}} + \omega_{\mu_c}^2 \mathbf{1}\mathbf{1}' + \varphi_{\lambda_i}^2 \mathbf{1}\mathbf{1}' + \boldsymbol{\Omega_{\mu\kappa}}\mathbf{1}' + \mathbf{1}\boldsymbol{\Omega'_{\mu\kappa}} + \\ + \boldsymbol{\Omega_{\epsilon\kappa}} + \boldsymbol{\Omega_{\epsilon\kappa}}' + \boldsymbol{\Omega_{\epsilon\mu}}\mathbf{1}' + \mathbf{1}\boldsymbol{\Omega'_{\epsilon\mu}} + \boldsymbol{\Gamma^{ic}}\end{aligned} \tag{A3}$$

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

$$\begin{aligned}Var(q^{ic}) = \boldsymbol{a^{ic\prime}}E(\boldsymbol{y^{ic}}\boldsymbol{y^{ic\prime}})\boldsymbol{a^{ic}} = \boldsymbol{a_{ic}}'\boldsymbol{\Omega}_\kappa\boldsymbol{a_{ic}} + \boldsymbol{a_{ic}}'\boldsymbol{\Omega}_{\epsilon_m^{ic}}\boldsymbol{a_{ic}} + \omega_{\mu_c}^2 + \varphi_{\lambda_i}^2 + \\ + 2\boldsymbol{a_{ic}}'\boldsymbol{\Omega_{\mu\kappa}} + 2\boldsymbol{a_{ic}}'\boldsymbol{\Omega_{\epsilon\kappa}}\boldsymbol{a_{ic}} + 2\boldsymbol{a_{ic}}'\boldsymbol{\Omega_{\epsilon\mu}} + \boldsymbol{a_{ic}}'\boldsymbol{\Gamma^{ic}}\boldsymbol{a_{ic}}\end{aligned} \tag{A4}$$

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 Appendix: 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^c_{it}, as follows: $RX^c_{it} = \frac{M^c_{it}}{M^c_{it}+GO^c_{it}} * X^c_{it}$, where M^c_{it} are country c's imports of good i; GO^c_{it} is country c's gross output of good i; and X^c_{it} 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.

B.2 CHELEM Country coverage

Countries included in the CHELEM database are: Albania, Algeria, Argentina, Australia, Austria, Belgium, Bangladesh, Bulgaria, Bosnia and Herzegovina, Belarus, Bolivia, Brazil, Brunei, Cameroon, Canada, Chile, China, Cote d'Ivoire, Colombia, Croatia, Cyprus, Czech Republic, Denmark, Ecuador, Egypt, Estonia, Finland, France, Gabon, Germany, Great Britain, Greece, Hong Kong, Hungary, Iceland, India, Indonesia, Ireland, Israel, Italy, Japan, Kazakhstan, Kenya, Kyrgyzstan, Korea, Latvia, Libya, Lithuania, Luxembourg, Macau, Malta, Morocco, Mexico, Malaysia, Netherlands, New Zealand, Nigeria, Norway, Pakistan, Paraguay, Peru, Philippines, Poland, Portugal, Romania, Russia, Saudi Arabia, Singapore, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Taiwan, Thailand, Tunisia, Turkey, Ukraine, Uruguay, United States of America, Venezuela, Vietnam. Exports to the rest of the world are calculated subtracting from each country's total exports the value of exports directed to the other 83 destinations.

C Appendix: Additional Results

The specification in equation (20) 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 tables 8 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 tradable 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.

Table C.2-C.5 show how robust our baseline estimates in tables 9-12, respectively, are to the inclusion of the same additional controls discussed above for table C.1.

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 Domestic Global Demand Risk, $GDMD^d_{ic}$				
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 Domestic Global Demand Risk, $GDMD^d_{ic}$				
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: Residual Demand Risk and Trade, 1992: robustness checks

Panel A. Dependent Variable: Residual Demand Risk, $RDMD_{ic}$				
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: Domestic Residual Demand Risk, $RDMD^d_{ic}$				
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 Residual Demand Risk, $RDMD^*_{ic}$				
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: Residual Demand Risk, Exports and Imports, 1992: robustness checks

Panel A. Dependent Variable: Residual Demand Risk, $RDMD_{ic}$				
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: Domestic Residual Demand Risk, $RDMD_{ic}^d$				
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 Residual Demand Risk, $RDMD_{ic}^*$				
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.