



Exchange rate volatility and fluctuations in the extensive margin of trade



Kanda Naknoi

Department of Economics, University of Connecticut, 365 Fairfield Way, Unit 1063, Storrs, CT 06269-1063, United States

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ABSTRACT

The existing evidence for exporters' entry and exit in response to exchange rate movements is based on either low frequency data or a sample with large devaluations. Using quarterly data of U.S. bilateral trade with 99 countries, this study provides new evidence that the extensive margin of trade fluctuates over the business cycle. First, I show that the extensive margin of exports to the U.S. and the extensive margin of imports from the U.S. are more volatile than the output of almost all trading partners. Next, I find that fixing exchange rates with the U.S. dollar, having a free trade agreement with the U.S., and an increase in country size is significantly associated with the stability of the pattern of trade with the U.S.

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1. Introduction

Recent studies have examined the role of exchange rate movements in the dynamic behaviors of the extensive margin of trade. [Bergin and Lin \(2012\)](#) provide evidence that an anticipation of a reduction of exchange rate volatility leads to an increase in the extensive margin of exports. [Bernard et al. \(2009\)](#) find that most of the year-to-year changes in U.S. trade including its adjustments to shocks following the 1997 Asian financial crisis occur along the intensive margin. However, [Alessandria et al. \(2010\)](#) use monthly trade data and document a large decline in the number of products being imported to selected Asian and Latin American currencies after large devaluations. In addition, [Alessandria et al. \(2014\)](#) demonstrate that the extensive margin of exports from selected developing countries to the U.S. increases after large devaluations.

This study contributes to the literature by providing new evidence that the extensive margin of trade fluctuates over the business cycle, and more so under a fixed exchange rate regime. First, I construct the extensive margin of exports and imports and their corresponding intensive margin from quarterly U.S. bilateral trade data, using the methodology in [Hummels and Klenow \(2005\)](#). Next, I filter the natural logarithm of the extensive margin of exports and imports and the intensive margin of exports and imports using the band-pass filter, the Hodrick–Prescott filter and the first-difference filter, and obtain their business cycle properties. Finally, I estimate the impact of exchange rate regimes on the variability of the extensive margin of exports and the extensive margin of imports, taking into account country-specific characteristics as

E-mail address: kanda.naknoi@uconn.edu

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suggested by the empirical literature on trade and growth, such as [Anderson and van Wincoop \(2004\)](#) and [Frankel and Rose \(1998, 2002\)](#).

To be precise, my measures of the extensive margin of exports and imports and the intensive margin of exports and imports are as follows. First, the extensive margin of exports is the weighted count of categories in which a country exports to the U.S., where the weight is the share of the rest of the world in those categories in which the world exports to the U.S. Second, the intensive margin of exports is the value of exports to the U.S. from the same country relative to exports from the rest of the world in those categories in which this country exports. Third, the extensive margin of imports is the weighted count of categories in which a country imports from the U.S., where the weight is the share of the rest of the world in those categories in which the world imports from the U.S. Finally, the intensive margin of imports is the value of imports from the U.S. to the same country relative to imports from the rest of the world in those categories in which this country imports.

I employ quarterly data of the U.S. trade flows of more than 10,000 10-digit Harmonized System (HS) categories with 99 trading partners from the second quarter in 1990 to the last quarter in 2009. Since changes in product classification occur many times in my sample period, I exclude the obsolete categories and the new categories from the entire sample period. The new and obsolete categories are identified using the methodology in [Pierce and Schott \(2012\)](#). In addition to the HS-10 categories, I aggregate categories into HS-8 and HS-6 categories to examine the robustness of the results.

There are five main findings. First, the extensive margin of exports and imports fluctuates over the business cycle. To be precise, the extensive margin of exports is much more volatile than the output of the exporting country, and the extensive margin of imports is more volatile than the output of the importing country. This finding is robust to the division of sample countries into high-income countries and low-income countries. Moreover, for the median country, the volatility of the extensive margin of exports is over half of the volatility of the intensive margin of exports, and the volatility of the extensive margin of imports is about one-third of the volatility of the intensive margin of imports.

Second, the extensive margin of imports is pro-cyclical for 90% of sample countries, but the cyclicity of the extensive margin of exports widely varies across countries. The number of countries with a pro-cyclical extensive margin of exports is almost equal to that of countries with a counter-cyclical extensive margin of exports; therefore, the extensive margin of exports of the median country appears uncorrelated with the output of the exporting country. The correlation of the extensive margin of exports or imports with the U.S. output has a similar pattern to its correlation with the output of the exporting country or the importing country, respectively.

Third, the extensive margin of exports is negatively correlated with the intensive margin of exports for 90% of sample countries. However, the number of countries of which the extensive margin of imports is negatively correlated with the intensive margin of imports is close to the number of countries of which the extensive margin of imports is positively correlated with the intensive margin of imports. As a result, the extensive margin of imports of the median country is almost uncorrelated with its intensive margin of imports.

Fourth, the exchange rate regime, which is classified by the standard deviation of absolute quarterly depreciation rate, has a significant impact on the variability of the extensive margin of trade. A fixed exchange arrangement is significantly associated with a more stable pattern of trade than a flexible exchange rate regime. The estimation takes into account the characteristics of the exporting country or the importing country as in [Frankel and Rose \(1998, 2002\)](#) and the exchange rate classification systems in [Calvo and Reinhart \(2002\)](#) and [Shambaugh \(2004\)](#).

Finally, I find that country size, as measured by population, and a free trade agreement with the U.S. are significantly and negatively correlated with the variability of the extensive margin of exports and imports. In other words, a large country is found to have a more stable pattern of trade with the U.S. than a small country. In addition, a country with a free trade agreement with the U.S. is found to have a more stable pattern of trade with the U.S. than does a country without one. Given the well-known fact that a large country has a low degree of trade openness, and a free trade agreement promotes trade integration ([Anderson and van Wincoop, 2004](#)), this finding implies that the relationship between trade openness and the stability of exporting pattern is ambiguous.

All five findings are robust to the filtering technique and the level of aggregation of product categories. At first glance, my empirical findings appear at odds with those in [Kehoe and Ruhl \(2013\)](#), who find little change in trade in the least-traded products between the U.S. and the trading partners that experienced neither trade liberalization nor a structural transformation. However, it is important to note that they employ low-frequency data. Specifically, their measure of changes in the extensive margin is the 10-year change in the share of trade in the least-traded products, whereas mine is the change in the product count weighted by trade share, and the change takes place over the business cycle.

My study contributes both to international trade and international macroeconomics literature as follows. First, the documented business cycle properties provide useful guidance for theoretical work on the dynamics of trade. Recently, [Naknoi \(2008\)](#) and [Rodriguez-Lopez \(2011\)](#) have demonstrated that the impact of nominal exchange rate fluctuations on the extensive margin of trade helps us understand the dynamics of real exchange rates. Still, monetary shocks in these models cannot replicate the negative correlation between the extensive margin and the intensive margin of exports as documented in this study. Total factor productivity shocks in the model by [Ghironi and Melitz \(2005\)](#) cannot replicate the negative correlation either, because such shocks yield pro-cyclicality of the extensive margin and the intensive margin of exports. Theoretically, shocks on costs of entering into exporting can yield the negative correlation. However, whether entry costs empirically change over the business cycle is an open question.

Second, my findings imply that the costs of entering the export market may not be so large in some industries. This result supplements the evidence for exporters' entry and exit in the trade literature, which has traditionally employed annual

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