Importing, Exporting and Firm-Level Employment Volatility*

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Abstract

In this paper, we use detailed trade and transactions data for the U.S. manufacturing sector to empirically analyze the direction and magnitude of the association between firm-level exposure to trade and the volatility of employment growth. We find that, relative to purely domestic firms, firms that only export and firms that both export and import are less volatile, whereas firms that only import are more volatile. The positive relationship between importing and volatility is driven mainly by firms that switch in and out of importing. We also document a significant degree of heterogeneity across trading firms in terms of the duration of time and intensity with which firms trade, the number and type of products they trade and the number and characteristics of their trading partners. We find these factors to play an important role in explaining the differential impact of trading on employment volatility experienced by these firms.

JEL Classification: F1, F16, L25, L60

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1. Introduction

There is significant heterogeneity in terms of the degree of global engagement across firms. A large majority of firms are purely domestic; they serve only the domestic market and source all their inputs domestically. Firms that engage in international trade do so by importing raw materials or intermediate production stages, or by exporting their products, or by engaging in both exporting and importing activities.[1] These globally engaged firms are likely to differ from purely domestic firms in terms of both the magnitude and volatility of shocks to which they are exposed, as well as their ability to smooth out shocks through diversification across markets. As a result, workers employed in these firms could experience differing levels of employment volatility compared to those employed in purely domestic firms. In this paper, we ask whether this is the case and analyze empirically the direction and the magnitude of the association between firm-level exposure to trade and variation in employment volatility at the firm level. This question is important as employment volatility at the firm-level could have significant consequences for workers in terms of the probability and cost of displacement, as well as the associated uncertainty and income risk, which have been a major component of the debate on the welfare impacts of globalization.[2]

Theoretically, there are various channels through which exposure to international trade could affect employment volatility at the micro level for firms with different levels of global engagement.[3] While increased exposure to productivity shocks abroad may amplify volatility at an importing firm, it could also dampen volatility by allowing the firm to shift non-core activities abroad and to diversify its exposure to domestic country-specific shocks and shocks to productivity of a particular variety of input. Specifically, if country-specific shocks are the dominant source of volatility, firm level imports could become a source of diversification resulting in a negative relationship between importing and volatility (Caselli, Koren, Lisicky and Tenreyro (2012)). A firm that sources inputs from a variety of countries, can more easily absorb a domestic macroeconomic shock by switching to alternate providers compared to a firm that only sources its inputs domestically. As a result, such a shock will have a greatly amplified impact on the firm sourcing its inputs domestically compared to an

[1] About 40% of the U.S civilian workforce is employed in trading firms, which differ significantly from purely domestic firms in terms of their productivity, size, employment composition, and wages (Bernard, Jensen, and Schott (2009)).

[2] See for example, Revenga (1992), Currie and Harrison (1997), Trefler (2004) and Amiti and Davis (2011) on the effects of trade liberalization at the firm-level in Mexico, Morocco, Canada, and Indonesia, respectively.

[3] At the aggregate level, several theoretical mechanisms have predicted a positive relationship between volatility and openness. Newberry and Stiglitz (1984) show that international competition, by posing a limit to price variability, reduces the stabilizing role of prices and exposes an economy to higher volatility. Increase in elasticity of final good demand and the associated labor demand elasticities with openness, could also result in greater employment and wage volatility from shocks to labor demand (Rodrik (1997), Slaughter (2001) and Krishna, Mitra and Chinoy (2001)). Similarly, increased specialization that follows openness could result in a less diversified production structure, and therefore, higher levels of risk in the domestic economy (Rodrik (1998)). Finally, Di Giovanni and Levchenko (2012) show that trade could raise aggregate volatility by making national output more dependent on idiosyncratic shocks of a handful of large firms.

importing firm. A similar negative relationship between importing and volatility is predicted if imported intermediate usage is associated with the complexity of the production process.[4] Moreover, if offshoring patterns in the U.S. are such that firms retain their fixed cost activities in the U.S. while offshoring their marginal cost activities abroad, employment volatility for workers in the U.S. plant could decrease (Bergin, Feenstra and Hanson (2011)). This is because all of the variability in demand is absorbed by changes in production activity abroad, while the magnitude of domestic fixed cost activity, by definition, stays fixed.[5] On the contrary, a change in labor demand elasticities provide a mechanism through which a larger imported input share could lead to *higher* employment volatility for workers employed in an importing firm.[6] The elasticity of labor demand for firms that engage in offshoring by purchasing intermediate inputs from abroad would be higher as these firms can more easily substitute imported inputs for domestic workers in response to a wage increase at home. As a result, in this case, a given productivity shock will lead to larger variations in employment in these firms. Therefore, the sign and magnitude of the association between importing and variation in employment at the firm level is theoretically ambiguous.

The relationship between exporting and volatility is similarly ambiguous. Relative to non-exporters, firms operating in countries with imperfectly correlated shocks should be in a better position to diversify demand shocks and to smooth out negative demand shocks in the domestic market. On the contrary, if the volatility of shocks is significantly higher in trading partners compared to the U.S., firms with high share of exports could be exposed to higher level of volatility compared to firms serving only the domestic market (Vannoorenberghe (2012)).[7]

In addition to the type and the level of global engagement, the frequency with which a firm participates in international markets also matters for the extent of employment volatility. A frequent switching to imports from domestic sourcing and from only domestic sales to some exporting, a

[4] For example, in Koren and Tenreyro (2013) firms using a large variety of inputs are less volatile as each individual variety matters less in production and firms can offset a shock to a particular variety by adjusting the use of other varieties. See also Krishna and Levchenko (forthcoming), which propose specialization in less complex (and therefore, more volatile) goods as an explanation for the higher level of output volatility experienced in developing countries. Note that while the theoretical predictions of the aforementioned papers on importing pertain to output volatility rather than employment volatility, with flexible labor markets and complementarity between labor input and domestically sourced or imported inputs, output and labor demand would move in the same direction.

[5] Bergin, Feenstra, and Hanson (2009) document that industry-level employment fluctuations in Mexico are substantially larger than those in the U.S. in industries with high levels of offshoring. This finding is consistent with a model in which offshoring amplifies and transmits demand shocks across borders (Bergin, Feenstra, and Hanson (2011)).

[6] See for example, Rodrik (1997), Slaughter (2001) and Senses (2010)).

[7] In a framework in which monopolistically competitive firms face market-specific demand shocks and convex costs, Vannoorenberghe (2012) show that as long as home and foreign shocks are not perfectly correlated, there exists an export share below which global sales of exporters are less volatile than that of non-exporters due to the diversification effect. Also see Nguyen and Schaur (2010) on transmission of foreign shocks to the domestic markets through the domestic supply of exporters. Both of these models emphasize the substitutability of exports and domestic sales due to convex costs, and are different than Berman, Berthou, and Héricourt (2011), which point to a liquidity-related complementary relationship between foreign and domestic sales.

commonly observed feature of the data,[8] is likely to introduce volatility at the firm level, given the shifting source of demand and the structure of production. Moreover, there could also be significant heterogeneity in terms of the levels of diversification and exposure across trading firms with different number of products traded and number of trading partners,[9] as well as partner country characteristics (such as income level, volatility, covariance with the U.S.) and type of products traded,[10] which could impact the relationship between employment volatility and trading. [11]

In this paper, our goal is to empirically quantify the direction and magnitude of the theoretically ambiguous relationship between employment volatility and the trading status of the firm. In our analysis we use comprehensive data for the U.S. that combines detailed trade and transactions data (LFTTD) with longitudinal firm-level data (LBD). The detailed information on trading partners as well as products traded provided in the linked trade and transactions data allows us to study in detail the relative contribution of diversification across markets (for final goods) and source countries (for inputs), and in terms of number of final products and inputs traded. The distinction is important because shocks can be transmitted through both demand and supply channels for firms, and the magnitude of shocks differ across countries and products. The longitudinal aspect of the data enables us to introduce time series variation into our estimating equations, and to additionally analyze within-firm variation in trade status and volatility through fixed effects specifications.

Consistent with increased possibility of diversification of shocks across markets, we find firms that only export (but not import) and firms that both import and export to be less volatile relative to non-trading firms, by 3 percent and 7 percent, respectively. While firms that only import (but not export) are more volatile (by 5 percent) we find this positive relationship to be mainly driven by firms that switch in and out of importing. This is consistent with increase in volatility that is associated with the increased ability of firms to substitute between in-house production and purchases of foreign inputs in response to domestic wage shocks. These findings continue to hold

[8] Eaton, Eslava, Kugler and Tybout (2008) find that roughly half of Columbian exporters did not export during the previous year. Besedes and Prusa (2006) document that more than half of all trade relationships are observed for a single year and approximately 80 percent are observed for less than five years. At the monthly frequency, Alessandria, Kaboski and Midrigan (2010) find trade flows to be both lumpy and infrequent.

[9] Bernard, Redding and Schott (2011) show that the distribution of exports across products is highly skewed within firms, and product selection accounts for a substantial proportion of the overall variance of exports.

[10] For example, firms can import raw materials or intermediate production stages that non-importing firms either produce in-house or source from the domestic market. Shocks to inputs that are complements to employment at the firm could have implications for employment volatility that are quite different than shocks to inputs that are substitutes.

[11] Related are the models in international real business cycle literature, which study the relationship between trade and the transmission of shocks between two countries. For example, Zlate (2010), Burstein, Kurz and Tesar (2008), and Ng (2010) develop models where productivity shocks that are passed through demand channels either increase or decrease co-movement depending on the structure of the trading relationship. For instance, production sharing (complementarity in production) increases co-movement between trading partners, as production in one country increases demand for intermediates from another. Emphasizing supply channels in the transmission of shocks, Johnson (2012) builds an augmented IRBC model with intermediate inputs that pass productivity shocks downstream and finds much of the relationship between trade and co-movement to be driven by correlated shocks between countries.

for alternative measures of volatility and when we aggregate firm-level data up to the industry level in order to account for the contribution of short-lived firms in our analysis.

The data also points to significant degree of heterogeneity across trading firms in terms of the duration of time and intensity with which firms trade, the number and type of products they trade and in terms of the number and characteristics of their trading partners. We find these factors to play an important role in explaining the differential impact of trading on employment volatility experienced by these firms. Specifically, our findings suggest that the duration of time a firm participates in international markets is an important determinant of employment volatility. For both importers and exporters, a larger fraction of time trading is associated with lower overall volatility, possibly due to the stability introduced by having a steady stream of inputs in the production process and a constant international source of demand. On the other hand, increased trade exposure, in terms of a larger share of inputs (especially from low-income countries) or a larger fraction of output (especially to middle-income countries), is strongly correlated with higher firm-level volatility. Given the negative association between export status of the firm and volatility, these results point to a qualitative difference between small and large exporters. Specifically, employment volatility is higher for firms, which export more than 17 percent of their total sales compared to firms that do not export, or export a smaller share. Note that the non-monotonicity of exporting suggests that the diversification effect that works to reduce volatility when the domestic and foreign shocks are not perfectly correlated, is important for many exporters, given that the average export share is 5 percent. Also in line with the diversification story, we find an increase in number of export destinations to be associated with lower levels of volatility. In contrast, higher number of source countries for imports are associated with higher levels of employment volatility at the firm-level, broadly consistent with country specific shocks being passed through inputs into the production process. A decomposition of imports reveals that the import intensity and volatility relationship is driven mainly by manufactured imports, which are more closely associated with offshoring, and not by imports of raw materials or inputs from the non-manufacturing sector. We find the GDP of the trading partner and the distance from the U.S. to the trading partner also to be important determinants of firm-level volatility both in the case of exports and imports.

Our paper is not the first to empirically explore the relationship between volatility and trade at the micro level. While much of the previous work empirically links trade to volatility at the industry level[12], several recent papers have also analyzed the relationship between trade status and volatility at

[12] For example, Di Giovanni and Levchenko (2009a) find industries that are more open to international trade to have higher levels of sales volatility, which they attribute to increased exposure to demand and supply shocks. Similarly, Krebs, Krishna and Maloney (2010) for Mexico and Krishna and Senses (2009) for the U.S., find a statistically and economically significant association at the industry level between openness and persistent income risk (variance of unpredictable changes in income). Our analysis of industry level employment data from the U.S. manufacturing sector for the 1976-2005 period, reported in Figure 1 suggests a similar positive relationship between openness and employment volatility.

the firm level.[13] Buch, Döpke, and Strotmann (2009) abstracting away from differences in trade intensity, find the volatility of sales growth to be lower for exporters in Germany during 1971-1998. Consistent with our findings for employment volatility in the U.S, Vannoorenberghe (2012) documents a non-monotonic relationship between global sales of a firm and export share in France[14], and Nguyen and Schaur (2010) find the volatility impact of trade to be different for Danish firms that continuously export compared to marginal exporters which do not export every period.

The paper is organized as follows. The next two sections present the data and our measures of volatility. We establish and present the stylized facts on trade and firm-level volatility, and verify them at the industry level in Section 4. Section 5 presents the sources of volatility, followed by a concluding summary.

2. Data

In this section we describe the firm and industry level data we use in our analysis. Industry identification, age, employment, firm identifiers, and longitudinal links for establishments source from the Longitudinal Business Database (LBD), which contains data on the universe of all private U.S. business establishments with paid employees from 1976 to present.[15] Given its complete coverage of all private establishments, the LBD allows a detailed analysis of employment dynamics and entry and exit of establishments. Moreover, the longitudinal coverage of the dataset is ideal given that firm-level volatility calculations necessitate consecutive observations over time for each firm.

We aggregate the establishment data from the LBD to the firm level using firm identifiers, and link it to the Longitudinal Firm Trade Transactions Database (LFTTD). In addition to individual trade transactions of imports and exports, LFTTD includes information on the product traded (at the 10-digit HS level), the nominal value of the transaction, and the destination countries for exports and source countries for imports.[16] We supplement the merged LBD and LFTTD dataset with detailed information on firm and industry characteristics. Data on firm characteristics such as, skill composition, shipments, number of products produced, and the cost of intermediate inputs are

[13] Also at the firm level, Kalemli-Ozcan, Sorensen, and Volosovych (2010) study the relationship between international exposure and volatility through the capital account, and find a positive association between foreign ownership and firm-level volatility.

[14] While a higher export share raises the volatility of the global sales of a firm, exporters with an export share less than 10% are slightly less volatile than comparable non-exporters.

[15] The LBD is constructed from the Business Register (the SSEL), which covers the universe of organizations used for Census Bureau surveys. See Jarmin and Miranda (2002) for a detailed description of the data.

[16] The LFFTD also includes information on shipment date and whether the shipment took place at arm's-length or not. See Bernard, Jensen, Redding, and Schott (2010) for more information about the LFTTD.

from the Census of Manufactures (CMF), which is collected every 5 years (in years ending in 2 and 7), for the full universe of establishments in the manufacturing sector. Industry-level data on import penetration, export share and trade share by country are from Schott (2008)[17] and data on shipments, employment, skill composition, wages, production and deflators are from the NBER productivity database (Bartelsman, Becker and Gray (2000)).

Since comprehensive industry and firm-level data are mostly available only for the manufacturing sector, for the ensuing analysis we restrict our sample to firms operating within the manufacturing sector. We identify a firm as a manufacturing firm if more than 50 percent of its total employment across all affiliated plants is in this sector.[18] In addition to the availability of detailed data, the manufacturing sector is well-suited for our analysis as it is more exposed to the competitive pressures and the market opportunities of international trade. Besides, while the share of the manufacturing sector in the U.S. is rather small, the contribution of this sector to overall output volatility is substantial (Ramy and Vine (2005)).

In our analysis we use data spanning 15 years from 1991 to 2005 since the LFTTD starts in 1992[19] and the most recent vintage available to us is 2005. In the merged LFTTD and LBD dataset, the establishment count ranges from about 390,000 to roughly 460,000 a year, accounting for about 60 percent of overall imports and exports in the manufacturing sector. The average establishment employment is 45; 20 percent of establishments are part of a multi-unit firm and 45 percent of the establishments in our sample are part of firms that have either imported or exported at least once.

Several aspects of our analysis require further modification of our sample. As we describe in detail in the next section, calculation of employment volatility requires positive employment observations for consecutive years for firms in the sample. To this end, we primarily utilize two separate samples from the merged firm-level data. First, we calculate firm-level volatility for firms that report positive employment for at least five consecutive years over the full sample period from 1991-2005 (15-year window). The five-year restriction provides sufficient observations to calculate firm-level employment volatility and yet allows us to retain some degree of entry and exit into our sample by including firms that are short-lived. In order to introduce temporal variation in volatility we also calculate volatility over three 5-year windows, from 1991 to 1995, 1996 to 2000, and 2001 to 2005. We clean the data of outlier observations by omitting firms with employment levels and employment growth rates at the top and bottom 1 percentiles from both the 5-year and 15-year sample windows.

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[17] The data we use are an update of Schott (2008) using the concordances from Pierce and Schott (2009) and Bartelsman, Becker and Gray (2000). For more detail, see Peter Schott's webpage at http://faculty.som.yale.edu/peterschott/sub_international.htm.

[18] In identifying the industry of an establishment, we use the Fort-Klimek NAICS concordance (1976-2007) to construct time-consistent industry codes (NAICS).

[19] While the LFTTD starts in 1992, we use employment data from the LBD for 1991 to construct change in employment between 1991 and 92.

2.1 Descriptive Statistics

In Table 1 we provide basic descriptive statistics calculated for the 15-year window from 1992-2005 for the full sample of firms and by trader status. The first two columns contain the means and standard deviations for the full sample of firms. Linking LBD, LFTTD and CMF, and cleaning the data for outliers result in a sample of 331,874 firms that report at least five years of positive employment. The table includes the descriptive statistics for firm-level employment, skill share (defined as the share of non-production workers in total employment), age,[20] multi-unit status, number of products produced,[21] number of countries exported to, the number of countries imported from, the number of exported and imported products,[22] and the percent of years a firm exports or imports.[23] Aggregating to the firm level naturally lowers the number of multi-unit organizations, which is now at 7 percent for the 15-year panel. Average firm employs 50 workers, a quarter of which are skilled workers. The average age is about 12 years and the average firm produces about 3 products. The remainder of the first two columns of Table 1 summarizes trade-related moments. During the 15-year window for the full sample of firms, the average firm exports to 1 country and imports from 0.4 and exports 1.8 products and imports 1.[24] On average, a firm exports 20 percent of the years they were under operation during the 15-year window and imports 10 percent of the time. Note that these averages are low as roughly 60 percent of firms in the full sample do not trade.

For our baseline analysis we divide firms into four categories by their trading status: Firms that do not engage in trade (non-traders), firms that only export (exporter only), firm that only import (importer only), and firms that both import and export (both) during the 15-year window and each of the three 5-year windows. For the 15-year window, we classify a firm as a "non-trader" if the firm did not export or import during any of the years for which it reported positive employment over the 15-year window. Similarly, a firm is an "importer only" ("exporter only") firm if it imported (exported) at least for one year during the 15-years and never exported (imported). A firm is defined as "both" if it engaged in both importing and exporting during at least one year during the 15-year window. These categorical variables are also constructed in a similar fashion for the three 5-year windows to allow for the transitions between trading status that are prevalent in the data. According to our classification, about 40 percent of the 15-year sample consists of firms that engage in trade;

[20] Age of a firm is calculated as the number of years the firm reports positive employment in the LBD. Age for firms were under operation for longer than the time frame of the LBD are top-coded at 30.
[21] Number of products the firm produces and the skill share source from the CMF, and are calculated as an average over the overlapping Census of Manufacturers years.
[22] Both imported and exported products are reported in 10 digit HS classification.
[23] The percent of years a firm exports (or imports) is calculated as the number of years an establishment exports (imports) relative to the number of years the establishment reports positive employment within a given window (15-year window in Table 1).
[24] For products and countries traded, the medians for the full sample are zero.

45 percent of these trading firms engage both in importing and exporting, 47 percent only export and 8 percent only import.

The remaining columns in Table 1 describe firm characteristics by trade status over the 15-year sample. Consistent with earlier findings, firms that do not trade are smaller, and produce fewer products compared to trading firms. Firms that both import and export are substantially larger and older, employ a higher share of skilled workers and are more likely to be multi-unit compared to both non-traders and to other trading firms that either only import or only export. These firms, on average, export to 5 countries (compared to an average of 1 for exporter only firms) and import from 2 (compared to 1 for importer only firms). The average number of products exported and products imported are about 8 and 5, respectively (compared to 2 for exporter only and importer only firms). Trading firms do not consistently export or import each period in which they produce: Exporter only firms export 40 percent of the time and importer only firms import 30 percent of the time.

Table 2 presents the share of firms by trade status for each sample window. Roughly 60 percent of firms never engage in trade throughout the entire 1991-2005 period. For the three 5-year windows, this share increases by 2-4 percentage points depending on the particular period. The increase in the fraction of non-traders is due to firms that trade only once or twice being counted as traders during the entire 15-year window, and identified as non-traders when using shorter intervals.[25] Figures reported in Table 2 suggest that the shares of firms in each trade status category do not vary much across time. The majority of firms that trade are either "exporter only" or "both". Roughly 20 percent of the firms only export and 18 percent both export and import. Firms that only engage in importing are a small fraction of our sample, at about 3 percent. These findings mirror the results in Bernard, Jensen, Redding, and Schott (2007), which report similar shares of sole importer firms, sole exporter firms, and firms that do both in 1997.

Next, we calculate transition probabilities between trade statuses both at 7-year and annual frequencies. In the top panel of Table 3, we divide the 15-year window into two mutually exclusive 7-year windows and present the transition probabilities between the four trade status categories. About 80 percent of firms retain their trading status from the first 7-year period to the next. For firms that only export or only import, the likelihood of transitioning to another trade status is substantially higher compared to firms that do both or neither. The year-to-year transition probabilities, reported in the bottom panel of Table 3, are relatively similar, but with higher probabilities of not switching between trade statuses for each category (especially for non-traders

[25] According to our classification, a firm that is labeled as a "non-trader" for the 15-year sample will be labeled as non-trader for all the 5-year windows (but not vice versa). Similarly, a firm can be labeled as a "both" firm for the 15-year sample but as a "non-trader" firm for at least one of the 5-year samples if the firm did not engage in international trade during the coverage of the 5-year window.

and importer only firms).[26] While there appears to be some inertia in trade status in the data (roughly 75 percent of firms maintain the same trade status), the results in Table 3 also point to significant number of firms that switch. For example, 20 percent of firms that both export and import, and 40 percent of firms that only export will not be doing so in the next period.

The categorical approach to identifying trade status, while informative, does not differentiate between major trading firms and firms which trade only a small fraction of their output or input. In order to take into account this heterogeneity, we also construct measures of intensity of imports and exports for a firm. For export intensity, we calculate the ratio of export value to the value of shipments. The import intensity measure is calculated as the ratio of imports to the cost of materials, where the cost of materials is measured as the cost of parts, fuels, electricity, and contract work incurred by the firm.[27] We decompose the import intensity measure into share of imported manufactured inputs, share of imported non-manufacturing inputs, and share of imported raw materials.[28] We further divide imported manufactured goods into offshoring related imports and imports of other manufactured goods. Offshored manufactured imports are defined as imports that are within the same 3-digit NAICS as the main industry of the firm, similar to the "narrow measure of outsourcing" used by Feenstra and Hanson (1999). Also included in the offshored category are goods shipped abroad and imported back after further processing under the production sharing provisions (Chapter 98 of the Harmonized Tariff Schedule).

The export and import intensity measures are summarized in detail in Table 4. The top panel reports averages and standard deviations over the entire 15-year window and the bottom panel summarizes the intensity measures conditional on positive values for each measure of interest. On average about 2 percent of shipments are exported and 2.5 percent of total cost of materials are imported. When we only focus on firms that export or import, the average shares are higher, with exports to shipments ratio at 5 percent and share of imported inputs roughly at 12 percent. Large standard deviations point to significant heterogeneity across firms in terms of their export and import intensities. We also find the share of imports of non-manufacturing inputs and imports of raw materials to be relatively small compared to the share of imported manufactured inputs, on average.

3. Measures of Volatility

[26] The year-to-year transitions probabilities are calculated annually and are averaged over the full 15-year panel.

[27] For both the import and export intensity measures, the numerators (total imports and exports) are average values calculated over the years for which positive dollar values are reported. Both the value of shipments and cost of materials are from the CMF.

[28] Following the definition employed in Hummels, Jorgensen, Munch and Xiang (2011), we use the HTS codes in the LFTTD data to identify raw materials, as products with HTS codes 1-15, 25, 26, 27, 31, and 41. Once raw materials are separated from the import data, we concord HTS to NAICS, and define manufactured goods as those in NAICS 31-33 categories. Non-manufacturing imports are then defined as imports of inputs that are not raw materials or manufacturing goods (such as printed and published materials, non-raw material agricultural products etc.).

As we noted before, the estimation of firm-level volatility of employment growth rates requires longitudinal data. For the 1991-2005 period we first calculate a time invariant measure of volatility for firms reporting positive employment for at least 5 consecutive years over the full 15-year window. This measure has the advantage of having most employment growth rates calculated over a long time span resulting in a more precise measure of firm-level volatility. We next use a time-varying volatility measure constructed over three 5-year windows to explore the robustness of our results to any time variation in firm-level volatility and to controlling for firm characteristics that are fixed over time.

The volatility measures we use capture the variability of growth rates (γ_{ijt}) of employment (E_{it}). For our primary measure of firm-level volatility we calculate a conditional growth rate of employment given by the estimated residuals from the following specification with log growth rates of employment in firm *i* at time *t* as the dependent variable:

$$\gamma_{ijt} = \ln(E_{it}) - \ln(E_{it-1}) = \phi_i + \mu_{jt} + \upsilon_{it}$$

Firm fixed effects ϕ_i are included to isolate the within firm effects and sector-year fixed effects (μ_{jt}) are included to capture sector specific shocks (such as shocks to factor prices, productivity or demand) that are common to all firms in a given sector. The estimated residual (υ_{it}) reflects the deviation of employment growth from the firm-average and from the sector-average at time *t*. Volatility is then calculated as the standard deviation of the residual growth rates for a window of length w:[29]

$$\sigma_i^w = Vol(\gamma_i) = \sqrt{\frac{1}{w}\sum \upsilon_{it}^2}\ .$$

We call this method the "residual" approach.

To ensure robustness of our results, we also calculate the growth rate of employment as the log difference in employment and use this measure to calculate the volatility as the standard deviation of firm employment growth:

$$\sigma_{it}^w = \left[\frac{1}{w}\sum_{\tau=0}^{w}(\gamma_{i,t+\tau} - \overline{\gamma_{it}})^2\right]^{1/2}$$

[29] This measure is very similar to the baseline measure (column (4) in Table 2) used in Vannoorenberghe (2012) (except for the omission of the growth rate of capital not available in our dataset), and the measure from Kalemli-Ozcan, Sorensen, and Volosovych (2010), which calculates volatility year-by-year as the absolute value of the residual (υ_{it}).

where w is the length of the window (5 or 15 years) and $\overline{\gamma_{it}}$ is the average growth rate over the window w.[30]

Table 5 reports summary statistics for the volatility of growth rates estimated using the residual approach[31] for the 15-year window (over the 1991-2005 period) and for the three 5-year windows (1991-1995; 1996-2000; 2001-2005), separately for the full sample of firms and by trading status of the firm. Several stylized facts stand out. First, on average, firms that only export, and firms that both export and import are less volatile compared to firms that only import and firms that do not engage in trade. This is true for both the time invariant measure calculated over 15 years and the time varying measure calculated over three 5-year windows. Second, on average, firm-level volatility does not show much time variation for either the full sample of firms or the sub-samples of firms by trading status. Note that this finding is partially due to the 5-year sample restriction which abstracts away from an important source of volatility arising from entry and exit of firms, by excluding firms that are short-lived (less than 5-years) from the sample.[32]

4. Trade and Volatility of Growth Rates

4.1 Volatility at the Firm-Level

Unconditional averages reported in Table 5 point to variation in employment volatility across firms with different trade status. In this section we formally test for such a linkage between trade status of the firm and its volatility. The first set of specifications examine whether trading firms differ in terms of employment volatility after controlling for industry and firm characteristics. We start by estimating the following specification:

$$ln\sigma_{ij,w} = \beta_0 + \beta_1 Exp_{i,w} + \beta_2 Imp_{i,w} + \beta_3 Both_{i,w} + \beta_4 ExpSh_{i,w} + \beta_5 ImpSh_{i,w} + \phi X_{i,w} + \theta Y_{j,w} + \varepsilon_{ij,w} \quad (1)$$

[30] In unreported results, we also calculate the growth rate of employment of firm i at time t as $\gamma'_{it} = \frac{E_{it} - E_{it-1}}{(E_{it} + E_{it-1})/2}$ following Davis, Haltiwanger, and Schuh (1996). This measure has the advantage of being bounded, and symmetric around zero and allows us to incorporate births and deaths into our analysis. Our main results are robust to using this measure and are available upon request.

[31] Since the two measures of employment volatility are highly correlated at about 0.8, we report the descriptive statistics only for volatility calculated using the residual method.

[32] Comin and Philippon (2005), record an actual increase in volatility for a sample of publically listed firms during the 1955-2000 period. As Davis, Haltiwanger, Jarmin, and Miranda (2007) point out, this increase is mostly due to the omission of privately held firms, which are smaller and short-lived. In the next section, we carry out our analysis at the industry level in order to evaluate the robustness of our main results to the inclusion of short-lived firms into our sample.

where *i* indexes the firm, *j* indexes the industry, and *w* indexes the window over which the volatility measure ($\sigma_{ij,w}$) and the explanatory variables are calculated. As we mentioned before, the categorical variables we construct take the value of one for firms that are only exporters and not importers (*Exp)*, only importers and not exporters (*Imp*), and for firms that engage in both importing and exporting (*Both)*, and zero otherwise. The omitted category (*Non-Trader)* includes firms that do not engage in international trade within the window analyzed. The firm-level trade intensity measures are: export share (*ExpSh)* calculated as the average exports relative to average shipments and import share (*ImpSh*) calculated as the average imports relative to average cost of materials. $Y_{j,w}$ represents the set of controls at the industry level such as the logarithms of import penetration, export share, industry size (measured as total employment), and the skill share of the industry (measured as the share of non-production workers in total employment); $X_{i,w}$ represents firm-level controls such as multi-unit status, skill share and logarithms of age and size. The control variables are calculated as the average over *w*, the window of interest.[33]

The estimation results for the 15-year window are reported in Table 6. We start by estimating equation (1) including only the categorical variables summarizing firm trade status along with firm level controls and industry fixed effects. Within industries, compared to purely domestic firms, we find firms that only export to be less volatile and firms that only import to be more volatile. Similar to firms that only engage in exporting, volatility of employment growth in firms that engage in both importing and exporting during this period is lower compared to firms that that do not trade. We find employment volatility to be lower for larger, older, and single-unit firms, and for firms with higher skill share.[34] Interestingly, firms that produce a wider range of products are also less volatile presumably due to the diversification of demand shocks. The trade status related results do not change when we include industry level controls instead of industry fixed effects in the specification. Results reported in column (2) suggest that employment volatility is higher for firms operating in industries with high import penetration and low export share. This finding is broadly consistent with Slaughter (2001) and Krishna and Senses (2009), which document a negative relationship between import penetration and labor demand elasticities and individual income risk, respectively. Firms in larger industries are less volatile, whereas firms in industries with higher share of skilled workers are more volatile.

Specifications estimated in columns (1) and (2) assume that the volatility impact of exporting is the same for a firm that exports an infinitesimal share of its output and a firm that exports a large share.

[33] For example, consider a firm that reports positive employment for seven consecutive years over the 15-year window (*w*=15). Then the dependent variable in Equation (1) is volatility calculated over six growth rates and the trade status is determined during this 7-year period. The intensity measures are calculated as the average import and export shares over these 7 years, and the firm-level controls are averaged over (one or two) Economic Censuses covered during the 7-year life cycle of this firm.

[34] Note that the negative association between volatility and the share of skilled workers in a firm holds only after controlling for skill composition at the industry level. Excluding industry skill share in equation (1), as in column (1), results in a positive firm skill-volatility relationship.

But this need not be the case. For example, if exchange rate fluctuations or demand shocks are propagated through the export channel to the employment demand of a domestic firm, then a larger fraction of output dedicated to foreign demand might result in an increase in the ease and speed at which shocks are transmitted to the firm. In fact, the model in Vannorrenberghe (2012) suggests that an exporter selling an infinitesimal share of output abroad and a firm selling solely to the domestic market will not differ in terms of volatility. In order to account for possible heterogeneity in the impact of trading on employment volatility, we replace the categorical trade status variables with share of exports in total sales and share of imports in total cost at the firm-level, and report the results in column (3). Both the share of exports and the share of imports have a significant and positive association with firm-level employment volatility. In column (4), we include the share of exports and imports together with the categorical variables to account for any intrinsic differences between trading and non-trading firms, and to allow for a non-monotonic impact of trading on firms based on intensity of exports and imports. We continue to find both the import share and the export share to be associated with higher firm-level volatility. The signs and the degree of significance for the categorical trade status variables are the same as the first two specifications reported in columns (1) and (2). While export status continues to have a significant negative coefficient in this specification, the results also suggest that the association between volatility and exporting is positive for firms with higher share of exports. Specifically, employment volatility is higher for firms, which export more than 17 percent of their total sales compared to firms that do not export, or export a smaller share.[35] Note that this result suggests that the diversification effect that works to reduce volatility when the domestic and foreign shocks are not perfectly correlated, is important for many exporters, given that the average export share is 5 percent. Similarly a firm in the "both" category, which imports the same fraction of materials as the average importer, and exports more than 30 percent of its output will be more volatile than a non-trading firm.

In Table 7 we report estimation results from several additional specifications that support the general robustness of our results. First, we introduce time-variation to equation (1) and use the employment volatility measures calculated over three 5-year windows as the dependent variable. The specifications are estimated with window fixed effects (t_w), industry fixed effects (δ_j) and both with and without firm fixed effects (α_j). The controls at the firm level $(X_{i,w})$ and industry-level $(Y_{j,w})$ are calculated as averages over each 5-year window. The estimation results from these specifications are reported in first three columns of Table 7. The results reported in column (1) without the intensity measures are consistent with those for the 15-year panel: Relative to firms that do not trade, exporters are less volatile, importers are more volatile, and firms that both import and

[35] Vannoorenberghe (2012) documents a similar non-monotonic relationship between exporting and volatility of the growth rate of firm sales: While on average the association between the export share and global sales volatility at the firm level is positive for a sample of French firms, the volatility is lower for firms with export to sales ratio of less than 10 percent.

export are less volatile. Column (2) introduces the export and import intensity measures. The results again are similar to those reported in Table 1 for the 15-year panel. The relationship between employment volatility and import and export intensities are positive and significant and the inclusion of continuous measures of import and export intensities, does not change the sign or significance of the categorical variables. Column (3) of Table 7 introduces firm fixed effects in order to control for any unobserved firm-level heterogeneity that is time-invariant. The fixed effects regressions are broadly consistent with our previous results, although the estimated coefficients are smaller, and in the case of sole importers, no longer statistically different from zero. The lack of significance for sole importers is not particularly surprising, as the coefficients in the fixed effects specifications are identified off variation over time in trade status. As we reported in Table 3, only a small number of firms in our sample are sole importers, and the number of firms switching in and out of this category is very small.

Next, we re-estimate the full specification in equation (1) with the categorical trade status variables and continuous trade measures for a balanced panel over our entire sample of 15 years. The balanced panel includes 103,884 firms that report positive employment for the entire sample period, and is a biased sample of long-lived, larger, and successful firms. But given the well documented empirical regularity that the firms that engage in international trade are both larger and more likely to survive compared to their domestic counterparts, arguably this selected group of firms may indeed be a more appropriate comparison group. The results are again consistent with our previous findings. In the next three columns (columns (5) through (7)) we present estimation results with the log difference measure of volatility (calculated using the standard deviation of the log differences in employment) as the dependent variable instead of volatility estimated using the residual method. Lastly, columns (8) through (10) report results with volatility of employment growth calculated at the establishment level (instead of firm level) as the dependent variable.[36] We find both the results based on the log difference measure of volatility and on the establishment-level volatility to be broadly consistent with our previous findings: We find establishments that are part of firms that only export, and firms that both export and import to be less volatile, whereas establishments that are part of importing only firms are more volatile. Like before, higher export and import intensities at the firm level are associated with higher levels of volatility.[37]

In the preceding analysis we identified a firm as an exporter or an importer for a given window regardless of the frequency with which the firm traded. However, the employment dynamics for firms that periodically import and/or export could be quite different from firms that continually engage in international trade. To explore this possibility, we first restrict our attention to firms that

[36] In this specification, the trade status variables as well as the intensity measures continue to be at the firm level since this data sources from the LFTTD. Accordingly, in this specification, the standard errors are clustered at the firm level.

[37] We also estimate equation (1) with volatility of (real) wage growth calculated using the residual method as the dependent variable and find our results to be consistent with our previous findings. These results are available upon request.

export (but do not import) in each period that they report positive levels of employment ("permanent exporters"), firms that import (but do not export) in each period that they report positive levels of employment ("permanent importers"), firms that import or export in each period that they report positive levels of employment ("permanent both") and firms that do not export or import ("non-trader") during each of the 15-year and 5-year windows. Firms that switch in and out of trading within a window are omitted from this sample. Estimation results for the 15-year window and the 5-year windows with and without firm fixed effects are reported in Table 8. While our findings for firms that always only export, and firms that always export and import are similar to our previous findings suggesting a lower level of volatility for these firms compared to non-trader firms, the sign on the categorical variable for firms that always only import is now negative and significant. This suggests that our previous finding that, importers were more volatile than firms that do not trade is mainly driven by firms that import periodically. We find this to be the case when we further decompose the categorical variables into permanent and temporary exporters, importers and firms that do both. Specifically, we identify a firm as a "temporary exporter" if the firm exports at least once but not for every year it reports positive employment, and never imports. Temporary importers and both are defined in an analogous fashion. The definition for permanent exporters, importers and both are the same as before. The estimation results reported in columns (4) through (6) in Table 8 suggest that firms that only export and firms that do both, experience a lower level of employment volatility compared to non-trader firms, regardless of whether they are permanent or temporary traders. But the magnitude of the estimated negative coefficient is an order of magnitude bigger for firms that do not switch in and out of trading. We find that while permanent importers also experience a lower level of employment volatility, firms that switch in and out of import markets experience a higher level of employment volatility. This again suggests that the positive association between importing and volatility reported in Tables 6 and 7, is mainly driven by temporary importers.[38] These findings highlight the importance of controlling for the duration of trading in the firm-level analysis that follows.

In summary, the results reported in this section present several stylized facts about the volatility of employment growth rates for trading firms relative to non-trading firms and the share of output and inputs traded. First, firms that only export, either temporarily or permanently, tend to be 2.5 to 6 percent less volatile than firms that do not trade, depending on the length of the window over which volatility is calculated. [39] Second, sole importers are 1.5 to 5 percent more volatile than firms that do not trade; this result is driven by organizations that switch in and out of importing. Third, firms that both import and export (temporarily or permanently) are about 6.5 to 9.3 percent less volatile than firms that do not trade. Finally, export intensity and import intensity are both positively related to

[38] A similar approach is taken in Nguyen and Schaur (2010) where marginal exporters experience higher sales volatility relative to non-traders, while permanent exporters do not differ from non-traders in Denmark.

[39] These numbers are based on the specifications with both categorical and continuous trade variables included over the 15-year (column (4) of Table 6) and 5-year windows (column (2) of Table 7).

volatility. For trading organizations, one standard deviation increase in trade intensity would increase firm employment volatility by roughly 1.7 percent for exporters, and 3.5 to 4 percent for importers.

4.2 Volatility at the Industry-Level

A drawback of the previous analysis is that the calculation of the volatility measure at the firm-level requires sufficiently long time series data for each firm, which restricts the sample to longer-lived firms, and abstracts away from a possibly important component of volatility resulting from entry and exit of firms. In particular, the criterion for inclusion in our main sample is at least four consecutive growth rates, which means that only firms that reported positive employment for 5 consecutive years during the window under consideration are in the sample. This introduces a degree of sample selection problem into our analysis. Specifically, about half of the firms that reported positive employment for at least one year during 1991-2005 are excluded from our sample based on the criterion that volatility is calculated over five consecutive observations.[40] Importantly, the contrast in findings between Comin and Philippon (2005) and Davis, Haltiwanger, Jarmin, and Miranda (2007) indicate that a sample biased towards larger and long-lived firms is likely to be different in terms of volatility characteristics and possibly its relationship with trade, compared to the entire population of firms.

In order to test whether our previous results are due to this sample selection bias, we aggregate the firm-level data by trade status and calculate volatility by industry and trade status. This approach allows us to analyze the volatility-trading status link by allowing for entry and exit of firms and, by including short-lived establishments in our analysis. We start by aggregating up firm level employment by industry, year and trade-status (non-trader, exporter only, importer only, and both exporter and importer).[41] We then calculate for each industry (6-digit NAICS level) and trade-status, employment growth rates and volatility calculated as the growth rate of employment (in log differences) and estimate a specification similar to (1), but at the industry level:

$$\ln \sigma_{j,w} = \alpha_0 + \alpha_1 Exp_{j,w} + \alpha_2 \operatorname{Im} p_{j,w} + \alpha_3 Both_{j,w} + \theta Y_{j,w} + \alpha_j + t_w + u_{j,w}, \qquad (2)$$

where $\sigma_{j,w}$ is the volatility of industry *j* in window *w* calculated either over the 15 or 5 year windows and σ_j are industry fixed effects. The 5-year window specification also includes industry level controls, $Y_{j,w}$, such as import penetration, export share, shipments and skill share, and time fixed

[40] This problem is not unique to our paper and is prevalent in studies of firm-level volatility. See for example, Nguyen and Schaur (2010) and Vannoorenberghe (2012) in trade context.

[41] For this part of the analysis, we abstract away from year-to-year switches in trade status and use time-invariant measures of trade status constructed over 15-year windows. We do this to avoid introducing spurious volatility at the industry-trade status level due to firms switching between trade statuses.

effects (t_w). In addition to employment volatility, we also conduct the industry-level analysis on volatility of the growth rate of the number of firms and the growth rate of real wages for each industry and trade-status category.

First two columns of Table 9 report industry-level results with employment volatility as the dependent variable. The estimation results for both the 15 and 5-year windows are consistent with our previous findings at the firm-level: Industry-level employment volatility associated with employment changes in importing firms is higher compared to that associated with non-traders, and the volatility from exporting firms are lower. Also as before, in a given sector, the volatility due to firms that both import and export is lower than volatility associated with those firms that do not trade. The results using volatility calculated for changes in firm count and real wages as the dependent variable are similarly consistent with our findings for employment volatility, with lower volatility due to firms that only export and firms that do both, and higher volatility due to firms that import, all relative to the aggregate for non-trader firms in each industry. The consistency of the firm-level results and industry-level results using aggregated data which incorporate volatility arising from short-lived firms, gives us some confidence that the results we report are not simply an artifact of the sample selection problem discussed before.

5. Sources of Volatility for Trading Firms

The empirical analysis in the previous section documented the relationship between employment volatility and trade status of the firm after controlling for various sources of heterogeneity at the firm and industry level. In this section, we focus on various factors that contribute to the differential level of employment volatility experienced by trading firms. In particular, we first investigate the relationship between employment volatility and the number of products traded, the number of countries a firm trades with, and the duration of time a firm participates in foreign markets. Next, we decompose the share of imports into share of imported manufactured inputs, imported raw materials, and other imports, and examine separately their relationship with employment volatility. Finally, we focus on the destination and source countries for exports and imports and study the trade-volatility relationship by first decomposing the share of imports and exports by income levels (low, middle, and high) of the trading partner and then by estimating separately the impact of country characteristics such as output volatility, GDP, distance to the U.S. and covariance with the

U.S. For the analysis that follows we restrict our attention to only trading firms, which include firms that only export, firms that only import, and firms that do both during the 15- and 5-year windows.[42]

5.1 Country and Product Counts

As we have discussed in Section 2, there is great degree of heterogeneity in terms of both the number of traded products and trading partners: The average trading firm exports to 3 countries and imports from 2 (with standard deviations of 6.11 and 2.98, respectively) and exports and imports about 5 products (with standard deviations of 14.07 and 15.26, respectively). Firms trade roughly about half the time they report positive employment. To explore this heterogeneity, we estimate Equation (1) by including the number of products traded, the number of countries a firm trades with, and the fraction of time a firm exports or imports (calculated as the number of years a firm reports positive exports (or imports) divided by the number of years it reports positive levels of employment). Each specification also includes share of exports and imports as well as the full set of firm level controls and fixed effects as described in the earlier section.[43]

The estimation results are reported in Table 10 for the 15-year windows in column (1) and for the 5-year windows with and without firm fixed effects in columns (2) and (3).[44] We find the share of both exports and imports to be positively associated with increased employment volatility, mirroring our previous findings. Likewise, consistent with the results in Table 6, larger firms and firms that produce a higher number of products experience lower levels of employment volatility. Several additional findings stand out. First, holding trade intensity constant, the fraction of time spent trading by a firm is associated with lower levels of firm volatility. This effect is larger in the case of exporting but is also significant for importers: An increase in the time traded by one year[45] lowers volatility by 3 percent for exporters and 0.7 percent for importers. Importantly, these results hold not just relative to non-traders but also relative to other trading firms, and hold both in the cross-section and within firms. The negative relationship between frequency of trading and volatility could reflect the impact of a more stable ordering and sales environment, and more consistent international demand and supply conditions for continuously trading firms.

Second, controlling for trade intensity, the fraction of time traded, and the number of products traded, we find that volatility is higher for firms that use imported inputs sourced from more

[42] While we report only the estimation results for the pooled sample of all trading firms, we have estimated variants of the specifications reported in this section separately for firms that are only importers, only exporters, and firms that do both. The results are very similar to those reported in Tables 10-13 and are available upon request.

[43] We have also estimated each specification including trade status dummies. This does not change the main results reported in this section.

[44] To preserve space, the estimated coefficients on firm-level controls and time varying industry-level controls (for the 5-year window analysis) are not reported in Table 10. These results are consistent with those reported in Table 6 and are available upon request.

[45] An increase of one year is equivalent to an increase in the percent years traded by 0.2 during the 5-year window.

countries and lower for firms that export to a larger number of destination countries. We find that a one standard deviation increase in the number of countries traded with is associated with about 5 percent decrease in exporter volatility and about 6 percent increase in volatility for importers. For exporters, this result is consistent with a diversification story, with firms exporting to more countries diversifying away country-specific demand shocks. In contrast, the result for importers indicates that holding the number of imported inputs constant, the more countries the firm imports from, any diversification effect is dominated by an increase in country specific shocks a firm is subject to. This result is consistent with country specific shocks being passed through inputs into the production process, as documented in Di Giovanni and Levchenko (2009b) and Johnson (2012).[46] Lastly, controlling for trade intensity, time traded, and the number of countries traded with, we find the number of exported products to be positively associated with firm-level volatility. Although this reversal of the relative importance of the diversification effect for product count is interesting, we do not over-emphasize this finding as the estimated coefficients are less precisely estimated with significantly smaller magnitudes compared to the estimates for number of trading partners.

5.2 Decomposing Imports

Our previous results consistently suggest that a higher share of imported inputs is associated with higher levels of firm level employment volatility. Note that, since the firms in our sample that report import usage are not "pure" wholesalers,[47] by definition, the imports of these manufacturing firms are inputs that are either substitutes or complements with the other inputs of the firm in the production process. Firms could be subject to supply shocks transmitted through imports similar to Johnson (2012), or could be subject to increased labor demand elasticities through increased possibility of substitution between imported inputs and employment within the firm (as in Rodrik (1997), Slaughter (2001) and Senses (2010)). Moreover, exogenous fluctuations in commodity prices could introduce an additional source of volatility through imports of raw materials.

In order to analyze the particular channel through which imports impact firm-level volatility, we decompose each firm's share of imports into the share of imported manufactured goods, imported raw materials, and other imported inputs (that are neither manufactured nor raw materials) and replace share of imports in Equation (1) with the detailed classification of imports. We then further decompose imported manufacturing inputs into "offshored" manufactured imports and general manufactured imports. We define "offshored" imports as those that are within the same 3-digit NAICS industry as the final good produced by the firm and products that are exported for further

[46] This finding is also broadly consistent with increased labor demand elasticities (and hence responsiveness of employment) as a result of substitution possibilities for domestic labor with availability of increased suppliers.
[47] "Pure" wholesalers, as defined by Bernard, Jensen, Redding, and Schott (2010), are firms that employ 100 percent of their workforce in the wholesale and the retail sector.

processing under the Chapter 98 of the Harmonized Tariff Schedule ('narrow' definition of offshoring).[48]

Table 11 contains the import decomposition results separately for the 15-year and 5-year windows. As before, the share of exports is positively and significantly associated with firm level volatility in all specifications. For the share of imports, we find imported manufacturing inputs, which is more closely associated with offshoring, to be the source of the positive relationship- we do not find the shares of imported raw materials and other inputs to have a statistically significant impact on volatility. Further decomposition of the share of imported manufactured inputs to imports due to "offshoring" and imports of other manufactured inputs suggest that both of these components contribute positively to firm-level volatility with a slightly higher coefficient on the latter.[49]

5.3 Country Characteristics

Next, we test whether the positive relationship between the share of imports and exports, and firm level volatility is related to the characteristics of the countries a particular firm trades with. For example, if demand or productivity shocks are especially more volatile for a particular set of countries, then firms that trade with these countries would be differentially impacted compared to firms that trade with countries that experience a more stable economic environment. To analyze this further, we first decompose the share of exports and imports based on the level of development of the trading partners of the firm, which is documented to be associated with the level of volatility in those countries.[50]

Table 12 presents the results linking firm-level volatility to the trading partner level of development for both imports and exports. In this specification, we replace the shares of non-raw material exports and imports in equation (1) with share of exports and imports from low income countries, from middle income countries, and from high income countries, where the income status of the country is classified according to the World Bank classification of countries based on per capita income.[51] The reported specifications all include share of raw materials as well as controls for firm and industry characteristics. As before, the analysis is performed for the sample of trading firms.

The estimation results suggest that exports to middle and high-income destinations contribute positively to volatility at the firm level, while the share of exports to low income countries do not have a statistically significant impact. We find the share of imports from countries of all three

[48] Chapter 98 of the Harmonized Tariff Schedule, or the production sharing provisions, allows imports that have U.S. content to enter the U.S. with reduced or no duties.
[49] The positive association between offshoring and employment volatility is consistent with a relative increase in labor demand elasticity in industries that engage in offshoring documented in Senses (2010).
[50] For example, Koren and Tenreyro (2007) find that as countries move up the development ladder, country-specific macroeconomic shocks decline together with a shift in industrial concentration away from the more volatile sectors.
[51] For the full list of countries in each group, please see: http://data.worldbank.org/about/country-classifications.

income categories to be associated with higher volatility, with the contribution to volatility decreasing with the level of income of the country. In all three specifications, the estimated magnitude is the biggest for the share of imports from low income countries, lower for the share of imports from middle income countries and the lowest for imports from high income countries.[52] [53]

Our next set of results relates firm volatility to additional country-specific factors for the trading partner of the firm, such as the level of GDP, output volatility, the distance to the U.S. and the covariance of output with the U.S.[54] Each of these measures is calculated as a weighted average at the firm level with the share of imports or exports from each country as weights. For example, the volatility of the import partner of a particular firm is the average of annual GDP volatility of each country the firm imports from, weighted by the share of imports of this firm from each country over the period which volatility is calculated. Each specification continues to include the aforementioned array of fixed effects and controls for firm and industry characteristics.

The results of this analysis can be found in Table 13. The first column present the 15-year results and the last two columns present the results from the 5-years specifications, with and without firm fixed effects.[55] We find that the further away a firm's export destinations are, the higher is the estimated firm-level volatility. The longer time lag and higher transaction costs of shipping to distant destinations could introduce inventory management problems, and hence, lumpy production and shipments resulting in higher levels of volatility.[56] We also find that, after controlling for other country characteristics, the higher the level of average income of the firm's export partners, the lower is the estimated firm level volatility. The estimated coefficient on the covariance term is positive, while statistically insignificant.[57] For import-partner characteristics, our findings suggest that firms that import from more volatile countries have on average higher firm level volatility. In contrast to the exporter results, distance is negatively associated with firm-level volatility—inputs shipped less frequently and in bulk, appear to allow firms to smooth their production process and to reduce the impact on employment volatility.

6. Conclusion

[52] A t-test of the equivalence of the estimated coefficients for imports from the low and middle income countries and, imports from the high and middle income countries are rejected at the 1 percent level of significance.

[53] This result is broadly consistent with findings in Bernard, Jensen, and Schott (2006) of a negative association between imports sourced from low-wage countries and plant survival, output and employment growth.

[54] The data for the country level volatility, covariance with the U.S. and the level of GDP are sourced from the Penn World Tables at pwt.econ.upenn.edu/php_site/pwt70/pwt70_form.php. The distances to the U.S. are from Andrew Rose's website at http://faculty.haas.berkeley.edu/arose/datagravstataWEO.zip.

[55] As before, the coefficients are less precisely estimated in the fixed effect specifications. This is mainly due to little within-firm variation over time in terms of average characteristics of the trading partner of the firm.

[56] See Alessandria, Kaboski, and Midrigan (2010). Also see McCann (2001), where the optimum size of a shipment increases with the haulage distance.

[57] While insignificant, a positive coefficient is consistent with a higher comovement between the U.S. firm and its trading partners, restricting the ability of the firm to diversify demand shocks using export markets.

In this paper, we focus specifically on within-industry variation in volatility and analyze empirically the direction and magnitude of the association between firm-level exposure to trade, and the volatility of employment growth. Our categorical results indicate that relative to non-trading firms, firms that only export and firms that both export and import are less volatile, whereas firms that import are more volatile. We find the positive relationship between importing and volatility to be driven mainly by firms that switch in and out of importing. These findings continue to hold at the industry level and are robust to various specifications. We also find the variation across trading firms in terms of the duration of time and intensity with which they trade, the number and type of products they trade and in terms of number and characteristics of their trading partners to play an important role in explaining the differential impact of trading on employment volatility experienced by these firms.

Our findings point to considerable heterogeneity in volatility of employment growth among firms with differing degrees of engagement with international trade and with respect to the characteristics of trading partners and products traded. We hope that our empirical findings for the U.S. will serve to guide the emerging theoretical literature in developing a unified theoretical framework considering the links between trade and firm-level volatility and its impact on the aggregate economy.

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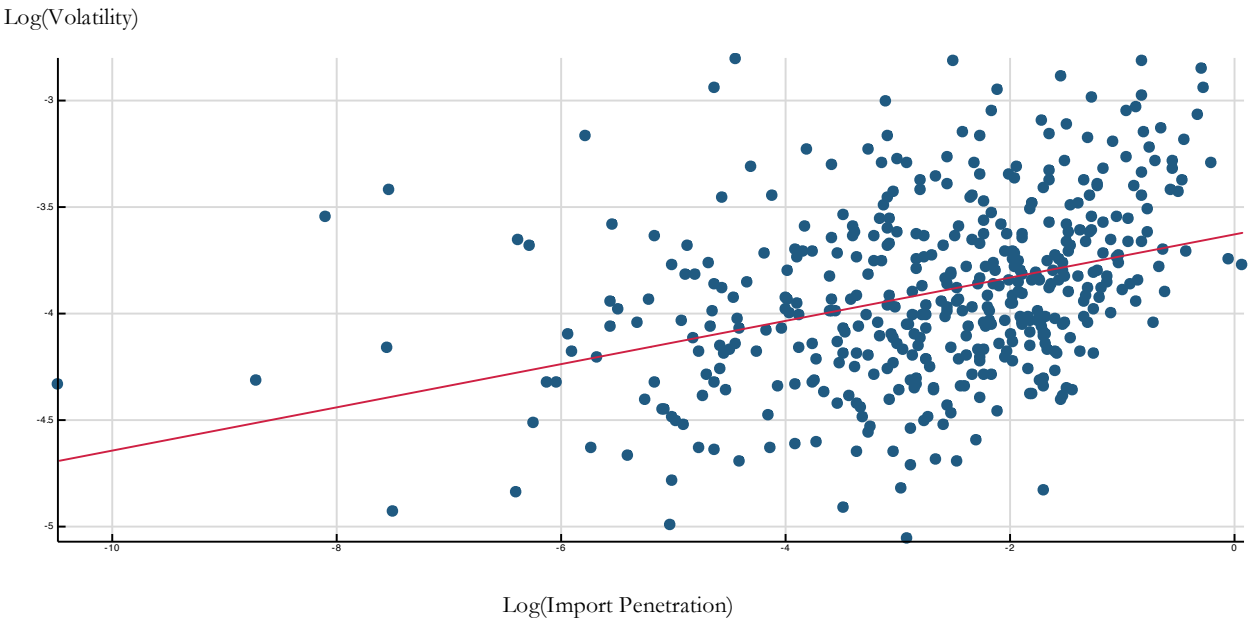
Figure 1 Industry-Level Volatility of Employment Growth Rates and Import Penetration, 1976-2005



Note: Reported values are industry-level volatility of employment growth rates and import penetration, averaged over 1976-2005. The fitted line is: Log(Volatility)=-3.63***+0.102***Log(Import Penetration). Source: Own calculations using the NBER Productivity Database and Schott (2008).

Table 1 Descriptive Statistics by Trader Status

	Full Sample		Non-Trader		Both Exporter & Importer		Only Exporter		Only Importer	
	Mean	Std. Dev	Mean	Std. Dev	Mean	Std. Dev	Mean	Std. Dev	Mean	Std. Dev
Employment	49.61	504.30	9.94	23.48	206.35	1168.80	28.77	63.76	24.52	57.08
Skill Share	0.25	0.18	0.22	0.17	0.33	0.18	0.27	0.16	0.25	0.17
Age	12.27	7.72	10.98	7.34	15.23	7.86	13.63	7.75	11.26	7.62
Multi-Unit Status	0.07	0.25	0.02	0.13	0.24	0.43	0.07	0.25	0.05	0.23
Number of Products	2.77	1.98	2.60	1.80	3.00	2.08	3.09	2.32	2.67	1.94
Number of Countries Exported to	1.15	4.02	0	0	4.91	8.32	1.35	1.09	0	0
Number of Countries Imported from	0.38	1.56	0	0	1.88	3.21	0	0	1.19	0.55
Number of Products Exported	1.77	8.90	0	0	7.76	19.66	1.91	1.75	0	0
Number of Products Imported	1.04	7.33	0	0	5.41	16.46	0	0	1.90	2.43
Percent of Years Exporting	0.20	0.34	0	0	0.71	0.31	0.38	0.30	0	0
Percent of Years Importing	0.10	0.26	0	0	0.52	0.35	0	0	0.30	0.27
Number of Firms	331,874		197,526		60,156		63,608		10,584	

Note: Descriptive statistics are calculated over the 15-year window from 1991-2005. All the statistics, except the number of products the firm produces and the skill share, are calculated from the LBD or the LFTTD. Product count and skill share are from the CMF.

Table 2 Share of Firms by Trade Status

	15-year window	5-year windows		
	1991-2005	1991-1995	1996-2000	2001-2005
Non-Trader	60%	64%	63%	62%
Exporter Only	19%	19%	20%	19%
Importer Only	3%	3%	3%	3%
Both	18%	14%	15%	16%

Source: Merged LFTTD-LBD sample.

Table 3 Transition Probabilities for Firm Trade Status

Panel A: 7-Year Transition Probabilities (between 1991-1998 and 1999-2005)

	1999-2005			
	Non-Trader	Both	Exporter Only	Importer Only
1991-1998				
Non-Trader	82%	2%	14%	2%
Both	2%	80%	15%	2%
Exporter Only	20%	21%	58%	1%
Importer Only	30%	29%	15%	26%

Panel B: Year-to-Year Transition Probabilities

	Non Trader$_{t+1}$	Both$_{t+1}$	Exporter Only$_{t+1}$	Importer Only$_{t+1}$
Non Trader$_t$	94%	5%	1%	0%
Both$_t$	4%	77%	13%	5%
Exporter Only	26%	9%	64%	1%
Importer Only	27%	18%	6%	49%

Note: The transitions probabilities in Panel A are calculated between two 7-year balanced panels (1991-1998 and 1999-2005). The transiiton probabilities in Panel B are calculated annually and are averaged over the full 15-year panel.

Table 4 Descriptive Statistics for Import and Export Intensity Measures

Variable	Mean	Std Dev	Obs
Full Sample			
Exports to Shipments Ratio (Export Intensity)	1.88%	7.8%	331,874
Imports to Cost of Materials Ratio (Import Intensity)	2.71%	12.0%	331,874
Manufacturing Import Intensity	2.60%	11.6%	331,874
Offshoring (Narrow Measure)	1.53%	9.4%	331,874
Other Manufacturing Materials	1.13%	7.6%	331,874
Non-Manufacturing Import Intensity	0.03%	1.2%	331,874
Raw Materials Import Intensity	0.08%	2.0%	331,874
Conditional on Positive Values			
Exports to Shipments Ratio (Export Intensity)	5.05%	12.2%	123,726
Imports to Cost of Materials Ratio (Import Intensity)	11.68%	23.8%	70,709
Manufacturing Import Intensity	11.51%	24.3%	70,709
Offshoring (Narrow Measure)	10.06%	22.3%	50,375
Other Manufacturing Materials	6.80%	17.6%	55,190
Non-Manufacturing Import Intensity	1.61%	8.6%	5,882
Raw Materials Import Intensity	4.53%	14.5%	5,896

Note: The summary statistics are calculated over the 15-year window (1991-2005). The top panel reports summary statistics including zeros and positive values. The bottom panel summarizes only positive values for the variable of interest.

Table 5 Volatility of Employment Growth Rates by Time Period and by Trade Status

15-year window	*1991-2005*		
	Mean	Std Dev	N
Full Sample	0.35	0.25	331,874
Exporter Only	0.32	0.24	63,608
Importer Only	0.38	0.27	10,584
Both	0.31	0.27	60,156
Non-Trader	0.36	0.24	197,526

5-year windows	*1991-1995*			*1996-2000*			*2001-2005*		
	Mean	Std Dev	N	Mean	Std Dev	N	Mean	Std Dev	N
Full Sample	0.30	0.25	180,854	0.28	0.24	203,350	0.29	0.24	190,789
Exporter Only	0.27	0.24	34,600	0.26	0.23	39,659	0.26	0.23	35,942
Importer Only	0.32	0.27	5,155	0.31	0.26	5,682	0.31	0.26	5,976
Both	0.26	0.26	25,998	0.25	0.25	30,836	0.25	0.24	30,107
Non-Trader	0.32	0.25	115,101	0.30	0.24	127,173	0.31	0.24	118,764

Note: Volatility of employment growth rates is calculated using the residual method. The top panel provides the descriptive statistics for the time-invariant measure of volatility calculated over 15-year windows. The bottom panel reports the descriptive statitics seperately for three 5-year windows.

Table 6 Volatility of Employment Growth Rates and Trade Status at the Firm-Level over 15 Years

	(1)	(2)	(3)	(4)
Both	-0.075 **	-0.032 **		-0.065 **
	(0.004)	(0.004)		(0.004)
Exporter Only	-0.042 **	-0.020 **		-0.025 **
	(0.003)	(0.003)		(0.003)
Importer Only	0.036 **	0.066 **		0.051 **
	(0.007)	(0.007)		(0.007)
Import Intensity			0.144 **	0.176 **
			(0.011)	(0.012)
Export Intensity			0.078 **	0.149 **
			(0.018)	(0.019)
Firm Employment	-0.030 **	-0.019 **	-0.026 **	-0.018 **
	(0.002)	(0.002)	(0.001)	(0.002)
Multi-Unit Status	-0.028 **	-0.039 **	-0.049 **	-0.045 **
	(0.006)	(0.006)	(0.006)	(0.006)
Skill Share	0.054 **	-0.269 **	-0.306 **	-0.275 **
	(0.011)	(0.017)	(0.017)	(0.017)
Age	-0.118 **	-0.129 **	-0.127 **	-0.127 **
	(0.002)	(0.002)	(0.002)	(0.002)
Number of Products	-0.116 **	-0.144	-0.141 **	-0.142 **
	(0.003)	(0.003)	(0.003)	(0.003)
Import Penetration		0.017 **	0.016 **	0.016 **
		(0.002)	(0.002)	(0.002)
Export Share		-0.024 **	-0.026 **	-0.024 **
		(0.002)	(0.002)	(0.002)
Industry Size		-0.004 **	-0.002	-0.004 **
		(0.001)	(0.001)	(0.001)
Industry Skill Share		0.061 **	0.052 **	0.056 **
		(0.010)	(0.010)	(0.010)
N	331,874	331,874	331,874	331,874
R^2	0.06	0.04	0.04	0.04

Note: The dependent variable in each specification is firm-level volatility of employment growth rates calculated using the residual method over the 15-year window. ** and * denote significance at the 1 and 5 percent levels, respectively. Robust standard errors are reported in parentheses. Column (1) includes industry fixed effects at 6 digit NAICS level.

Table 7 Volatility of Employment Growth Rates and Trade Status at the Firm-Level- Robustness

	Firm-Level							Establishment-Level		
	Residual Method				Log Differences			Residual Method		
	5-Year Windows			15-Year Balanced	15-Year	5-Year Windows		15-Year	5-Year Windows	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Both	-0.058 **	-0.093 **	-0.022 **	-0.019 **	-0.010 *	0.007	-0.015 *	-0.069 ***	-0.079 ***	-0.030 ***
	(0.004)	(0.004)	(0.006)	(0.006)	(0.004)	(0.004)	(0.007)	(0.004)	(0.007)	(0.006)
Exporter Only	-0.055 **	-0.061 **	-0.010 **	-0.023 **	-0.036 **	-0.043 **	-0.009 *	-0.026 ***	-0.041 ***	-0.013 ***
	(0.003)	(0.003)	(0.004)	(0.005)	(0.003)	(0.003)	(0.004)	(0.003)	(0.004)	(0.004)
Importer Only	0.031 **	0.015 *	0.004	0.023 *	0.023 **	0.021 **	0.012	0.0412 ***	0.0307 ***	0.0001
	(0.006)	(0.006)	(0.008)	(0.010)	(0.006)	(0.006)	(0.009)	(0.007)	(0.007)	(0.008)
Import Intensity		0.144 **	0.038 *	0.180 **	0.148 **	0.131 **	0.036 **	0.0645 ***	0.0952 ***	0.0403 **
		(0.009)	(0.017)	(0.018)	(0.011)	(0.009)	(0.019)	(0.011)	(0.011)	(0.018)
Export Intensity		0.154 **	0.063 **	0.121 **	0.094 **	0.153 **	0.087	0.0215	0.1006 ***	0.0491 **
		(0.013)	(0.021)	(0.027)	(0.016)	(0.012)	(0.023)	(0.018)	(0.016)	(0.022)
N	574,993	574,993	574,993	103,884	321,292	548,411	548,411	352,990	629,008	629,008
R^2	0.09	0.09	0.06	0.17	0.20	0.24	0.20	0.08	0.11	0.07
Firm Fixed Effects	NO	NO	YES	NO	NO	NO	YES	NO	NO	YES
Time Fixed Effects	YES	YES	YES	NO	NO	YES	YES	NO	YES	YES
Industry-Level Controls	YES	YES	YES	NO	NO	YES	YES	NO	YES	YES

Note: ** and * denote significance at the 1 and 5 percent levels, respectively. Robust standard errors are reported in parentheses. Each specification includes industry fixed effects at the 6 digit NAICS level and (unreported) covariates at the firm-level including multi-unit status, size, skill share, age, and the number of products. In addition, the results over 5-year windows include time fixed effects and (unreported) time-varying covariates at the industry-level including size, skill share, import penetration and share of exports.

Table 8 Volatility of Employment Growth Rates and Detailed Trade Status at the Firm-Level

	15-Year	5-Year Windows		15-Year	5-Year Windows	
	(1)	(2)	(3)	(4)	(5)	(6)
Permanent Exporter	-0.406 **	-0.224 **	-0.066 **	-0.336 **	-0.195 **	-0.055 **
	(0.012)	(0.005)	(0.017)	(0.012)	(0.005)	(0.007)
Temporary Exporter				-0.039 **	-0.038 **	-0.009 *
				(0.004)	(0.003)	(0.004)
Permanent Importer	-0.283 **	-0.140 **	-0.088 **	-0.264 **	-0.148 **	-0.072 **
	(0.034)	(0.014)	(0.041)	(0.033)	(0.014)	(0.019)
Temporary Importer				0.022 **	0.028 **	0.007
				(0.007)	(0.006)	(0.008)
Permanent Both	-0.546 **	-0.274 **	-0.151 **	-0.409 **	-0.245 **	-0.146 **
	(0.014)	(0.007)	(0.029)	(0.011)	(0.006)	(0.010)
Temporary Both				-0.110 **	-0.087 **	-0.036 **
				(0.005)	(0.004)	(0.006)
Import Intensity	0.308 **	0.180 **	0.021 **	0.273 **	0.230 **	0.077 **
	(0.024)	(0.012)	(0.029)	(0.013)	(0.009)	(0.017)
Export Intensity	0.321 **	0.296 **	0.144	0.202 **	0.242 **	0.085 **
	(0.039)	(0.018)	(0.040)	(0.019)	(0.013)	(0.021)
N	211,640	419,348	419,348	331,874	574,993	574,993
R^2	0.05	0.08	0.05	0.07	0.09	0.06
Firm Fixed Effects	NO	NO	YES	NO	NO	YES
Time Fixed Effects	NO	YES	YES	NO	YES	YES
Industry-Level Controls	NO	YES	YES	NO	YES	YES

Note: : ** and * denote significance at the 1 and 5 percent levels, respectively. Robust standard errors are reported in parentheses. Each specification includes industry fixed effects at the 6 digit NAICS level and (unreported) covariates at the firm-level including multi-unit status, size, skill share, age, and the number of products. In addition, the results over 5-year windows include time fixed effects and (unreported) time-varying covariates at the industry-level including size, skill share, import penetration and share of exports.

Table 9 Volatility of Growth Rates and Trade Status at the Industry-Level

	Employment		Number of Firms		Real Wages	
	15 Year	5 year	15 Year	5 year	15 Year	5 year
	(1)	(2)	(3)	(4)	(5)	(6)
Both	-0.596 **	-0.669 **	-0.818 **	-0.976 **	-0.304 **	-0.379 **
	(0.051)	(0.045)	(0.029)	(0.036)	(0.039)	(0.039)
Exporter Only	-0.181 **	-0.194 **	-0.296 **	-0.379 **	-0.058 **	-0.105 **
	(0.044)	(0.039)	(0.023)	(0.028)	(0.030)	(0.031)
Importer Only	0.526 **	0.468 **	0.516 **	0.637 **	0.764 **	0.738 **
	(0.047)	(0.044)	(0.031)	(0.034)	(0.040)	(0.036)
N	1514	4433	1496	4233	1517	4439
R^2	0.55	0.3746	0.75	0.606	0.73	0.46
Time Fixed Effects	NO	YES	NO	YES	NO	YES
Industry-Level Controls	NO	YES	NO	YES	NO	YES

Note: : ** and * denote significance at the 1 and 5 percent levels, respectively. Robust standard errors are reported in parentheses. Each specification includes industry fixed effects at the 6 digit NAICS level. In addition, the results over 5-year windows include time fixed effects and (unreported) time-varying covariates at the industry-level including size, skill share, import penetration and share of exports.

Table 10 Volatility of Employment Growth Rates and the Number of Trading Partners and Products Traded

	15-Year	5-Year Windows	
	(1)	(2)	(3)
Import Intensity	0.091 **	0.091 **	0.049 **
	(0.015)	(0.011)	(0.018)
Export Intensity	0.264 **	0.273 **	0.090 **
	(0.021)	(0.014)	(0.023)
Percent Years Imported	-0.047 **	-0.033 **	-0.046 **
	(0.009)	(0.006)	(0.010)
Percent Years Exported	-0.209 **	-0.150 **	-0.065 **
	(0.007)	(0.005)	(0.009)
Number of Countries			
Exported To	-0.009 **	-0.008 **	-0.007 **
	(0.001)	(0.000)	(0.001)
Imported From	0.023 **	0.018 **	0.005
	(0.002)	(0.001)	(0.003)
Number of Products			
Exported	0.002 **	0.002 **	0.001 **
	(0.000)	(0.000)	(0.000)
Imported	-0.001	-0.001 **	0.000
	(0.000)	(0.000)	(0.000)
Employment	-0.075 **	-0.102 **	-0.197 **
	(0.002)	0.002	0.007
Total Number of Products	-0.113 **	-0.063 **	-0.010 **
	(0.004)	(0.002)	(0.004)
N	134,348	213,955	213,955
R^2	0.13	0.14	0.10
Firm Fixed Effects	NO	NO	YES
Industry-Level Controls	NO	YES	YES
Time Fixed Effects	NO	YES	YES

Note: : ** and * denote significance at the 1 and 5 percent levels, respectively. Robust standard errors are reported in parentheses. Each specification includes industry fixed effects at the 6 digit NAICS level and (unreported) covariates at the firm-level including multi-unit status, size, skill share, age, the number of products and the fraction of time importing and exporting. In addition, the results over 5-year windows include time fixed effects and (unreported) time-varying covariates at the industry-level including size, skill share, import penetration and share of exports.

Table 11 Volatility of Employment Growth Rates and Decomposition of Firm-Level Imports

	15-Year		5 years		
	(1)	(2)	(3)	(4)	(5)
Export Intensity	0.239 **	0.241 **	0.225 **	0.226 **	0.056 *
	(0.022)	(0.022)	(0.015)	(0.015)	(0.025)
Import Intensity					
Manufactured Inputs	0.234 **		0.160 **		
	(0.020)		(0.013)		
Offshoring (Narrow Measure)		0.182 **		0.127 **	-0.001
		(0.024)		(0.017)	(0.034)
Other Manufacturing Inputs		0.315 **		0.207 **	0.006
		(0.031)		(0.020)	(0.039)
Raw Materials	0.227	0.228	0.099	0.099	0.244
	(0.119)	(0.119)	(0.075)	(0.075)	(0.138)
Non-Manufacturing Inputs	0.360	0.366 *	0.260	0.262	-0.172
	(0.169)	(0.169)	(0.137)	(0.137)	(0.233)
N	131,422	131,422	205,774	205,774	205,774
R^2	0.13	0.13	0.14	0.14	0.10
Firm Fixed Effects	NO	NO	NO	NO	YES
Industry-Level Controls	NO	NO	YES	YES	YES
Time Fixed Effects	NO	NO	YES	YES	YES

Note: : ** and * denote significance at the 1 and 5 percent levels, respectively. Robust standard errors are reported in parentheses. Each specification includes industry fixed effects at the 6 digit NAICS level and (unreported) covariates at the firm-level including multi-unit status, size, skill share, age, the number of products and the fraction of time importing and exporting. In addition, the results over 5-year windows include time fixed effects and (unreported) time-varying covariates at the industry-level including size, skill share, import penetration and share of exports.

Table 12 Volatility of Employment Growth Rates and Income Levels of Trading Partners

	15-Years	5 years	
	(1)	(2)	(3)
Export Intensity			
Low Income Countries	-0.282	0.108	-0.280
	(0.494)	(0.408)	(0.569)
Middle Income Countries	0.269 **	0.341 **	0.055
	(0.081)	(0.049)	(0.063)
High Income Countries	0.220 **	0.200 **	0.051
	(0.026)	(0.018)	(0.030)
Import Intensity			
Low Income Countries	0.710 **	0.474 **	0.320
	(0.225)	(0.176)	(0.262)
Middle Income Countries	0.216 **	0.226 **	0.096 **
	(0.029)	(0.021)	(0.035)
High Income Countries	0.125 **	0.097 **	0.027
	(0.023)	(0.015)	(0.028)
N	131,779	209,164	209,164
R^2	0.13	0.14	0.10
Time Fixed Effects	NO	YES	YES
Industry-Level Controls	NO	YES	YES
Firm Fixed Effects	NO	NO	YES

Note: : ** and * denote significance at the 1 and 5 percent levels, respectively. Robust standard errors are reported in parentheses. Each specification includes industry fixed effects at the 6 digit NAICS level and (unreported) covariates at the firm-level including multi-unit status, size, skill share, age, the number of products, the fraction of time importing and exporting, and import share of raw materials. In addition, the results over 5-year windows include time fixed effects and (unreported) time-varying covariates at the industry-level including size, skill share, import penetration and share of exports.

Table 13 Firm-Level Volatility and Characteristics of Trading Partners

	15 Years	5 years	
	(1)	(2)	(3)
Export Intensity	0.218 **	0.217 **	0.057
	(0.023)	(0.017)	(0.030)
Import Intensity	0.197 **	0.174 **	0.073 **
	(0.015)	(0.011)	(0.021)
Export Partner			
Volatility	-0.023 *	0.000	0.011
	(0.009)	(0.006)	(0.008)
Distance from the U.S.	0.030 **	0.014 **	-0.011
	(0.007)	(0.005)	(0.010)
Covariance with the U.S.	44.532	22.484	31.738
	(48.352)	(24.079)	(29.460)
GDP	-0.026 **	-0.035 **	-0.008
	(0.009)	(0.007)	(0.012)
Import Partner			
Volatility	0.070 **	0.018 **	0.001
	(0.008)	(0.004)	(0.006)
Distance from the U.S.	-0.036 **	-0.033 **	-0.018
	(0.007)	(0.006)	(0.010)
Covariance with the U.S.	-66.347	-34.902	-16.174
	(41.399)	(18.540)	(23.375)
GDP	0.020 **	-0.024 **	0.000
	(0.006)	(0.004)	(0.007)
N	59,436	86,027	86,027
R^2	0.15	0.15	0.08
Time Fixed Effects	NO	YES	YES
Industry-Level Controls	NO	YES	YES
Firm Fixed Effects	NO	NO	YES

Note: : ** and * denote significance at the 1 and 5 percent levels, respectively. Robust standard errors are reported in parentheses. Each specification includes industry fixed effects at the 6 digit NAICS level and (unreported) covariates at the firm-level including multi-unit status, size, skill share, age, the number of products, the fraction of time importing and exporting, and import share of raw materials. In addition, the results over 5-year windows include time fixed effects and (unreported) time-varying covariates at the industry-level including size, skill share, import penetration and share of exports.