



# Microeconomic uncertainty, international trade, and aggregate fluctuations



George Alessandria<sup>a,\*</sup>, Horag Choi<sup>b</sup>, Joseph P. Kaboski<sup>c</sup>, Virgiliu Midrigan<sup>d</sup>

<sup>a</sup> Department of Economics, University Rochester, 204 Harkness Hall Rochester, and NBER, NY 14627, USA

<sup>b</sup> Monash University, Australia

<sup>c</sup> University of Notre Dame, NBER, USA

<sup>d</sup> New York University, NBER, USA

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## ABSTRACT

The extent and direction of causation between micro volatility and business cycles are debated. We examine, empirically and theoretically, the source and effects of fluctuations in the dispersion of producer-level sales and production over the business cycle. On the theoretical side, we study the effect of exogenous first- and second-moment shocks to producer-level productivity in a two-country DSGE model with heterogeneous producers and an endogenous dynamic export participation decision. First-moment shocks cause endogenous fluctuations in producer-level dispersion by reallocating production internationally, while second-moment shocks lead to increases in trade relative to GDP in recessions. Empirically, using detailed product-level data in the motor vehicle industry and industry-level data of U.S. manufacturers, we find evidence that international reallocation is indeed important for understanding cross-industry variation in cyclical patterns of measured dispersion.

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## 1. Introduction

A growing literature attributes an important fraction of cyclical fluctuations in output to changes in the distribution of idiosyncratic shocks affecting heterogeneous producers. This literature shows in a range of closed economy models that more volatile producer-specific shocks can generate a downturn in economic activity. A primary example is the Great Recession, during which there was a substantial increase in dispersion of growth rates across establishments. Still, understanding the extent to which volatility leads to recessions, or recessions lead to volatility, remains an important task.<sup>1</sup> In this paper, we revisit the relationship between idiosyncratic volatility and business cycles empirically and theoretically. We do so in the context of an open economy model with non-convex trade participation decisions across heterogeneous producers. Trade models and data constitute a natural laboratory for examining the role of uncertainty, since the selection

\* Corresponding author at: Department of Economics, University Rochester, 204 Harkness Hall Rochester, NY 14627, USA. Tel.: +1 585 275 5252; fax: +1 585 256 2309.

E-mail address: [George.Alessandria@Rochester.edu](mailto:George.Alessandria@Rochester.edu) (G. Alessandria).

<sup>1</sup> Bloom (2009) and Bloom et al. (2012) argue that volatility leads to recessions. In Bachmann and Moscarini (2012), recessions lead to experimentation and thus to micro volatility. Bloom (2014) gives an excellent review of the literature. The work by Decker et al. (2014) is perhaps the most relevant to ours. They model endogenous countercyclical volatility through firm's choice of the number of markets in which to sell. Their empirical measures of markets are industries and the number and locations of establishments, however.

into exporting is well understood. Moreover, firms rely to different extents on international trade, so swings in international trade affect firms differentially. Additionally, international business cycles are not perfectly synchronized, so net exports fluctuate in response to country-specific shocks.

On the theoretical side, our analysis focuses on the effects of both first- and second- moment shocks in a variation of the two-country real business cycle model of [Backus et al. \(1994\)](#) extended to include producer heterogeneity and realistic entry and exit from the export market as in [Alessandria and Choi \(2007\)](#).<sup>2</sup> This model captures the well-known features that (1) not all producers export, (2) those that do are relatively large, and (3) exporting is quite persistent. We first consider the effect of first-moment shocks to the level of productivity on aggregate output and measured producer-level dispersion. Here we find that a home productivity shock (e.g., a recession in the U.S.) will generate an increase in the dispersion in sales growth across heterogeneous producers through two channels. First, there is a direct cost channel. The country-specific shock affects the relative costs of imported and domestic goods, leading to a reallocation of purchases between the two and thus an increase in the dispersion of consumer purchases. Second, there is a market participation channel as domestic producers differ in their export participation. A country-specific shock affects non-exporters differently from exporters, leading to a reallocation of production across these heterogeneous producers. Clearly, these channels depend critically on openness. We show that the model can generate potentially quantitatively important fluctuations in dispersion.

We use the open economy model to consider the effect of exogenous second-moment<sup>3</sup> shocks to producer-level productivity, as studied by [Bloom et al. \(2012\)](#) and [Arellano et al. \(2012\)](#) in a closed economy. Contrary to this closed economy literature, we find that a shock increasing producer-level dispersion increases exports. Though the increase in exports is small, it is two orders of magnitude larger than the impact on output itself, as higher dispersion allows exporting firms to export more. Thus, the ratio of trade to GDP rises. Given that trade fell substantially more than output during the Great Recession, this constitutes a puzzle for the model.

We next evaluate the importance of first-moment shocks on measured producer-level dispersion by examining the role of reallocation from international trade in explaining the increase in dispersion measured by [Bloom et al. \(2012\)](#). We focus narrowly on the cross-sectional measures of sales and expenditure growth rather than on other measures, such as the volatility of stock earnings (e.g., [Herskovic et al., 2014](#); [Bloom et al., 2012](#)), which our model is less suited to address.<sup>4</sup>

At the aggregate level, we find that international reallocation is as strongly related to fluctuations in uncertainty as GDP growth is. Across a wide range of industries, international reallocation is an important source of fluctuations in industry-level dispersion over time. Industries with the largest increase in dispersion are more open both in the narrow period 2007–2009 and in periods of international reallocation more broadly.

Finally, we look within a particular industry, using automobiles as a case study. The automobile industry is an important industry that had a large and persistent decline in economic activity during the Great Recession. It is also extremely well measured, allowing us to look at product-level variation as well as at variation for firms both within and outside of the U.S. We find that an important share of the increased dispersion in sales and production from 2008 to 2011 can be attributed to reallocation between the Big 3 firms and Japanese firms. This reallocation is driven by identifiable shocks: a spike in oil prices that has a relatively stronger impact on the Big 3, the pre-bankruptcy crisis and post-bankruptcy recovery of the Big 3, and the Japanese tsunami which lowered Japanese sales. Indeed, we find that the Japanese tsunami, a clear country-specific supply shock, generates a rise in dispersion of sales and production growth that is nearly as large and persistent as the rise observed during the Great Recession.

The next section develops and calibrates the two-country model of heterogeneous producers with an endogenous export decision. In [Section 3](#), we study how the model economy responds to first- and second-moment shocks. [Section 4](#) presents evidence on the relationship between industry volatility and trade reallocation both across industries and within automobiles, our case study. [Section 5](#) concludes.

## 2. Model

We describe and calibrate a modified version of the model of [Alessandria and Choi \(2007\)](#), augmented to allow for idiosyncratic volatility with country specific time-varying dispersion. Specifically, there are two symmetric countries, home ( $H$ ) and foreign ( $F$ ), each with a unit mass of heterogeneous producers producing differentiated intermediate goods. Intermediate goods producers differ exogenously by the variety they produce and their productivity, and endogenously by their capital and exporter status. Exporting requires both an up-front cost to start exporting and a fixed continuation cost to stay in the market in subsequent periods. In each country, competitive firms produce final goods with a CES technology that

<sup>2</sup> The Alessandria–Choi model is a general equilibrium variation of the partial equilibrium model of firm export participation in the presence of idiosyncratic and aggregate uncertainty and a sunk export cost developed in a series of papers by Baldwin, Krugman, and Dixit to explain the non-linear relationship between the real exchange rate and net exports in the 1980s. Variations of this model have been shown to capture the cross-section and dynamics of export participation of producers in many countries (see [Das et al. \(2007\)](#) and [Alessandria and Choi \(2014a\)](#)) as well as the dynamics of trade growth ([Alessandria and Choi \(2014b\)](#)).

<sup>3</sup> [Novy and Taylor \(2014\)](#) examine the role of shocks to aggregate uncertainty on trade flows in an  $sS$  inventory model with higher fixed costs of sourcing abroad than at home as in [Alessandria et al. \(2010\)](#). [Bekes et al. \(2014\)](#) study how changes in idiosyncratic demand uncertainty affect the size and frequency of trade flows. [Carballo et al. \(2014\)](#) consider the effect of uncertainty about trade policy on trade in the great trade collapse.

<sup>4</sup> [Fillat and Garetto \(2012\)](#) do show that excess stock returns are related to export and multinational production participation and that these differences in returns can be rationalized in a model of with sunk costs of export participation and multinational production.

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