EXCHANGE RATE FLUCTUATIONS, CURRENCY INVOICING, AND INTERNATIONAL TRADE

by

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DISSERTATION ABSTRACT

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Title: Exchange Rate Fluctuations, Currency Invoicing, and International Trade

Economic intuition suggests that real currency depreciation should lead to long run improvement in a country's trade balance. The short run implications of real depreciation are relatively unknown. The current literature suggests that the short run relationship between trade and real exchange rates is country-specific. This literature has not explored if product and trading partner characteristics play a role in this relationship. This dissertation explores how heterogeneity in trade influences the responsiveness of trade to real exchange rate fluctuations. To my knowledge, this is the first set of papers exploring this heterogeneity.

The first paper of this dissertation explores heterogeneity with U.S. commodity-level trade data. Trade responsiveness to real fluctuations varies across product and trading partner characteristics. I find no evidence of long run gains in trade following real depreciation, suggesting that currency manipulation policies meant to improve a country's trade balance may have no effect on trade in the long run.

Prices in international trade contracts with U.S. firms are largely invoiced in U.S. dollars. However, the current literature suggests that the currency in which these prices are set should affect the relationship between trade and real exchange rates in the short run. The second paper of this dissertation explores the implications of currency invoicing patterns using Japanese commodity-level trade data. I find that the response of trade to real fluctuations may differ in the short and long run across product and trading partner characteristics. I also find that the response of trade in the long run may be correlated with comparative advantage.

The third paper of this dissertation explores the implications of foreign exchange market liberalization in Japan following the Asian Financial Crisis. I find that liberalization, coupled with

financial market reforms, resulted in trade being less responsive to real fluctuations. I also find no evidence of long run trade balance improvement before or after liberalization and that the reform may have eliminated temporary short run gains, suggesting that currency manipulation policies may have no effect on short or long run trade.

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CHAPTER I

INTRODUCTION

The differential short run and long run responses of trade flows to real exchange rate fluctuations are mentioned in many commonly used international economics textbooks. A trend that quickly emerges in these texts is the lack of empirical evidence concerning the short run response of trade to real exchange rate fluctuations. For instance, Krugman, Obstfeld, and Melitz (2015) note that empirical evidence suggests an initial deterioration in the trade balance lasting six to twelve months following currency depreciation (479). Husted and Melvin (2013) cautions that the available evidence from actual depreciations suggests that "the effects of devaluation differ across countries and time, so that no strong generalizations are possible" (315) and Feenstra and Taylor (2015) notes that "the assumption that a depreciation boosts spending on home country's goods may not hold in the very short run" (522).

Economic intuition suggests that currency depreciation should improve a country's trade balance. As a country's currency depreciates, foreign goods become more expensive to consumers resulting in a decrease in imports. At the same time, exports increase because the country's goods have become cheaper relative to foreign goods to foreign consumers. The combined effects of rising exports and falling imports results in an improvement in the depreciating country's trade balance. Empirical evidence suggests that this intuition holds in the long run. In the long run, firms can adjust their buying and selling behavior, given the new relative value of domestic currency, such that the trade balance improves and settles at a new, higher equilibrium level. However, in the short run, the trade balance may deteriorate following depreciation because traded good prices and quantities are fixed in international contracts that do not immediately adjust to exchange rate fluctuations.

If differential short run and long run trade responses exist, then a short run negative or null response of trade to real depreciation may affect policy makers' implementation of beneficial long run policies that have either no effect or a negative effect in the short run. Null or negative effects coinciding with election cycles may increase the likelihood of a principal-agent problem where policy makers do not implement beneficial long run exchange rate policies in order to further their political careers. In addition, currency manipulation is a common tool employed by policy makers even though the immediate effects of these policies on trade are relatively unknown. Recent events involving currency manipulation to influence the level of international trade include (1) yen devaluation in December 2012[1]; (2) Switzerland's cap on the Swiss franc-euro exchange rate and its removal in February 2015; and (3) the Russian central bank's attempts to stabilize the value of the Russian ruble by selling foreign currency reserves[2]

One reason for the lack of consensus in the literature may be that the response of trade to real depreciation is heterogeneous across countries and products due to comparative advantage. That is, depending on the areas of comparative advantage and disadvantage, international trade flows may be more or less sensitive to exchange rate fluctuations. For example, if Japan has the comparative disadvantage in a good, then the elasticity of import demand for that good is likely inelastic. When real exchange rate fluctuations occur, firms importing these products are may be unable to change their behavior resulting in greater potential for differential short run and long run trade responses. In contrast, goods in which Japan has a comparative advantage are likely to have more elastic import demand meaning that firms are more likely to adjust their buying and selling behavior to quickly achieve the predicted long run equilibrium outcome. Comparative advantage may vary by country, product, and country-by-product characteristics, which suggests that the dynamics of trade flows to exchange rate shocks are likely country, product, and/or country-product specific.

The second chapter of this dissertation examines the relationship between trade and real exchange rate fluctuations accounting for heterogeneous trade responses using U.S. trade data. I find that the predicted positive long run relationship between real exchange rate depreciations and U.S. trade does not exist and that that its non-existence is not the result of the persistent U.S. trade deficit. The results suggest that U.S. dollar depreciation has not effect on trade in the long run. I also find that homogeneous good export and import responses to real depreciation are much more volatile than the response of differentiated good exports and imports which may be due to the substitutability of consumption across homogeneous goods.

In addition to heterogeneous trade responses along the lines of comparative advantage, an additional layer of heterogeneity exists at the contract level that may drive differential short run

[1] "Once more with feeling ; Japan and Abenomics." The Economist, 18 May 2013: 24(US). Academic OneFile. Web. 23 June 2014

[2] G.S. and C.W. "What's really there?" The Economist, 12 Dec 2014. Web. 2 Mar 2015.

and long run trade responses to real exchange rate fluctucations. The current literature suggests that these differential responses are driven by the use of foreign currencies to denote prices in international contracts, referred to as 'invoicing currency'. Firms that agree to pay or receive payment for goods in a currency other than their own currency expose themselves to exchange rate risk, the risk that the value of the goods changes due to exchange rate fluctuations. An exchange rate fluctuation should result in these trade flows responding more and more quickly than trade transactions using domestic currency. As suggested by the current currency invoicing literature, the currency used in an international transaction is determined by the bargaining power of firms which depends on firm size, shipment size, the final destination of the goods, the enforceability of contracts, etc.

Heterogeneous trade responses due to currency invoicing practices cannot be explored using U.S. trade data because nearly all trade transactions with U.S. firms are invoiced in U.S. dollars (Gopinath and Rigobon (2008)). To address this, my third chapter examines the relationship between real exchange rate fluctuations and Japanese trade. Japanese firms use both yen and foreign currencies to denote international trade contracts and there exists a literature on the trading partner and product characteristics that are correlated with the use of particular currencies in contracts. I find evidence of differential responses in short run and long run trade responses to real depreciation at the intersection of product and trading partner characteristics. In addition, I find that the response of trade in the long run may be correlated with comparative advantage.

The fourth chapter explores the implications of the "Big Bang" reform in Japan following the Asian Financial Crisis in 1997. One specific aspect of the reform concerned the Foreign Exchange and Foreign Trade Control Law (FEFTCL), which prior to April 1998, restricted access to foreign exchange markets to designated foreign exchange banks. Prior to reform, firms wishing to conduct foreign exchange operations in Japan had to purchase foreign currency through specific foreign exchange banks. These regulations resulted in large transactions costs for firms and individuals wishing to participate in these markets. The FEFTCL revisions, coupled with broad financial reform, have potentially large consequences for both the short run and long run responsiveness of Japanese trade to real exchange rate fluctuations. After the reforms, all financial institutions were granted access foreign currency markets which lowered transaction costs for firms and individuals seeking foreign currency. Additionally, firms and individuals were granted easier access to use futures markets to hedge against exchange rate risk.

Identifying the consequences of FEFTCL reform on trade is valuable for both policy makers attempting to spur growth in trade and for internationally trading firms maximizing profits. Firms that are able to hedge against exchange rate risk are likely to participate more or continue to participate in international goods and services markets. In addition, firms who are not trading internationally may enter international markets when given the ability to hedge exchange rate risk. I find that the FEFTCL revisions resulted in Japanese trade responding less to real exchange rate fluctuations which is likely due to the new ability of firms to quickly respond to real fluctuations through participation in foreign exchange and futures markets. These findings are consistent across good and trading partner characteristics.

CHAPTER II

DISAGGREGATING TRADE BALANCES: ANALYSIS OF THE RESPONSIVENESS OF THE U.S. TRADE BALANCE TO REAL U.S. DOLLAR EXCHANGE RATE FLUCTUATIONS

Introduction

Economists have been studying the relationship between exchange rates and trade since the early 1900s; however, relatively little is known about this empirical relationship. Economic theory suggests that, in the long run, currency depreciation should result in a country's exports rising and imports falling because their goods have become relatively cheaper to consume than foreign goods. Overall, the country's trade balance should improve. There exists some empirical evidence that supports this idea. However, when considering the implications of currency depreciation in the short run, there is little consensus over what should happen to trade both theoretically and empirically.

Some theoretical literature attributes the short run response of trade to real depreciation to the currency used to set prices in international contracts, or invoicing currency. One such theory, popularized by Magee (1973), is the J-curve hypothesis which states that real exchange rate depreciation causes a country's trade balance to deteriorate in the short run and improve in the long run. The short run deterioration should only occur if foreign currency invoicing is used to denote both export and import contracts or to denote import contracts. Otherwise, there should be no short run deterioration. Table 1 (see the Appendix for all tables and figures) summarizes the effects particular invoicing patterns should have on a country's trade flows.

In Table 1, differential short run and long run trade balance responses to real depreciation only occur in the presence of foreign currency invoicing, a firm-specific characteristics. The current literature explores differential short run and long run trade responses using country-level trade data, thus ignoring the currency used to invoice contracts. This aggregation likely creates biased estimates where the short run responsiveness of foreign currency denoted trade flows is averaged with the short run non-responsiveness of the domestic currency denoted trade flows. These studies still find mixed results concerning the short run response of country-level trade. While some of these results may be explained by the currency used to invoice contracts, they may also be driven by the characteristics of trade. For instance, firms trading homogeneous goods likely respond to real depreciation differently than firms trading in heterogeneous goods due to the availability of substitutes and market structure.

If there exist heterogeneous short run trade responses to real depreciation, then government policies that affect the value of a currency may have adverse effects in some industries and not others in the short run. Negatively affected industries may have enough social capital to persuade policy makers to not implement beneficial policies that generate temporary adverse outcomes. Knowledge of the relationship between trade and real exchange rates can alleviate this problem, especially if the adverse outcomes generated by exchange rate fluctuations are shown to occur over a short period of time.

In addition, despite not knowing the full implications of currency manipulation, it is a common tool employed by policy makers to influence the level of international trade. Current examples of this behavior include (1) yen devaluation in December 2012[1]; (2) Switzerland's cap on the Swiss franc-euro exchange rate that was removed in February 2015; and (3) the Russian central bank's attempts to stabilize the value of the Russian ruble by selling foreign currency reserves[2].

In contrast to the current literature, this chapter empirically explores the effects of real depreciation on commodity-level trade. Using disaggregated data enables me to explore heterogeneous trade responses across characteristics of trade that are unobservable in country-level trade. To my knowledge, this is the first paper to explore the responsiveness of trade to real depreciation using data disaggregated.

One issue when estimating the responsiveness of trade to real exchange rate fluctuations is that trade responses should be directly linked to the currency denomination of international contracts. Internationally trading firms write contracts that specify the quantity of goods being exchanged, the price at which these goods are exchanged, and a timeline over which these goods are to be exchanged[3]. In order to specify a price of the good, trading firms must agree upon a currency to be used for payment. International trade in goods and services occurs over time rather than immediately which means that profit maximizing firms must consider the effect of changes

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[1] "Once more with feeling ; Japan and Abenomics." The Economist, 18 May 2013: 24(US). Academic OneFile. Web. 23 June 2014

[2] G.S. and C.W. "What's really there?" The Economist, 12 Dec 2014. Web. 2 Mar 2015.

[3] There is a growing literature on how firms select trading partners and the costs associated with their search: Békés and Muraközy (2012), Roberts and Tybout (1997), Rauch and Watson (2003), Eaton et al. (2008).

in the relative value of currencies because it has implications for the profitability of international transactions. The extent of these implications depends on a firm's ability to hedge exchange rate risk. U.S. firms minimize exchange rate risk by contracting in U.S. dollars. Gopinath and Rigobon (2008) find that 90% of U.S. imports and 97% of U.S. exports are invoiced in U.S. dollars. By invoicing in U.S. dollars, the value of U.S. firm transactions is unchanged when real dollar fluctuations occur because U.S. firms never use dollar exchange rates to complete international transactions. The incidence of U.S. dollar invoicing in U.S. international trade minimizes the need to control for firm invoicing behavior when identifying the relationship between U.S. trade and real exchange rate fluctuations. That is, the responsiveness of U.S. trade to real depreciation should not be due to the currency denomination of contracts.

The current literature employs time series techniques to correct for simultaneity bias that exists between the trade balance, real exchange rates, and national income measures (mainly GDP, GNP, or the industrial production index (IP)). The most frequently employed model is the vector error correction model (VECM). VECMs correct for simultaneity bias by simultaneously estimating equations for the trade balance, real exchange rate, and national income. This process requires assuming an ordering of the simultaneous variables which dictates how these variables are related to one another and is important in the estimation of impulse response functions (IRFs) which are used to visualize the estimated response of trade balances to real exchange rate fluctuations. Although VECMs are informative when analyzing country-level trade responses to real exchange rate fluctuations, they cannot be used to identify heterogeneity in responses across countries, types of traded goods, or major economic events such as the formation of the Eurozone.

This paper is, to my knowledge, the first to utilize commodity trade data to explore the responsiveness of trade to real exchange rate fluctuations. There are several advantages this approach has over VECM techniques employed by the current literature. First, panel data methods enable one to use covariates that would otherwise be omitted from a time series regression, such as whether or not trading partners are in a currency union, are experiencing an economic recession, and the types of goods being traded. These covariates have implications for the responsiveness of trade balances to real exchange rate fluctuations that have been overlooked until now. Second, using commodity trade data minimizes endogenity bias between national aggregates and the trade balance. That is, while exchange rates and national income influence commodity-level trade balances, commodity-level trade balances have little to no effect on bilateral exchange rates or national income, because trade in any one commodity does not compose enough of a country's total trade to influence national aggregates.

In addition to being able to explore heterogeneous reactions across countries and types of traded goods, commodity-level data eliminates averaging effects whereby the effects of real exchange rate fluctuations cancel one another out because traded goods respond in competing ways. The results of this paper demonstrate that not accounting for these heterogeneous reactions may be driving inconclusive results in the current literature.

Omitting important covariates and not accounting for heterogeneous effects that influence the relationship of the trade balance and real exchange rate will distort coefficient estimates on contemporaneous and lagged values of the real exchange rate. The current literature has generated inconclusive evidence concerning the relationship between trade and real exchange rates using country-level trade data. I find that disaggregating the data into product groups significantly aids in the identification of this relationship. I also find that time series techniques fail to account for structural changes in the relationship between trade and real exchange rates. More specifically, while past studies have noted that the relationship between trade and real exchange rates may be trading partner-specific, I find evidence that suggests this relationship may also be product-specific.

This paper is structured such that Section 2.2 is a review of the current literature. Section 2.3 contains the expected relationship between real exchange rates and trade. Section 2.4 discusses the data. Section 2.5 presents the empirical specification and Section 2.6 contains the empirical results. Section 2.7 concludes. Figures summarizing and tables containing the full estimation results are located in the Appendix.

Literature Review

The related theoretical and empirical microfoundations of real exchange rates and trade begin with Junz and Rhomberg (1965, 1973) and Magee (1973). Junz and Rhomberg (1965, 1973) empirically investigate the responsiveness of trade flows to relative price changes and find that export market shares are affected by relative price changes using aggregate U.S. trade data. They find that the response of the value of exports to relative price changes (i.e. exchange rate fluctuations) is strongest after four to five years. Magee (1973) intuitively explains why one would expect the components of the trade balance, specifically traded quantities and prices of traded goods, to react to exchange rate fluctuations differently in the short run and the long run. For instance, contracts between buyers and sellers specifying the quantity of goods being exchanged and the prices at which these goods are being exchanged limit the ability of buyers and sellers to adjust to relative price changes (i.e. exchange rate fluctuations). That is, traded quantities are fixed over a short period of time whereas the relative prices of traded goods are not; hence, when a currency depreciates, the relative price of foreign goods to domestic goods increases. Firms cannot immediately adjust their behavior which may cause a decline in the trade balance in the period before previously made contracts expire.

Ultimately, the currency denomination of contracts dictates if and how trade will respond to real depreciation. For example, if export contracts are primarily denominated in domestic currency while import contracts are largely written in foreign currency, then the value of exports will remain unchanged when domestic currency depreciates because foreign firms are absorbing the exchange rate fluctuation. The value of imports will rise because domestic firms are absorbing the exchange rate fluctuation. The overall effect on the trade balance would be negative. However, when contracts expire and firms are able to adjust the quantity of goods they exchange based on new relative prices, the value of the trade balance will increase and converge to a new, more positive equilibrium. This occurs because the value of the country's goods has fallen relative to foreign goods, increasing world consumption of the country's exports. Additionally, domestic country imports fall because foreign goods are more expensive relative to domestic goods leading domestic consumers to consume more domestic goods relative to foreign goods.

Early empirical work uses annual trade data and typically finds mixed results concerning trade balance responses to real depreciation. Miles (1979) finds that currency devaluations do not improve the trade balance, while Himarios (1985), using a subset of countries in Miles (1979), finds that currency devaluations improve the trade balance in 90% of the sampled countries. By the mid-1980s, quarterly and monthly trade data became standard in the literature.

Rose and Yellen (1989) uses a country-level panel to explore the relationship between trade and real exchange rates and develops what is now the standard equation in the empirical literature:

$$TB_{jt} = a + b \ln Y_{home,t} + c \ln Y_{jt} + d \ln REX_{jt} + \epsilon_t \tag{2.1}$$

where TB_{jt} is the home country's trade balance with country j, measured as net exports to j deflated by the home GNP deflator, $Y_{home,t}$ is real home GNP, Y_{jt} is real GNP in country j, and RER_{jt} is the real exchange rate in home currency per country j's currency. Rose and Yellen (1989) uses the United States as the home country and instruments for the real exchange rate and country incomes to mitigate endogeneity bias. After their initial estimation and employing a variety of robustness checks, they conclude that there is no evidence of negative short run trade balance responses to real depreciation. However, they present several reasons for their null results that include problems associated with weak instruments and the potential presence of unit roots. Other papers employing the Rose and Yellen (1989) estimation strategy include Marwah and Klein (1996), who confirm the presence of negative short run trade balance responses to real depreciation using quarterly trade data between the U.S. and Canada, and Shirivani and Wilbratte (1997), who find a statistically significant relationship between the trade balance and the real exchange rate using monthly trade data.

To account for the endogeneity between the trade balance, real exchange rate, and measures of national income and potential unit root and cointegration problems, the literature began exclusively using time series techniques, namely vector autoregressions (VARs) and vector error correction models (VECMs). Bahmani-Oskooee and Brooks (1999) was the first to employ a vector error-correction model (VECM) based on the Rose and Yellen (1989) empirical specification:

$$\Delta \ln TB_{jt} = a_i + \sum_{i=1}^{n} b_i \Delta \ln TB_{j,t-i} + \sum_{i=1}^{n} c_i \Delta \ln Y_{US,t-i} + \sum_{i=1}^{n} d_i \Delta \ln Y_{j,t-i} + \sum_{i=1}^{n} f_i \Delta lnREX_{j,t-i}$$
$$+ \delta_1 lnTB_{j,t-1} + \delta_2 lnY_{US,t-1} + +\delta_3 lnY_{j,t-1} + \delta_4 \ln REX_{j,t-1} + \epsilon_t \tag{2.2}$$

where TB_{jt} is the U.S. trade balance with trading partner j at time t. No unit root testing is involved in their empirical strategy. However, recent work by Bahmani-Oskooee employs the cointegration techniques proposed by Pesaran et al. (2001) to test the null hypothesis of no cointegration, i.e. H_0: $\delta_1 = \delta_2 = \delta_3 = \delta_4 = 0$, against the alternative of each δ_i (i =1, 2, 3,

4) being non-zero. Bahmani-Oskooee and Brooks (1999) finds no support for the presence of a negative short run relationship between trade balances and real depreciation, but do find support for the long run prediction that currency depreciation improves the trade balance. Other studies using this technique include Bahmani-Oskooee and Goswami (2003), Hacker and Hatemi-J (2004), and Dash (2005).

In general, studies employing VECMs find evidence of cointegration, but find mixed results concerning the short run response of trade to real exchange rate fluctuations. For instance, Bahmani-Oskooee and Goswami (2003) find evidence of negative short run trade balance responses to real depreciation in two out of nine observed trading partners of Japan. Kanitpong (2001) finds evidence of short run negative responses in two out of five observed trading partners of Thailand. Wilson (2001) finds evidence of short run negative responses between one of three observed trading partners of Singapore. In general, empirical work concludes that the short run response of trade balances to real exchange rate depreciations largely depends on the sampled countries and that there is no consistent pattern across all countries. However, the literature has neglected estimation strategies using panel data despite most research studies having access to it.

This paper uses the framework of the current literature to design a new approach to estimating the relationship between trade balances and real exchange rate fluctuations. By using panel data techniques and exploiting characteristics of disaggregate trade data, I am able to estimate country, product, and country-product responses to real fluctuations with minimal concern of endogeneity bias.

Hypotheses

Assuming Marshallian demand and supply, export quantities are a function of the real exchange rate and foreign income while import quantities are a function of the real exchange rate and domestic income. Let X_t^Q denote export quantities of the home country at time t, M_t^Q denote import quantities of the home country at time t, Y_t be a measure of domestic income at time t and Y_t^* be a measure of foreign income at time t, then

$$X_t^Q = X_t^Q(RER_t, Y_t^*) \qquad M_t^Q = M_t^Q(RER_t, Y_t) \tag{2.3}$$

where $RER_t = \frac{(P_t^* \times E_t)}{P_t}$ denotes the real exchange rate in domestic currency per unit of foreign currency in time t. P_t is the price of exports in domestic currency, P_t^* is the price of imports in foreign currency at time t, and E_t is the nominal exchange rate in domestic currency per foreign currency at time t

Intuitively, the amount of exports the domestic country can sell on the world market depends on the income levels of foreign countries participating in the world market. An increase in the income of a foreign country should lead to an increase in exports from the domestic country. If the domestic country's currency depreciates (i.e. a rise in the real exchange rate), demand for that country's goods on the world market will increase because goods from this country have become cheaper relative to goods from other countries. A similar story can be told concerning the relationship between the domestic country's quantity of imports and the real exchange rate and domestic income. Expressed mathematically,

$$e_X > 0 \qquad \frac{\partial X_t^Q}{\partial Y_t^*} > 0$$

$$e_M < 0 \qquad \frac{\partial M_t^Q}{\partial Y_t} > 0$$

where $e_X = \dfrac{RER_t}{X_t^Q} \times \dfrac{\partial X_t^Q}{\partial RER_t}$ is the elasticity of exports and $e_M = \dfrac{RER_t}{M_t^Q} \times \dfrac{\partial M_t^Q}{\partial RER_t}$ is the elasticity of imports.

The trade balance is defined as the ratio of the current value of exports to the current value of imports.[4]

$$\begin{aligned} TB_t &= \frac{P_t \times X_t^Q(RER_t, Y_t^*)}{E_t \times P_t^* \times M_t^Q(RER_t, Y_t)} \\ &= \frac{X_t^Q(RER_t, Y_t^*)}{RER_t \times M_t^Q(RER_t, Y_t)} \end{aligned} \tag{2.4}$$

Intuitively, an increase in the real exchange rate increases the quantity of goods being exported (X_t^Q) and decreases the quantity of goods being imported (M_t^Q) which leads to an increase in the trade balance (TB_t). An increase in foreign income (Y_t^*) increases the trade

[4]The traditional definition of the trade balance is the current value of exports less the current value of imports. However, the current literature defines the trade balance as the ratio of exports to imports in order to minimize the number of observations lost when the variables are transformed by the logarithmic function and to remove units of measurement.

balance via its positive relationship with the quantity of exports while an increase in domestic income decreases the trade balance via its negative relationship with the quantity of imports.

One can show that

$$e_{TB} = \begin{cases} > 0 & \text{if } \dfrac{X_t^Q e_X - RER_t M_t^Q e_M}{RER_t M_t^Q} > 1 \\ < 0 & \text{otherwise} \end{cases} \tag{2.5}$$

where e_{TB} is the elasticity of the trade balance with respect to the real exchange rate. Equation 2.5 states that the long run response of a country's trade balance will be positive if the trade weighted response of exports and imports is greater than one. This is a modified version of the Marshall-Lerner conditions which state that the long run response of trade to real depreciation will be positive if the sum of the export and import elasticities exceeds one.

In addition, one can show that

$$\frac{\partial TB_t}{\partial Y_t^*} > 0 \qquad \frac{\partial TB_t}{\partial Y_t} < 0$$

Data

This analysis focuses on OECD trade with the United States. The sampled U.S. trading partners include Austria, Belgium, Canada, Denmark, Finland, France, Germany, Ireland, Italy, Japan, South Korea, Mexico, Netherlands, Norway, Portugal, Spain, Sweden, Turkey, and the United Kingdom from Q1:1990 to Q4:2011. These trading partners and this time period were selected based on data constraints.

Trade data was collected from the United States International Trade Commission (ITC) Dataweb database. Export data is from the series "U.S. Total Exports" and import data is from the series "U.S. General Imports". Both imports and exports are measured in thousands of U.S. dollars (current prices).

Nominal exchange rates were collected from PACIFIC Exchange Rate Service which is maintained by the University of British Columbia's Sauder School of Business. The consumer price index (CPI) and gross domestic product (GDP) were gathered from the Organization for Economic Co-Operation and Development's OECD.Stat database. CPI data is from the

"Consumer Prices" (MEI) series and is measured as an index with base year 2005. GDP data was collected from the "Quarterly National Accounts: OECD member countries GDP Expenditure Approach" series and is measured in millions of national currency with current prices and is seasonally adjusted.

The Rauch Goods Classification Index developed by Rauch (1999) was obtained from Jon Haveman's International Trade Data website.[5] An alternative classification also used in this paper is the Harmonized System (HS) Standard Product Groups which categorize goods into four categories: raw materials, intermediate goods, capital goods, and consumer goods. This classification is based on the United Nations Conference on Trade and Development (UNTAD) standard operating procedures and is available through the World Banks' World Integrated Trade Solution (WITS) database.

Other covariates used in empirical analysis are dummy variables for U.S. recessions, Eurozone recessions, the Asian Financial Crisis, and a dummy variable for whether a country has adopted the euro as its national currency. U.S. recession dates were collected from the National Bureau of Economic Research (NBER) website, Euro-area recessions were collected from the Centre for Economic Policy Research (CEPR) Euro-Area Business Cycle Dating Committee, the Asian Crisis dates were collected from PBS's Frontline website[6], and national currency data was collected from the European Commission's "Economic and Financial Affairs" website[7].

The trade balance was constructed by dividing the value of exports in U.S. dollars by the value of imports in U.S. dollars. The real exchange rate in U.S. dollars per foreign currency was constructed by multiplying the nominal exchange rate in U.S. dollars per foreign currency by the foreign country consumer price index divided by the U.S. consumer price index. Hence, an increase in the real exchange rate is interpreted as currency depreciation.

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[5] Source: Haveman, Jon. "International Trade Data: Rauch Product Differentiation Codes". July 2007. < *http://www.macalester.edu/research/economics/page/haveman/Trade.Resources/TradeData.html* >. Original Source: Rauch, James E. "Networks Versus Markets in International Trade," Journal of International Economics 48(1) (June 1999): 7-35.

[6] PBS: Frontline. "The Crash: Timeline of the Panic". 2013. < *http://www.pbs.org/wgbh/pages/frontline/shows/crash/etc/cron.html* >

[7] European Commission: Economic and Financial Affairs. "The Euro". 06 June, 2013. < *http://ec.europa.eu/economy_finance/euro/* >

Empirical Specification

A distributed lag model is used to empirically estimate the effects of real U.S. dollar depreciation on U.S. trade. In order to examine different dimensions by which U.S. trade may react to real depreciation in the U.S. dollar, empirical estimations involved varying sets of interaction terms between the real exchange rate and covariates including dummies for whether a country has adopted the euro, dummies for Rauch index goods, and dummies for HS Product Group goods. For all models, the subscript indexes identify the following: 'i' denotes country, 'j' denotes commodity, 't' denotes time. All estimations also included country-commodity fixed effects and quarter-year fixed effects. The empirical specification is given by Equation 2.6.

$$\begin{aligned} \ln TB_{i,j,t} =& \alpha + \beta_0 \Delta \ln GDP_{i,t} + \gamma_0 \Delta \ln RER_{i,t} + \gamma_1 \Delta \ln RER_{i,t-1} \\ &+ \gamma_2 \Delta \ln RER_{i,t-2} + \gamma_3 \Delta \ln RER_{i,t-3} + ... + \gamma_{10} \Delta \ln RER_{i,t-10} \\ &+ Z_{i,j,t} + \varepsilon_{i,j,t} \end{aligned} \tag{2.6}$$

Equation 2.6 was estimated using different real exchange rate lag lengths. The optimal lag length was determined by comparing estimates across specifications with lag lengths ranging from two to ten. Large variation in coefficient estimates from specifications differing in only one lagged variable are indicative of multicollinearity due to autocorrelation in the real exchange rate variables. The optimal lag length was selected by identifying specifications with significant coefficient estimates that were consistent across estimations with different lag lengths. The number of lags in equation 2.6 is consistent with the lag lengths found in the current literature. Knight and Artus (1984) and Klaussen (2004) indicate that the full response of the trade balance to an exchange rate fluctuation is between six to twelve months, while Junz and Rhomberg (1965) indicates that the full response could take a maximum of five years to be realized. The lag structure of equation 2.6 falls within this range (at 2.5 years).

One primary concern of the current literature is endogeneity between the trade balance, real exchange rate variables, and GDP. There are two ways that commodity-level data minimizes endogeneity. First, no one commodity composes a large enough portion of total trade to influence the real exchange rate or GDP. Second, the endogeneity bias is likely in the levels of the data. Using the first difference of the logs of the variables should eliminate this bias.

Results

The subsections below explore several questions that the current literature has been unable to explore using time series methods. The first subsection examines how data aggregation affects the relationship between U.S. trade and real exchange rate fluctuations. The second subsection explores heterogeneous responses of U.S. trade to real depreciations among goods defined by the Rauch Index as differentiated or homogeneous and goods defined by the Harmonized System Product Groups as raw materials, intermediate goods, capital goods, or consumer goods. The third subsection explores the implications of the formation of the Eurozone on the relationship between real U.S. dollar depreciation and U.S. trade.

The empirical specifications employed contain both country-commodity fixed effects and quarter-year fixed effects. Standard errors are clustered on country. The real exchange rate is calculated such that an increase is real U.S. dollar depreciation.

I find that the long run response of U.S. trade balances to real depreciation is not statistically significant which is contrary to current theoretical predictions in the literature. This finding is consistent when both accounting and not accounting for heterogeneity among goods and is not attributable to persistent U.S. trade deficits in the sample period. I also find that homogeneous good trade responses to real depreciation are much more volatile than the response of differentiated good exports and imports which is likely due to the substitutability of homogeneous goods. Additionally, I find that market structure and firm behavior influences the responsiveness of product trade to real depreciation. Finally, I find that the formation of the Eurozone substantially reduced the responsiveness of U.S. trade flows to real U.S. dollar depreciation against Eurozone country currencies.

The Effects of Data Aggregation

One primary concern of the current empirical literature is the endogenous relationship between trade, GDP, and real exchange rates. Changes in national income are indicative of the ability to purchase more or less goods internationally. An increase in foreign income will likely increase domestic exports, thus increasing the domestic trade balance. However, a country's trade balance is a component of GDP such that an increase in a country's trade balance will increase GDP. Additionally, Broda and Romalis (2011) find that international trade depresses exchange rate volatility. The endogenous relationship between trade and GDP and trade and real exchange rates should bias coefficient estimates on GDP upward and coefficient estimates on real exchange rate variables downward.

There are two ways that this analysis minimizes simultaneity bias. First, using disaggregated data minimizes endogeneity between trade and GDP and trade and real bilateral exchange rates, because no one commodity category composes enough of total trade to influence the level of GDP or the real bilateral exchange rate[8]. Second, simultaneity bias is likely between levels of the variables. Transforming the variables into log first differences should eliminate this bias.

Table 2 contains the estimation of Equation 2.6 using three levels of data aggregation. Column (1) contains the estimates for country-level trade, while columns (2) and (3) contain estimates for commodity-level trade using the 2-digit and 4-digit harmonized system. Although the estimation results in columns (1) thru (3) use different levels of data aggregation, the coefficient signs on the contemporaneous real exchange rate and the first two lags of the real exchange rate are consistent across aggregations. This suggests that the direction of the average response of country-level and commodity-level trade balances to real depreciation is similar. The coefficient estimates in column (1) are similar in magnitude to estimates in the current literature.

In addition, the estimated long run effects of real depreciation are similar across aggregations. One percent real U.S. dollar depreciation generates a negative long run response in bilateral trade balances of approximately 0.5356%. The long run responses of HS2 and HS4 trade are -0.1995% and -0.216%, respectively. However, these estimated effects are not significant, suggesting that real dollar depreciation does affect trade in the long run.

The coefficient estimates for the real exchange rate in Table 2 are the response of U.S. trade balances to one percent real dollar depreciation contemporaneously and each quarter following the real depreciation. While these results are useful for getting a sense of how and when U.S. trade is responding to real dollar fluctuations, the cumulative response of trade is more informative

[8]Regressing the log first difference of GDP or real exchange rate on the log first difference of commodity trade reveals that the coefficient estimates on the trade balance are never significant and very small.

when thinking about the response of trade over time. Figure 1 depicts the cumulative effect of one percent real U.S. dollar depreciation at time zero on U.S. country-level and commodity-level trade balances. The cumulative effect is the effect of one percent real depreciation over time, accounting for the response of trade in previous quarters. For instance, the cumulative effect of one percent real U.S. dollar depreciation on bilateral trade balances two quarters after the depreciation has occurred is given by multiplying the effects of depreciation on trade from previous quarters: $(1 - .03370) \times (1 + .05881) \times (1 - .02784) = -0.5356$.

Figure 1 reveals that the contemporaneous average response of country-level trade balances (solid line) is significant and negative. One percent real U.S. dollar depreciation results in country-level trade balances falling by approximately 3.370%. The magnitude of this coefficient estimate is comparable to the magnitudes of estimates in the current literature. The average contemporaneous fall in commodity-level trade balances (dotted and dashed lines) is slightly negative and insignificant: -0.385% for HS2 trade and -0.340% for HS4 trade.

In contrast to the current literature, figure 1 suggests that, on average, the long run response of U.S. trade balances to real depreciation is insignificant. Current literature suggests that the long run effect of currency depreciation is positive because it encourages world consumption of the country's exports while decreasing the country's imports. However, if there is no long run response, then currency manipulation policies implemented to promote export competitiveness will not achieve this goal over a long time horizon, which is approximately 2.5 years here. The primary question concerning these policies then becomes what happens to trade flows in the short run. If there are no short term gains from currency depreciation in the short run, then policies that manipulate currency values temporarily raise the cost of international trade for domestic and foreign firms.

The short run responses of U.S. trade to real depreciation appear to be close to zero. However, this result may be driven by averaging heterogeneous commodity trade responses to real depreciation. The next section estimates heterogeneous trade balance responses allowing the coefficient estimates to vary by product-type, according to both the Rauch Index and HS Product Groups.

Heterogeneous Responses Across Products

Lack of commodity trade balance responsiveness to real depreciation suggests that commodities may have heterogeneous responses to currency depreciation, which may be driven by variation in contracts across commodity types or variation in transportation time (which varies based on the complexity of the good, size of the shipment, distance of the seller or buyer, etc.). Heterogeneous responses driven by variation in contracts can be partially observed in U.S. trade data, because U.S. trade is largely invoiced in U.S. dollars; Gopinath and Rigobon (2008) find that 90% of U.S. imports and 97% of U.S. exports are invoiced in U.S. dollars. The prevalence of U.S. dollar invoicing in U.S. trade minimizes the effects of currency invoicing on the responsiveness of U.S. trade to real depreciation. According to Table 1, when both U.S. exports and U.S. imports are invoiced in U.S. dollars, real dollar depreciation should not affect either of these trade flows in the short run. Thus, the estimated responsiveness of U.S. trade to real exchange rate fluctuations should be driven by other characteristics of trade, both observable and unobservable.

Variation in transportation time is partially accounted for by using country-commodity and quarter-year fixed effects. In addition, the Rauch Index and Harmonized System (HS) Product Groups capture the variation in transportation time due to product characteristics. The Rauch Index defines goods as homogeneous, referenced priced (similar to homogeneous), or differentiated based on whether the goods price is published or market determined. HS Product Groups, defined by the United Nations Conference on Trade and Development (UNCTAD), separate goods into four categories: raw materials, capital goods, intermediate goods, and consumer goods.

There should be a difference between the responsiveness of homogeneous good trade and of differentiated good trade to real dollar depreciation. Homogeneous goods and referenced priced goods are defined by the Rauch Index as goods whose price is determined on organized exchanges or whose price is printed in trade catalogs. Goods classified by Rauch (1999) as homogeneous or as referenced priced are combined into one group in this analysis and are hereafter referred to as homogeneous goods. In addition to U.S. trade being largely invoiced in U.S. dollars, homogeneous good contracts are typically denoted in U.S. dollars (Goldberg and Tille (2005), Gopinath and Rigobon (2008)). Because of the increased likelihood of U.S. dollar invoicing in homogeneous good trade, it's unlikely that homogeneous good trade flows will respond to real U.S. dollar depreciation in the short run. Rather, one would expect to see a delayed response of homogeneous good trade flows to real depreciation. In contrast, differentiated good contracts are more likely to be invoiced in a foreign currency. In the short run, there may be a small increase in differentiated good exports and imports. However, because U.S. trade is predominantly in U.S. dollars, there will likely be no short run response of trade to real depreciation.

In addition to variation in contract invoicing, the length of homogeneous good and differentiated good contracts is very different. Gopinath and Rigobon (2008) and Arezki, Lederman, and Zhao (2015) find that price changes occur more frequently in homogeneous good sectors than differentiated good sectors because the elasticity of demand for homogeneous goods is more elastic than the elasticity of demand of differentiated goods. This suggests that homogeneous good trade contracts are likely shorter than differentiated goods contracts because the cost of not being able to adjust prices is costly for the buyer, seller, or both.

Figure 2 summarizes the results of estimating Equation 2.6 using a dummy variable equal to one if the good is differentiated (Dif) and a dummy variable equal to one if the good is homogeneous (Hom). Table 3 contains the full estimation results used to construct Figure 2. From Figure 2, homogeneous good commodity trade balances respond to real depreciation after approximately two quarters, at which these trade balances fall, on average, by 1.152%. However, the third quarter following the depreciation, the response is a positive 2.020%. These estimates suggest that many importing and exporting firms are able to adjust their buying/selling behavior two to four quarters following real U.S. dollar depreciation. This would suggest that the average contract length is between 6-12 months in length, which is consistent with the findings of Gopinath and Rigobon (2008) who find that the median price duration in a contracted currency is approximately 10.6 months for imports and 12.8 months for exports.

To get a complete picture of the responsiveness of trade, Figure 3 summarizes the response of homogeneous and differentiated good exports and imports to real U.S. dollar depreciation. Table 3 contains the estimation output. As expected, the response of homogeneous and differentiated good exports and imports in Figure 3 is indicative of the response of the corresponding trade balances in Figure 2. Significant changes in the U.S. trade balance appear to be driven by changes in the value of imports rather than the value of exports. Most significant changes in Figure 2 correspond to significant changes in the value of imports in Figure 3. This is not a surprising result because U.S. imports contain more foreign currency invoicing than U.S. exports which means that U.S. imports should respond to real depreciation in the short run than U.S. exports.

Figure 3 suggests that homogeneous goods trade is more responsive to real U.S. dollar depreciation than differentiated goods trade, which is consistent with the findings of Gopinath and Rigobon (2008) and Arezki, Lederman, and Zhao (2015) that homogeneous good prices change more frequently differentiated good prices. It's likely that the duration of homogeneous goods contracts is shorter than the duration of differentiated goods contracts because of the substitutability of homogeneous goods across different sellers. Hence, firms buying homogeneous goods should be able to adjust more quickly to exchange rate fluctuations than firms purchasing differentiated goods.

While the Rauch Index presents some interesting ideas concerning how different types of traded products respond to real depreciation, one can use the Harmonized System (HS) Product Groups to categorize goods as consumer goods, capital goods, intermediate goods, or raw materials. The advantage of using HS Product Groups is that there may still be a good deal of heterogeneity in the categories provided by the Rauch Index.

In order to account for heterogeneity across HS Product Groups, dummy variables for each category of goods were interacted with the real exchange rate variable and its lags. Table 4 contains the full estimation output and Figure 4 summarizes these results. The variability of responsiveness across goods may be linked to each good type's market structure. The markets for raw materials may be more competitive than the markets for capital and intermediate goods. Raw materials are homogeneous goods that likely have many domestic and foreign suppliers of an identical product which makes substitution between suppliers easy, while the markets for intermediate goods and capital goods are likely less competitive because firms buying these products may have specific requirements for these goods. This makes substitution between suppliers difficult and costly. Consumer goods are likely less responsive to real depreciation than other goods because exchange rate pass-through in consumer good prices is very low (Bacchetta and van Wincoop (2003)).

The long run response of trade balances among the HS Product Groups is negative in Figure 4. However, the estimated response of exports and imports suggests that the trade balances response should be insignificant and close to zero. This result is likely due to the export only observations that are lost when creating the trade balance (ratio of exports to imports). If a good is not imported or a good is not exported, then the trade balance variable is undefined and not used to estimate the response to real depreciation. In contrast, using exports or imports as the dependent variable is able to capture these observations. What is likely happening is that goods that are both exported and imported respond differently to real depreciation than goods that are only exported or only imported. Hence, the different long run predictions when comparing the response of the trade balance with the response of exports and imports. If the undefined observations were used in the estimation of the response of the trade balance, the long run effect would likely be insignificantly different from zero for all four product groups.

While different products clearly exhibit different trade responses to real depreciation, one factor still unaccounted for is the formation of the Eurozone over the sample period. The Eurozone is a currency union that resulted in the elimination of nearly all barriers to trade across a set of European countries and resulted in the elimination of a substantial amount of exchange rate volatility between the U.S. dollar and European currencies. The next section explores the implications of euro on the responsiveness of U.S. trade balances to real depreciation.

U.S. Trade Responsiveness During the Adoption of the Euro

One advantage of using panel data is that I can identify country-specific characteristics that may substantially impact the relationship between trade and exchange rates. The results of this section suggest that the formation of the euro substantially decreased the responsiveness of U.S. trade to real dollar depreciation.

The U.S. trade balance response to real U.S. dollar depreciation against the euro and real U.S. dollar depreciation against the Mexican peso or Canadian dollar should not be the same, because of the different roles played by the euro, Canadian dollar, and Mexican peso in international marks and the value of trade between the U.S. and these countries. The euro plays an increasingly important role in international trade as an international currency, meaning that euro denominated contracts are becoming more popular both in trade transactions with Eurozone firms and as a third party (vehicle) currency (Goldberg and Tille (2005)). In contrast to the previous literature, I can evaluate the impact of the formation and adoption of the euro on U.S.

trade responses to real depreciation. Twelve of the nineteen countries found in this sample are European countries, most of which transitioned from using an independent national currency to using the euro during the sample time period.

The primary question that emerges is: has the introduction and use of the euro significantly altered the relationship between U.S. trade and real U.S. dollar depreciation? In order to answer this question, I use a dummy variable equal to one after Q1:1999 for Eurozone countries[9]. The euro was introduced to Eurozone countries in two stages. The first stage began in January 1999. In this stage, the euro was used as an electronic currency, consequently, European countries adopting the euro fixed their national currency's exchange rate with the "European Currency Unit" (ECU), which became the "Euro" in 2001. Stage two was the introduction of the euro as physical currency which occurred in January 2002. [10]

Figure 5 summarizes the results of Table 5, which contains the full estimation results of Equation 2.6 when using a dummy variable for the euro. Figure 5 suggests that the formation of the Eurozone resulted in a significant reduction in the volatility of U.S. trade responses to real U.S. dollar depreciation against European currencies. The negative long run trade balance response to real depreciation is present both before and after the formation of the Eurozone. The long run trade balance response is insignificantly different from zero, suggesting that real dollar depreciation has no long run effects on trade between the U.S. and Eurozone.

In addition to accounting for the formation of the Eurozone, one can look at the heterogeneity in the responses of different product types both before and after Eurozone formation. Figure 6 summarizes the effect of real depreciation on homogeneous and differentiated goods trade before and after the formation of the Eurozone. The estimation results are in Table 6. Figure 6 suggests that after the formation of the Eurozone both homogeneous good and differentiated good trade balances become less responsive to real depreciation. The short run response of homogeneous good trade balances is reversed following the formation of the Eurozone. Despite decreased responsiveness, the long run responses of homogeneous good and differentiated good trade balances remain insignificant.

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[9]All European countries in the dataset that are currently members of the Eurozone joined the Eurozone when it started in January 1999.

[10]European Commission. "Economic and Financial Affairs: The euro".

Conclusion

The current literature finds a weak relationship between trade and real exchange rates and argues that the weak result suggests that this relationship is trading partner-specific. However, microeconomic literature exploring exchange rate pass-through and characteristics of trade contracts suggests that this relationship depends on product- and trading partner-specific characteristics. By using country-level time series data, the current literature has been unable to explore how product and trading partner characteristics affect this relationship. In this paper, I use commodity-level U.S. trade data to explore the implications of trading partner and product characteristics on the relationship between trade and real exchange rate fluctuations.

I find that trade responds heterogeneously across products and trading partner characteristics. Using the Rauch Index to identify homogeneous and differentiated goods, I find that homogeneous good trade responses to real depreciation are much more volatile than those of differentiated goods. This is likely due to homogeneous goods having more elastic demand which results in more frequent price changes than differentiated goods. This also suggests that homogeneous good contracts may be shorter than differentiated good contracts which may be driving the heterogeneous short run responses between these product types. As an alternative to the Rauch Index, I use the Harmonized System Product Groups to categorize goods as raw materials, intermediate goods, capital goods, and consumer goods. I find that raw materials and consumer goods are less responsive to real depreciation than capital goods and intermediate goods. This lack of responsiveness is likely due to market structure and the degree of exchange rate pass-through. I also find that the formation of the Eurozone substantially reduced the responsiveness of U.S. trade balances to real U.S. dollar depreciation against European currencies. The smoothing of U.S. trade balance responsiveness is partially attributable to heterogeneous responses across types of goods.

In contrast to the current literature, I find that real U.S. dollar depreciation does not significantly affect trade in the long run. This suggests that currency manipulation policies intended to increase export competitiveness may have no effect on trade over a long time horizon (here 2.5 years). If this is the case, these policies temporarily increase the costs of international trade and may adversely affect some industries in the short run.

The current literature overlooks the currency used to set prices in international transactions which should be result in short run responsiveness or non-responsiveness in trade flows. While unobservable in the data, previous literature has found that nearly all U.S. trade is invoiced in U.S. dollars. Thus, the estimated responses throughout this chapter are fairly independent of the currency used to denote contracts. The current literature predicts that these trade flows should not respond in the short run to real depreciation. However, I find some trade responsiveness in the short run when accounting for heterogeneity within trade which suggests that inconsistent estimates in aggregate trade studies may be due to averaging effects.

In the next chapter, I explore the implications of currency invoicing on the responsiveness of trade to real depreciation using Japanese data.

CHAPTER III

CURRENCY INVOICING, THE DYNAMICS OF TRADE, AND EXCHANGE RATE SHOCK

Introduction

Domestic currency depreciation should improve the trade balance of the domestic country. Following depreciation, domestic and foreign consumers consume more domestic goods relative to foreign goods. For the domestic country, this results in an increase in domestic good exports and a decrease in foreign good imports, thereby improving the domestic trade balance. This is the motivation behind currency manipulation policies meant to improve a country's export competitiveness. Empirical evidence suggests that this intuition is likely true in the long run. However, the short run consequences of currency depreciation are unknown. In the long run, firms and consumers are able to adjust their behavior to the new realized exchange rate. In contrast, the short run introduces frictions in the form of international contracts. These contracts set the quantity of a good to be traded and the price at which the good is traded and are fixed over a short period of time. This means that when a currency depreciates, not all firms will be able to immediately respond the exchange rate change.

According to the current literature, the response of trade in the short run to real depreciation depends on the currency used to denote prices in contracts, referred to as the invoicing currency. Consider a U.S. exporter who enters into a contract with a Japanese firm. Suppose the Japanese firm agrees to pay the U.S. firm in U.S. dollars. If the U.S. dollar depreciates before the expiration of this contract, the Japanese firm benefits because they can use the new realized exchange rate to convert yen to dollars for payment of the goods, paying less yen for each dollar than prior to the depreciation. The U.S. firm receives the same amount for the good post-depreciation as they would have prior to depreciation. In the short run, the value of this export transaction in terms of U.S. dollars is unchanged. Now suppose that the Japanese firm agrees to pay for the goods in yen. When the U.S. dollar depreciates, the U.S. firm must convert the yen denoted payment to U.S. dollars, exchanging the yen for more U.S. dollars than prior to the depreciation. This results in the value of this export transaction in terms of U.S. dollars increasing. Table 1 summarizes the effects of currency invoicing on the relationship between trade and real depreciation.

In general, foreign currency invoicing will result in an increase in the value of trade transactions in the short run while domestic currency invoicing will result in no response in the short run. Firms can use local currency pricing (LCP), when prices are set in the purchaser's currency, producer currency pricing (PCP), when prices are set in the seller's currency, or a vehicle currency to invoice international trade contracts. Firms bargain over the invoicing currency in order to maximize profits and minimize exposure to exchange rate risk[1]. How firms have chosen to invoice contracts may largely determine how trade flows respond to real exchange rate fluctuations in the short run.

The currency invoicing literature finds that the invoicing of trade contracts depends on firm-, market-, and product-specific features of the goods being bought and sold in internationally. Thus, the identification of the response of trade flows to real exchange rate fluctuations requires that firm-, market-, and product-specific features are accounted for in empirical analysis. The current literature ignores the currency denomination of contracts by using country-level data, which results in estimates that average the responsiveness of foreign currency invoiced trade and the non-responsiveness of domestic currency invoiced trade. This has yielded largely insignificant and mixed results concerning this short run relationship.

One primary concern of the current literature is the potential for differential short run and long run responses to real depreciation. That is, the short run response of trade balances to real depreciation may be negative while the long run responses are positive. Table 1 indicates that the short run response is likely attributable to the currency used to invoice international transactions. In addition, there is another necessary, but not sufficient, condition that enables trade flows to have differential responses in the short and long run: firms and consumers cannot immediately adjust consumption in response to exchange rate fluctuations. Thus short run trade responses that deviate from the long run outcome need to have relatively inelastic demand and supply for foreign goods in the short run. The elasticity of demand and supply for foreign goods likely varies by country and by product along the lines of comparative advantage and is likely correlated with currency invoicing decisions[2].

[1]See Giovannini (1998), Donnenfeld and Zilcha (1991), and Friberg (1998) for theoretical discussions

[2]See Soderbery (2012) for estimates of import demand and supply by product

In addition, there may also be heterogeneous reactions of trade flows to real depreciation driven by product, country, and product-country characteristics that are unobserved in current country-level studies. These heterogeneous responses may be correlated with comparative advantage. Depending on the areas of comparative advantage and disadvantage, international trade flows may be more or less sensitive to exchange rate fluctuations. For example, if Japan has the comparative disadvantage in a good, then the elasticity of import demand for that good is likely inelastic. When real exchange rate fluctuations occur, firms importing these products are less likely to change their behavior in the short run. In contrast, goods in which Japan has a comparative advantage are likely to have more elastic import demand. This means that firms are likely to change their short run behavior following real exchange rate fluctuations.

In addition, comparative advantage also varies by trading partner. Japan may have the comparative advantage in intermediate goods when trading with the United States and it may also have a comparative disadvantage in intermediate goods when trading with Korea. In other words, the elasticity of import demand for intermediate goods with the U.S. is relatively elastic while the elasticity of import demand for intermediate goods with Korea is relatively inelastic. Because of this, the short run response of trade in intermediate goods between Japan and the U.S. is likely substantially different than the short run response of trade in consumer good between Japan and Korea. This suggests that the dynamics of trade flows to exchange rate shocks may be country, product, and/or country-product specific.

The previous chapters revealed that there may be no long run gains of currency depreciation, suggesting that currency manipulation policies to increase export competitiveness may only have temporary gains. However, because the short run response of trade balances to real depreciation may be negative, currency manipulation policies may actually harm their domestic industry. Estimation strategies employed by the current literature are not sufficient for identification of the relationship between real exchange rate fluctuations and trade because they do not account for heterogeneity within trade, including the currency denomination of contracts. To my knowledge, the current literature primarily estimates the short run effects of real exchange rate depreciation using vector error correction models (VECMs). VECMs are used to estimate the response of country-level trade to fluctuations in bilateral real exchange rates. These responses are estimated for several trading pairs and are compared in order to establish patterns in short run bilateral trade. The results of these studies usually confirm long run improvement in the trade balance, but fail to find a pattern in its short run response.

To my knowledge, this paper is the first to explore the responsiveness of trade flows to exchange rate fluctuations using disaggregated trade data to account for product, country, and invoicing currency heterogeneity. This paper uses the empirical currency invoicing literature to identify trade flows that likely meet the necessary contract invoicing conditions that enable differential short run and long run responses to real exchange rate fluctuations. In addition, this is, to my knowledge, also the first paper to form predictions concerning how vehicle currency invoicing affects the responsiveness of trade.

The decision to use Japan as the "home" country is deliberate. Japan is the third largest economy in the world, heavily engaged in international trade, and has an independent currency (as opposed to Eurozone countries) with a floating exchange rate that experiences many appreciations and depreciations over the sample period[3]. Additionally, Japanese firms use a variety of currencies to invoice international contracts. Approximately 40% of Japan's exports and 20-30% of Japan's imports are invoiced in yen[4]. The variety of currencies used to denominate contracts allows for cases where the necessary conditions on the contracting environment for differential short run and long run trade responses resulting from real depreciation are met.

Overall, I find evidence that differential responses in short run and long run trade responses to real depreciation require looking at the intersection of good types and trading partner characteristics. When looking at the intersection of these characteristics, I find that the response of trade in the long run may be correlated with comparative advantage.

The remainder of this paper is organized as follows. Section 3.2 is a review of the current, relevant literature. Section 3.3 contains theoretical predictions for the results. Section 3.4 develops expectations of where the necessary invoicing conditions for differential short run and long run trade responses resulting from real depreciation are met. Section 3.5 describes the dataset. Section 3.6 describes the empirical specification. Section 3.7 contains the results and Section 3.8 concludes.

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[3]BBC News: Asia, "Japan Profile: Overview". Updated: 15 Aug. 2014. Accessed: 27 Aug. 2014. .

[4]ASEAN Institute for International Monetary Affairs, "Ways to promote foreign trade settlements denominated in local currencies in East Asia". February 2010. Goldberg and Tille (2005) find similar proportions of Japanese exports and imports invoiced in yen.

Literature Review

Theoretical discussions of the relationship between the trade balance and exchange rate fluctuations date back to the 1940s. Lerner (1944) develops conditions on the elasticity of import demand and export supply that eliminate trade frictions generated by sticky quantities called the Marshall-Lerner conditions. More specifically, the Marshall-Lerner conditions state that a home country's trade balance will improve in response to a currency devaluation if the sum of the elasticity of home import demand and the elasticity of foreign export supply exceeds one, i.e. both demand and supply are relatively elastic. Violating the Marshall-Lerner conditions guarantees that consumption patterns of foreign goods cannot immediately adjust to changes in the value of the home country's currency. Using the Marshall-Lerner conditions, Robinson (1947) discusses the mechanisms by which a home currency devaluation need not lead to an improvement in the home country's trade balance. Explicit models of the relationship between the trade balance and real exchange rate are developed by Alexander (1952) and Mundell (1960). Alexander (1952) uses an elasticities approach to model the relationship between the trade balance and the real exchange rate while Mundell (1960) succinctly constructs and explains the classicalist approach to modelling this relationship using Marshallian demand and supply curves. Both approaches are still used.

In the 1970s, two empirical branches emerged in the trade-exchange rate literature. One branch, which includes Magee (1973), Krugman and Taylor (1978), and Gylfason and Risager (1984), began characterizing and exploring the implications of bilateral exchange rate fluctuations on bilateral trade flows, while the other branch, which includes Hooper and Kohlhagen (1978), Kenen and Rodrik (1986), Thursby and Thursby (1987), and De Grauwe (1988), began characterizing and exploring the implications of the increasing volatility of post-Bretton Woods bilateral exchange rates.

The branch concerning the relationship between trade balances and exchange rate fluctuations primarily focuses on the J-curve hypothesis, popularized by Magee (1973). The J-curve hypothesis states that currency depreciation will result in trade balance deterioration in the short run and trade balance improvement in the long run. Early empirical J-curve studies focus on the relationship between country-level trade and bilateral real exchange rates and find mixed results. For instance, Miles (1979) finds that currency depreciation does not improve the trade balance, while Himarios (1985), using a subset of countries in Miles (1979), finds that currency depreciation improves the trade balance. Other studies employing aggregate trade data include Bahmani-Oskooee (1985), Rosensweig and Koch (1988) and Himarios (1989), all of which report mixed evidence for the J-curve hypothesis.

Rose and Yellen (1989) use panel regression techniques on quarterly aggregate bilateral trade data to examine the J-curve hypothesis. Despite finding no evidence of the J-curve effect, nearly every post-1989 J-curve study uses some form of the empirical model employed by Rose and Yellen (1989). This model is given by the following equation:

$$TB_{jt} = a + b \times lnY_{home,t} + c \times lnY_{j,t} + d \times lnREX_{j,t} + \varepsilon_t \tag{3.1}$$

where $TB_{j,t}$ is the home country's trade balance with country j at time t measured as net exports to j deflated by the home country's GNP deflator. $Y_{home,t}$ is real home country GNP at time t, $Y_{j,t}$ is real GNP in country j at time t, and $REX_{j,t}$ is the real exchange rate in home currency per country j's currency. More recent papers employing the panel data methods of Rose and Yellen (1989) include Marwah and Klein (1996), who confirm the presence of the J-curves using quarterly trade data between the United States and Canada, and Shirivani and Wilbratte (1997), who find a statistically significant relationship between the trade balance and the real exchange rate using aggregate monthly bilateral trade data between the United States and the following trading partners: Canada, France, Germany, Italy, Japan, and the United Kingdom.

Rose (1991) builds on the work of Rose and Yellen (1989) by examining the relationship between the real effective exchange rate and the bilateral trade balance using time series parametric and non-parametric techniques and finds no evidence of a strong relationship between the bilateral trade balances and the real effective exchange rate. Bahmani-Oskooee and Brooks (1999) argue that the inconclusive evidence for the J-curve hypothesis comes from the misidentification of unit roots and cointegration stemming from the low power of the Dickey-Fuller test and Augmented Dickey-Fuller test. To overcome this, Bahmani-Oskooee and Brooks (1999) use vector error-correction models to eliminate the simultaneity bias and unit root/cointegration bias found in earlier empirical J-curve studies. They find that the short-run effects of U.S. dollar depreciation do not result in a J-curve effect. However, they do confirm that currency depreciations improve the trade balance in the long run.

More recent studies continue to employ the VECM approach to examine J-curves and include Bahmani-Oskooee and Goswami (2003), Hacker and Hatemi-J (2004), Dash (2005), and Bahmani-Oskooee and Harvey (2010). In general, these studies find evidence of cointegration between the aggregate trade balance, real exchange rate, and national income, but find mixed results concerning the presence of J-curves. Empirical work on the J-curve usually concludes that J-curves are country-specific and that no discernible, global J-curve pattern exists.

The literature on the relationship between trade and exchange rate volatility grew simultaneously with the literature on the relationship between the trade balance and real exchange rate fluctuations. Hooper and Kohlhagen (1978) tests how exchange rate volatility affects the volume of trade and finds no significant effect. In contrast, Kenen and Rodrik (1986) examines the imports of industrial countries and finds that exposure to volatility differs across countries, but that, on average, increasing exchange rate volatility depresses trade.

Recent work on exchange rate volatility and trade finds more uniform results. Rose (2000) uses a gravity model to assess the effects of currency unions on trade. In addition to finding a significant positive effect of currency unions on trade, Rose (2000) finds a small negative effect of exchange rate volatility on trade. Teneryro (2006) finds no significant impact of exchange rate volatility on trade. However, Byrne, Darby, and MacDonald (2006) argue that previous literature fails to find a relationship between exchange rates and trade balances because the literature uses the consumer price index to construct the real exchange rate. Using sectoral price indices, they find a large negative impact of exchange rate volatility on trade.

This paper employs panel data methods on commodity trade balances, rather than bilateral trade balances, to identify the short and long run responses of trade flows to real exchange rate fluctuations. Unlike the previous literature, by using commodity trade data, this paper identifies product-specific responses to real exchange rate fluctuations and accounts for heterogeneous invoicing currency practices. In order to identify trade flows likely to meet the necessary contract invoicing conditions conducive to differential short run and long run effects, this paper employs the findings of the empirical contract invoicing literature.

The empirical currency invoicing literature is relatively small and new due to limited access to currency invoicing data. Several empirical regularities have emerged within this literature. The more common regularities include: (1) homogeneous goods are primarily invoiced either LCP or in U.S. dollars[5]; (2) exports, especially differentiated goods exports and exports to advanced countries, tend to be invoiced LCP[6]; (3) less developed countries tend to use vehicle currencies to invoice international transactions[7]; (4) LCP invoicing is prominent among exports to markets with less volatile currencies than the origin market[8]. In addition to these empirical regularities, Goldberg and Tille (2008, 2009) finds that large shipments tend to be invoiced LCP and that the euro is playing an increasingly large role in transactions between Eastern European countries and Eurozone countries. Fendel, Frankel, and Swonke (2008) survey German exporters and find that firm invoicing decisions are driven by the ability of the firm to use mark-ups if the law of one price holds in their respective market.

Much of the empirical currency invoicing literature focuses on the use of either local or producer currency pricing in contracts. Several studies explicitly focus on the internationalization of the U.S. dollar and the Euro. Frankel and Wei (1994) considers the emergence of the yen as an international currency among East Asian nations and finds that throughout the 1980s, Eastern Asian countries primarily used the U.S. dollar in trade transactions and that dollar use is likely to continue. Kamps (2006) investigates the use of the euro as an invoicing currency and finds that the U.S. dollar is still the primary vehicle currency used in international transactions especially among countries with monetary instability and with less differentiated traded products. Goldberg and Tille (2005) explicitly examine the role of the U.S. dollar as a vehicle currency and conclude that U.S. dollar pricing frequently occurs in homogeneous and reference priced goods trade.

The theoretical currency invoicing literature is large and well-established. Giovannini (1988), Donnenfeld and Zilcha (1991), and Friberg (1998) demonstrate the basic structure of the literature. These papers consider the invoicing decisions of a single exporting firm setting its price ex ante of the realized exchange rate. More recent work in this literature by Bacchetta and van Wincoop (2001, 2005), Corsetti and Pesenti (2002), and Devereux et al. (2004) approach the optimal invoicing currency choice using either general equilibrium open economy models or partial equilibrium open economy models.

[5] Goldberg and Tille (2008, 2009) and Kamps (2006)

[6] Goldberg and Tille (2008, 2009), Friberg and Wirlander (2008), Oi et al. (2004), Ligthart and Werner (2012), Ito et al. (2012)

[7] Goldberg and Tille (2008), Yousefi and Wirjanto (2003)

[8] Donnenfeld and Haug (2003) and Kamps (2006)

Hypotheses

The following model is based on the models described in Rose and Yellen (1989), Rose (1991), and Hacker and Hatemi-J (2004), but deviates in its construction of export and import prices. Prices are a linear function of yen denominated prices, foreign prices, and vehicle currency prices whose weights are determined by the share of contracts invoiced in each particular type of currency.

Assuming Marshallian demand and supply, export quantities are a function of the real exchange rate and foreign income while import quantities are a function of the real exchange rate and domestic income. Let X_t^Q denote export quantities of the home country at time t, M_t^Q denote import quantities of the home country at time t, Y_t is a measure of domestic income at time t and Y_t^* is a measure of foreign income at time t, then

$$X_t^Q = X_t^Q(RER_t, Y_t^*) \qquad M_t^Q = M_t^Q(RER_t, Y_t) \tag{3.2}$$

where RER_t denotes the real exchange rate in domestic currency per units of foreign currency at time t. Intuitively, the value of exports the domestic country can sell in the world market depends on the income levels of foreign countries participating in the world market and the bilateral real exchange rate between the home and foreign country. An increase in the income of the foreign country should lead to an increase in domestic country exports. If the domestic country's currency depreciates (i.e. a rise in the real exchange rate), domestic goods become relatively cheaper than foreign goods, increasing world demand for the domestic country's goods. A similar story can be told concerning the relationship between the domestic country's quantity of imports and the real exchange rate and domestic income. Expressed mathematically,

$$\frac{\partial X_t^Q}{\partial RER_t} > 0 \qquad \frac{\partial X_t^Q}{\partial Y_t^*} > 0$$

$$\frac{\partial M_t^Q}{\partial RER_t} < 0 \qquad \frac{\partial M_t^Q}{\partial Y_t} > 0$$

Define the trade balance (TB_t) as the ratio of the current value of exports in domestic currency to the current value of imports in domestic currency[9]:

$$TB_t = \frac{P_t^X \times X_t^Q(RER_t, Y_t^*)}{P_t^M \times M_t^Q(RER_t, Y_t)} \tag{3.3}$$

where P_X is the price of exports in domestic currency and P_t^M is the price of imports in domestic currency at time t. Firms have the ability to price their goods in yen (P_t), foreign currency (P_t^*), or in a vehicle currency, (P_t^V) meaning that the price of exports is a weighted average where the weights are the share of contracts invoiced in each particular currency. Thus

$$P_t^X = \alpha_0 \times P_t + \alpha_1 \times P_t^* \times E_t^{\frac{DC}{FC}} + (1 - \alpha_0 - \alpha_1) \times P_t^V \times E_t^{\frac{DC}{V}}$$

$$P_t^M = \gamma_0 \times P_t + \gamma_1 \times P^*_{t \times E_t^{\frac{DC}{FC}}} + (1 - \gamma_0 - \gamma_1) \times P_t^V \times E_t^{\frac{DC}{V}}$$

where α_0 and γ_0 are the shares of exports and imports invoiced in domestic currency, α_1 and γ_1 are the shares of exports and imports invoiced in the trading partners currency, and $\alpha_0 + \alpha_1 < 1$ and $\gamma_0 + \gamma_1 < 1$. $E_t^{\frac{DC}{FC}}$ is the domestic currency per foreign currency nominal exchange rate and $E_t^{\frac{DC}{V}}$ is the domestic currency per vehicle currency nominal exchange rate. One can show that the trade balance becomes

$$TB_t = \frac{(f + g \times RER_t^* + (1 - \alpha_0 - \alpha_1) \times RER_t^V) \times X_t^Q}{(\gamma_0 + \gamma_1 \times RER_t^* + (1 - \gamma_0 - \gamma_1) \times RER_t^V) \times M_t^Q}$$

where $RER_t^* = \frac{P_t^* \times E_t^{\frac{DC}{FC}}}{P_t}$ is the domestic currency per foreign currency real exchange rate and $RER_t^V = \frac{P_t^V \times E_t^{\frac{DC}{V}}}{P_t}$ is the domestic currency per vehicle currency real exchange rate.

[9]The traditional definition of the trade balance is the current value of exports less the current value of imports. However, the current literature defines the trade balance as the ratio of exports to imports in order to minimize censoring when using logarithmic transformation. Thus, I define the trade balance as the ratio of exports to imports rather than exports minus imports.

If the value of exports and imports are greater than zero, then one can show that the long run effects of an increase in foreign income or domestic income are

$$\frac{\partial TB_t}{\partial Y_t^*} > 0 \tag{3.4}$$

$$\frac{\partial TB_t}{\partial Y_t} < 0 \tag{3.5}$$

In order to generate differential trade responses in the short and long run, the Marshall-Lerner conditions cannot be satisfied in the short run; i.e. the elasticity of demand for exports and for imports must be relatively inelastic in the short run. If this is true, then over a short period of time, M_t^Q and X_t^Q can be treated as constant. This implies that the short run effect of bilateral real exchange rate depreciation, conditional on the yen-vehicle currency exchange rate remaining unchanged, is given by

$$\frac{\partial TB_t}{\partial RER_t^*} = \begin{cases} > 0 & \text{if } \dfrac{X_t^Q}{M_t^Q} > \dfrac{\gamma_1}{\alpha_1} \\ < 0 & \text{otherwise} \end{cases} \tag{3.6}$$

In words, the relative share of foreign currency invoiced imports must be less than the ratio of exports to imports to generate a short run effect that deviates from the expected long run improvement in the trade balance. In addition, Equation 3.6 demonstrates why foreign currency invoicing of both exports and imports requires a pre-depreciation trade deficit. That is, if $\alpha_1 = \gamma_1$, then the quantity of exports must be less than the quantity of imports.[10]

The short run response of the trade balance to a change in the domestic currency-vehicle currency exchange rate, ceteris paribus, is given by

$$\frac{\partial TB_t}{\partial RER_t^V} = \begin{cases} > 0 & \text{if } \dfrac{X_t^Q}{M_t^Q} > \dfrac{1-\gamma_0-\gamma_1}{1-\alpha_0-\alpha_1} \\ < 0 & \text{otherwise} \end{cases} \tag{3.7}$$

Intuitively, if the relative share of vehicle currency invoicing of imports is greater than the ratio of exports to imports, then the short run trade balance response should be negative.

[10]If the prices of exported and imported goods are assumed to be the same, then this implies that the value of exports must be less than the value of imports

Forming Expectations of Contract Invoicing Environments

One potential reason that the current literature has been unable to identify the response of trade flows to real currency depreciation may be the use of country-level trade data. Using country-level trade data likely underestimates the responsiveness of trade flows to exchange rate fluctuations because of heterogeneous currency invoicing patterns. The responsiveness of foreign currency invoiced transactions is averaged with the non-responsiveness of domestic currency transactions in country-level data which mutes the responsiveness of trade to real exchange rate fluctuations.

While I cannot observe the currency used to invoice trade transactions, to account for the responsiveness responsiveness of trade attributable to invoicing currencies, I utilize the results of the empirical contract invoicing studies to determine currency invoicing patterns across product and country characteristics. Using this information, I then identify the trade flows most likely to exhibit differential short run and long run trade balance responses to real depreciation.

According to Magee (1973), the necessary conditions for differential short and long run responses are: (1) exports are invoiced using LCP (non-yen currency) and imports are invoiced using PCP (non-yen currency) and there is a trade balance deficit prior to currency depreciation; or (2) both exports and imports are invoiced PCP (exports in yen, imports in non-yen currency). Table 1 summarizes Magee (1973) predictions. These necessary conditions are not generally met in bilateral trade flows. For instance, approximately 40% of Japan's exports and 20-30% of Japan's imports are invoiced in yen.[11] The remaining transactions are invoiced in trading partner currency or invoiced in vehicle currencies. U.S. dollar invoicing in transactions with the U.S. and other trading partners is prominent in Japanese trade. In 2001, U.S. dollar invoicing composed approximately 52% of Japanese exports and 70% of Japanese imports (Goldberg and Tille (2005)).

One innovation of this paper is the consideration of vehicle currency invoicing and how it affects the responsiveness of trade to real exchange rate fluctuations. A large portion of Japanese trade is invoiced in U.S. dollars rather than in LCP or PCP. One of the primary reasons for this behavior is that firms trading intermediate goods or raw materials can limit exchange rate pass-

[11] Source: ASEAN Institute for International Monetary Affairs, "Ways to promote foreign trade settlements denominated in local currencies in East Asia". February 2010. Goldberg and Tille (2005) find similar proportions of Japanese exports and imports invoiced in yen.

through into final goods prices by invoicing in foreign currency. Ito et al. (2012) and Oi et al. (2004) find evidence of this behavior. The question of how vehicle currency invoicing affects the responsiveness of trade to real exchange rate fluctuations has, to my knowledge, yet to be considered either theoretically or empirically.

The following subsections discuss in which trade flows the necessary contract invoicing conditions discussed in Magee (1973) are likely to occur. The invoicing conditions for the Japanese trade balance will only be met at the intersection of trade flows characterized by either PCP or LCP export flows and PCP import flows. The final subsection summarizes the trade flows expected to be invoiced using vehicle currencies.

Attributes of Export Flows Expected to be Invoiced LCP

Ito et al. (2012) surveys 23 exporting Japanese firms in three industries (automobile, electrical machinery, and general machinery) about how they price their goods in international contracts. They find that LCP is prevalent among the surveyed Japanese exporting firms. More specifically, LCP is most likely to occur in exports to advanced countries and when Japanese firms are not competitive in the destination market. Ito et al. (2012) also finds that LCP is likely when a firm's headquarters in Japan is sending goods to an affiliate. However, they also find that the U.S. dollar is used to denominate contracts when the final destination market is the U.S., especially in automobiles and electronics exported from Japan to Asian nations, which means that exports to an affiliate in the automobile and electronic industries are likely to be either LCP or priced using a vehicle currency. In addition, Goldberg and Tille (2008) also find LCP invoicing in homogeneous good exports and exports to Europe.

In contrast, Oi et al. (2004) and Ligthart and Werner (2012) find LCP invoicing in differentiated goods in line with Krugman (1986)'s price-to-market (PTM) theory. Goldberg and Tille (2009) finds evidence of LCP for larger export shipments, while Donnenfeld and Haug (2003) and Kamps (2006) find that LCP invoicing is more prevalent in exports to destination markets with more volatile currency values than the origination market.

Attributes of Export Flows Expected to be Invoiced PCP

While Ito et al. (2012) finds that LCP is more prevalent among Japanese exporters than PCP invoicing, Oi et al. (2004) finds evidence of PCP invoicing in Japanese exports when Japan has a larger world trade share than its trading partner and in exports to Asian nations in several industries (primarily equipment, machinery, and nonmetallic mineral products). Ito et al. (2012) also finds evidence of PCP invoicing in Japanese exports to Asian nations and that the share of exported goods to Asian nations invoiced in yen is smaller than the share of exported goods to Asian nations invoiced in U.S. dollars. Yousefi and Wijanto (2003) echoes the findings of Oi et al. (2004) and Ito et al. (2012) that firms from nations that are relatively larger tend to invoice PCP. Goldberg and Tille (2008), Kamps (2006), and Oi et al. (2004) find that PCP invoicing is more prevalent in differentiated goods exports.

Attributes of Import Flows Expected to be Invoiced PCP

To my knowledge, there are no contract invoicing studies specifically studying the currency invoicing patterns in imports. The expected attributes of PCP imports are likely symmetrical to PCP exports. Thus, PCP invoicing is expected to occur with imports from relatively larger countries, countries with large market shares in the Japanese market, and in differentiated goods imports (Goldberg and Tille (2008), Ligthart and Werner (2012)).

Over 90% of U.S. exports are invoiced using U.S. dollars which suggests that imports from the U.S. are priced in U.S. dollars, i.e. imports from the U.S. will be invoiced PCP (Gopinath and Rigobon (2008)). In addition, trade with Eurozone countries tends to be invoiced in the euro. (Goldberg and Tille (2005))

Trade Flows Expected to Meet the Necessary Invoicing Conditions for Differential Responses

Using the information from the previous subsections, one can find the intersection of exports invoiced LCP and imports invoiced PCP and the intersection of exports invoiced PCP and imports invoiced PCP. These intersections identify trade flows that meet the necessary contract invoicing conditions for differential short and long run trade responses.

Table 7 summarizes these results and identifies the intersection of the characteristics of trade likely involving PCP invoiced imports and PCP or LCP invoiced exports. Both LCP invoiced exports and PCP invoiced imports and PCP invoiced exports and PCP invoiced imports are likely to occur in differentiated goods trade flows and in trade flows with the United States and Europe.

Trade Flows Expected to use Vehicle Currency Invoicing

Vehicle currencies are currencies used to denote contracts that do no involve domestic agents. For example, Ito et al. (2012) notes that Japanese exporting firms typically use the U.S. dollar as an invoicing currency in transactions with Mexican and Russian firms and in transactions with affiliates in Asian nations where the final product is destined for the United States; the U.S. dollar is a vehicle currency in these transactions.

The most commonly used vehicle currency by both developed and developing nations is the U.S. dollar due to its stability and the size of U.S. international market transactions. In addition, internationally traded homogeneous goods are priced in U.S. dollars on organized exchanges and there is evidence that firms trading in these goods invoice contracts in U.S. dollars regardless of the nationality of the firm and the destination of the goods. Goldberg and Tille (2005) refers to this as the "coalescing effect" where firms entering homogeneous good markets adopt the pricing practices of existing firms. In addition, Oi et al. (2004) and Ito et al. (2012) note that Japanese firms tend to use U.S. dollars in trade transactions involving Asian nations. This is especially true in trade transactions between affiliates where the final good's destination market is the United States.

The trade flows that best match these two descriptions occur between Japan and Asian nations in homogeneous goods or in intermediate goods. These trade flows are used to explore differential Japanese trade balance responses to yen depreciation against vehicle currencies (i.e. the U.S. dollar) and against its trading partner's currency.

Data

Data used in this paper are from the Organization for Economic Co-operation and Development (OECD) and various government websites. The eighteen countries included in the final version of the dataset are China, the United States, South Korea, Hong Kong, Thailand, Germany, Singapore, Malaysia, Australia, Indonesia, the United Kingdom, Mexico, the

Netherlands, Russia, Canada, France, India, and Brazil. These countries are among Japan's top trading partners and their inclusion in the dataset was ultimately determined by the availability of each country's gross domestic product (GDP) and consumer price index (CPI). The dataset is quarterly and runs from 1988:Q1 to 2013:Q4.

While data is available between 1988-2013, in April 1998, a revision of the Foreign Exchange and Foreign Trade Control Law (FEFTCL) became effective and restructured "Japanese firms' practice of exchange rate risk management" (Shimizo and Sato (2014), Ito et al. (2008)). The revision was a part of the Japanese Financial System Reform, known as the "Japanese Big Bang", following the Asian Financial Crisis.[12]. Due to the nature of this reform, the dataset will be limited to 1998:Q2 to 2013:Q4. The next chapter explores the implications of FEFTCL reform on the responsiveness of Japanese trade to real exchange rate fluctuations.

The export and import data is from the Japanese Ministry of Finance and was downloaded as monthly data from January 1988 to December 2013. The monthly data was averaged over three month periods to create a quarterly measure of trade. The exchange rate series is from the Archive of the University of British Columbia's Sauder School of Business "PACIFIC Exchange Rate Service". GDP and CPI data is primarily from the OECD. GDP and CPI data for Hong Kong are from the Census and Statistical Department of Hong Kong, for Thailand are from the Bank of Thailand, for Singapore are from the Department of Statistics Singapore, and for Malaysia are from the Bank Negara Malaysia (Central Bank of Malaysia) Economic and Financial Data.

Two commodity classifications were used to distinguish product types. Rauch (1999) classifies commodities based on whether the goods are traded on an organized exchange, the goods' price is published in a trade journal, or the good has neither of these characteristics. Goods traded on organized exchanges are labelled homogeneous goods and goods with prices published in trade journals are labelled as reference priced goods. Goods with neither of these properties are labelled differentiated goods. I combine reference priced goods and homogeneous goods into one category referred to as homogeneous goods. The Rauch index was collected from Jon Haveman's "International Trade Data" website.

[12]Financial Services Agency of the Government of Japan, "Japanese Big Bang".

An alternative classification system to the Rauch Index employed in this paper is the Harmonized System (HS) Standard Product Groups. The HS Standard Product Groups are based on the United Nations Conference on Trade and Development (UNCTAD) standard operating procedures and are from the World Integrated Trade Solutions (WITS) website. This classification system categorizes goods into four categories: raw materials, intermediate goods, capital goods, or consumer goods.

Empirical Specification

A distributed lag model is used to empirically estimate the effects of real exchange rate depreciation on Japanese commodity trade balances using quarterly data. All regressions include country-commodity fixed effects and quarter-year dummy variables. For all models, the subscript indices identify the following: 'i' denotes country, 'j' denotes commodity, 't' denotes time.

Seven lags (1.75 years) were selected by comparing models with different lag specifications to find the empirical model with statistically significant and consistent estimates across specifications. Seven lags is consistent with the estimates of the current literature which suggests a time frame from anywhere from six months to five years.[13] However, the majority of studies appear to employ between two and twelve lags when using quarterly data. In general, the estimated coefficients were insensitive to the chosen lag length.[14]

$$\begin{aligned} \Delta \ln TB_{i,j,t} = \alpha + \beta_0 \Delta \ln GDP_{i,t} + \gamma_0 \Delta \ln RER_{i,t} \\ + \gamma_1 \Delta \ln RER_{i,t-1} + \gamma_2 \Delta \ln RER_{i,t-2} + ... + \gamma_7 \Delta \ln RER_{i,t-7} \\ + Z_{i,j,t} + \alpha_{i,j} + \tau_t + \varepsilon_{i,j,t} \end{aligned} \tag{3.8}$$

$\alpha_{i,j}$ denotes country-commodity fixed effects. τ_t denotes quarter-year fixed effects.

Dummy variables and interaction terms are used to estimate potential heterogeneous responses of the Japanese trade balance to yen depreciation. These dummy variables and

[13] Junz and Rhomberg (1965) suggest that the full response of the trade balance to real exchange rate fluctuations could be as long as five years. However, evidence from Artus and Knight (1984) and Klaussen (2004) suggest that the full response to trade flows is realized after approximately six to twelve months.

[14] The primary difference between different lag structures was the significance of the point estimates. All estimates remained approximately within one standard deviation of one another.

interaction terms are denoted by $Z_{i,j,t}$ in Equation 3.8. The set of variables in $Z_{i,j,t}$ varies by specification. The dummy variables were selected based on the empirical contract invoicing literature and include interactions between the real exchange rate and indicators of categorizing commodities by the Harmonized System Product Groups and the Rauch Index, a dummy indicating if the trade flow is with the United States or from Europe, and a dummy indicating trade with Asian nations.

The Rauch Index categorizes commodities based on whether the good's price is determined on an organized exchange, published in a trade journal, or determined in open markets. Goods whose prices are determined on organized exchanges and whose prices are published in trade journals are labelled homogeneous goods. Goods whose prices are determined in open markets are labelled differentiated goods.[15] The Harmonized System (HS) Product Groups categorize commodities as raw materials, intermediate goods, capital goods, or consumer goods based on the United Nations Conference on Trade and Development (UNCTD) standard operating procedures.

Results

This section contains the results of estimating Equation 3.8 using dummy variables to identify the variation in responsiveness across trade flows that exhibit currency invoicing patterns conductive to differential short run and long run responses to real depreciation. Section 3.7 contains the estimation results for Equation 3.8 with no added interaction terms identifying heterogeneous reactions of trade flows to yen depreciation. Sections 3.7 contains the estimation results when accounting for currency invoicing heterogeneity and Section 3.7 contains results for trade flows likely exhibiting vehicle currency invoicing.

Overall, I find evidence that differential responses in short run and long run trade responses to real depreciation require looking at the intersection of good types and trading partner characteristics. When looking at the intersection of these characteristics, I find that the response of trade in the long run may be correlated with comparative advantage.

[15]The Rauch Index classifies goods traded on organized exchanges as homogeneous goods while goods whose prices are published in trade journals are classified as reference priced goods. In this paper, I combine the two categories. Goldberg and Tille (2005) is one of many other works that also do this.

Baseline Results: No Heterogeneous Reactions to Yen Depreciation

Table 8 contains estimation results of Equation 3.8 when not accounting for currency invoicing heterogeneity. The evidence for deviations from long run responses should manifest as negative coefficients for the first set of real exchange rate lags. At some point, the coefficients on these lags are expected to become positive. The initial negative coefficients correspond to short run deterioration in the trade balance and the positive coefficients correspond to long run improvement in the trade balance.

Results in Table 8 indicate that the average effect of a yen depreciation on Japanese commodity trade balances is positive. The results suggest that one percent real yen depreciation generates a 0.170% contemporaneous, average increase in Japanese commodity trade balances. The coefficient estimates are the quarterly effects of yen depreciation; however, the cumulative effect over time gives a clearer picture of the total impact of real exchange rate fluctuations. The cumulative effect is calculated as the effect of real depreciation each quarter conditional on the response of previous quarters. The long run effect is given by the cumulative effect seven quarters after real depreciation.

Based on the empirical currency invoicing literature, Japanese firms use both domestic and foreign currency invoicing in international trade; however, foreign currency invoicing and vehicle currency invoicing occur in more than half of Japanese trade transactions, as noted in Section 3.4. This information suggests that Japanese trade balances should increase in the short run in response to real yen depreciation, which is consistent with the estimates in Table 8. The long run response of trade balances to real depreciation is also positive, as predicted by the current literature.

Figure 7 clearly illustrates that the results in Table 8 do not contain evidence of differential short run and long run trade balance responses to real yen depreciation. The unaccounted heterogeneity in currency invoicing across products and trading partners may result in substantial variation from the above results. Real exchange rate fluctuations are transmitted via the invoicing currency used in an international transaction. Using the results of Section 3.4 regarding the expected currency invoicing environment, one can begin to search for differential short and long run trade responses. The following sections explore the trade flows likely to exhibit heterogeneous short and long run trade responses.

Allowing Heterogeneous Reactions to Real Yen Depreciation

The intersection of LCP invoiced exports and PCP invoiced imports is expected to occur when Japan trades with advanced countries and in differentiated goods trade. For the following estimation results, advanced countries are those expected to be economically larger than Japan and who compose a large share of world trade. The countries most likely to meet these conditions are the United States and Western European countries, which in this sample are the United Kingdom, France, and Germany. Differentiated goods and homogeneous goods are identified using the Rauch Index (Rauch (1999)). Differentiated goods are defined as goods whose prices are market determined. Homogeneous goods are defined as goods traded on organized exchanges or whose prices are listed in trade catalogs[16].

Figure 8 summarizes the estimation results of Equation 3.8 when accounting for trade with the United States and European countries. The full estimation results are contained in Table 9. The quarterly response of Japanese trade balances with non-U.S./European trading partners is positive and statistically significant both concurrently and the first quarter following real depreciation. According to the estimates in Table 9, one percent real depreciation results in an average long run increase in Japanese trade balances with non-U.S./European trading partners of 0.5764%. In contrast, the initial response of Japanese trade balances with the U.S. and sampled European countries falls contemporaneously by 0.296% in response to a one percent real depreciation and increases thereafter. The long run effect is an average increase of 0.3186%.

Trade between Japan and the U.S. and Europe appears to exhibit differential short and long run effects which is consistent with what is expected to happen given the likely currency invoicing environment established in Section 3.4. Japanese firms trading with advanced countries are likely to invoice contracts using their trading partners' currency. That is, Japanese exports to and imports from the U.S. and European countries are likely to be invoiced in U.S. dollars, the euro, or the pound. When the Japanese yen depreciates against these currencies then both Japanese exports and imports are likely to increase contemporaneously with the depreciation. The differential short run and long run responses are generated by the relative size of exports to imports while the adjustment process is driven by trading firms' responses to the depreciation.

[16]The Rauch Index classifies goods traded on organized exchanges as homogeneous goods and goods whose prices are printed in trade catalogs as reference priced goods. I combine these two groups into one, which I refer to as homogeneous goods.

The negative short run response of trade balances with the U.S. and Europe suggests that Japanese trade balances with these countries are negative.

To see this, consider Figure 10 which contains the cumulative response of Japanese exports and imports to real yen depreciation. Both Japanese exports to and imports from the U.S. and sampled European countries increase contemporaneously with yen depreciation; however, the value of imports rises more than the value of exports which generates the contemporaneous fall in Japanese trade balances with the U.S. and Europe seen in Figure 8. Approximately one to two quarters following depreciation, Japanese and U.S./European firms adjust to the new relative value of the yen and Japanese exports increase while Japanese imports fall.

In the short run, international contracts are sticky, in that the quantities bought and sold are fixed. When real depreciation occurs, the relative price of yen to foreign currency has changed. If both export and import contracts are predominantly invoiced in foreign currency, then Japanese exporters and importers must use the new relative price of yen to convert payments to yen. As a result, both the value of imports and the value of exports will rise. If the value of imports increases by more than the value of exports, then the ratio of exports to imports should fall which is what is observed in Figures 8 and 10.

Over time, trade contracts expire and firms are able to adjust their buying and selling behavior based on the new value of the real exchange rate. Because the value of the yen has fallen, foreign goods are more expensive and Japanese importers should import less. In addition, Japanese goods are now cheaper for foreign countries to consume and Japanese exporters should export more. As Japanese exports rise and Japanese imports fall, the Japanese trade balance improves. In the long run, one percent real depreciation is estimated to increase both Japanese exports and imports with the U.S. and European countries. Japanese exports increase by 0.4304% and Japanese imports increase by 0.1126% which results in a long run estimated trade balance improvement of approximately 0.3186%.

In contrast, exports to other trading partners rise while imports falls. The persistent increase in exports to other nations may be driven by Japanese multinational behavior. Ito et al. (2012) suggests that Japanese multinationals export intermediate goods to other (primarily Asian) nations for assembly into final goods that are then sold to the U.S. and Europe. These transactions are conducted in U.S. dollars in order to avoid exchange rate pass-through into the price of the final good. Yen depreciation would result in a contemporaneous increase in the value of the exports to these nations and would also encourage Japanese multinationals to increase trade with these nations in order to boost final goods sales in the U.S. Hence, yen depreciation would indirectly increase Japanese trade with the U.S. and Europe through increased affiliate trade.

In addition to trade responsiveness being specific to trade with relatively larger countries versus relatively smaller countries, the responsiveness to trade in the short and long run may also be product-specific. Figure 9 summarizes the results of Equation 3.8, allowing for differential responses across differentiated and homogeneous good trade balances. For both types of goods, commodity trade balances typically exhibit positive and significant contemporaneous increases in response to real yen depreciation. The responses differ in that differentiated good trade balances monotonically increase and converge to higher long run equilibrium while the estimated response of homogeneous good trade balances does not before converging. The long run effect of real depreciation on differentiated good trade balances is 0.5711% while the long run effect on homogeneous good trade balances is 0.4662%.

Based on the empirical currency invoicing literature, homogeneous goods trade should respond differently to real depreciation than differentiated goods trade, because, as Goldberg and Tille (2005) note, foreign currency and vehicle currency invoicing are prevalent in homogeneous goods trade due to a "coalescing effect", while evidence suggests that differentiated goods trade is invoiced in both domestic and foreign currency. Japanese firms engaged in the differentiated goods market are likely using more yen invoicing which means that differentiated goods trade balances should respond less to real yen depreciation in the short run. The currency invoicing literature finds mixed results concerning the prevalence of local currency pricing, producer currency pricing, and vehicle currency pricing in differentiated goods trade. Rather, the literature finds that currency invoicing in differentiated goods relies on trading partner characteristics.[17]

The estimation results for homogeneous and differentiated goods exports and imports are summarized in Figure 11. Differentiated good exports gradually increase over time while differentiated good imports gradually fall. The combined responses result in the gradual increase in differentiated good trade balances identified in Figure 9. In contrast, homogeneous good

[17] Oi et al. (2004), Ligthart and Werner (2010), Goldberg and Tille (2008), and Kamps (2006) are specific examples of this.

exports increase and gradually fall over time. Overall, these exports increase relative to pre-depreciation levels. Additionally, homogeneous good imports initially rise then fall, as predicted.

While trading partner characteristics and good characteristics influence the invoicing currency used in a transaction on their own, using the intersection of these characteristics should enable more accurate identification of environments likely to exhibit differential short run and long run responses to real yen depreciation. Because I do not observe the currency used to invoice contracts, the better I am able to predict the currency invoicing environment, the more likely I will be able to accurately predict the responsiveness of trade. Identifying intersections of the characteristics described in the currency invoicing literature may be critical to pinning down differential short run and long run trade balance responses to real depreciation.

The currency invoicing literature described in Section 3.4 suggests that one should see foreign currency pricing in Japanese trade with the U.S. and European countries in homogeneous goods. Homogeneous goods trade with the U.S. and European countries should exhibit short run increases in both exports and imports in response to real depreciation. There will also likely be some responsiveness in differentiated goods trade between Japan and the U.S. and European countries. However, because there may be some yen invoicing in these trade flows, they are expected to respond less in the short run to real yen depreciation than homogeneous goods trade.

Figure 12 summarizes the estimation results of Equation 3.8 when heterogeneous reactions of Japanese trade balances are accounted for in differentiated goods and advanced countries. While there is some variation in differentiated goods trade in trade with the U.S. and European countries versus trade with other countries, there is substantial variation in the responsiveness between homogeneous good trade balances with U.S. and European countries and these trade balances with other trading partners. Homogeneous good trade balances with the U.S. and Europe decline in the long run by 1.4124%. When only accounting for heterogeneity across one dimension of trade characteristics, all long run estimates of the response of trade to real depreciation were positive. This evidence suggests that real depreciation may not benefit all sectors of an economy in the long run, especially sectors that are more competitive or in which Japan has a comparative disadvantage.

Estimating the responsiveness of imports and exports within this intersection of characteristics yields some additional interesting results. Figure 13 further demonstrates that the responsiveness of trade varies by trading partner and by goods. In addition, it provides evidence that the trade deficit or shrinking trade surpluses in homogeneous goods trade balances with the U.S. and Europe generated by real depreciation are likely the result of Japan's comparative disadvantage in homogeneous goods as well as foreign currency invoicing in these trade flows. Japan likely has a comparative disadvantage in homogeneous goods such as raw materials, leading it to rely on importing these goods. Regardless of real depreciation, Japanese firms must import raw materials because Japan does not have the natural resources to produce these goods domestically. In addition, the empirical currency invoicing literature notes that these trade flows are likely to use foreign currency pricing which means that real yen depreciation quickly increases the value of these imports in terms of yen, decreasing Japanese homogeneous good trade balances.

Overall, I find evidence that differential responses in short run and long run trade responses to real depreciation can be found across trading partner characteristics and across trading partner by commodity characteristics. This suggests that trading partner characteristics play a crucial role in determining invoicing currencies, which is reinforced by the findings of the currency invoicing literature. Hence, the evidence of trade responsiveness to real yen depreciation across trading partners. The estimate results also suggest that commodity characteristics on their own are not driving currency invoicing decisions. Rather, commodity characteristics are secondary to trading partner characteristics. Moreover, the stronger results across commodity and trading partner characteristics suggest that the responsiveness of trade to real depreciation is correlated with comparative advantage.

The Role of Vehicle Currencies

To my knowledge, this paper is the first to investigate the implications of vehicle currency invoicing on the responsiveness of trade to real exchange rate fluctuations, both in forming a hypothesis of and empirically investigating these implications. Firms who use vehicle currencies should only change their trading behavior when the value of the yen changes in terms of the vehicle currency rather than in terms of their trading partner's currency. Consequently, real yen depreciation against a vehicle currency should generate a different trade balance response than real yen depreciation against non-vehicle currencies. This may be generating the results for homogeneous goods trade in the previous section.

The most commonly used vehicle currency worldwide is the U.S. dollar. Ito et al. (2012) and Oi et al. (2004) present evidence that Japanese firms commonly use the U.S. dollar as a vehicle currency in transactions with Asian nations. Figure 14 summarizes the results of estimating Equation 3.8 with interaction terms between a dummy variable indicating trade flows with Asia and a dummy variable indicating observations when the U.S. dollar appreciates against the yen. Interactions between the real exchange rate variables and both dummies were also included in the specification. Table 12 contains the estimation results.

One would expect that if trade between Japan and Asian nations is predominantly invoiced using the U.S. dollar as a vehicle currency, then real yen depreciation should increase Japanese trade balances with Asian nations the short run. Ito et al. (2012) notes that Japanese multinationals export intermediate goods from Japan to affiliates in Asia who then assemble the final product and export the good to its final destination, typically the U.S. or Europe. If the yen depreciates relative to the U.S. dollar, then the value of Japanese exports invoiced in U.S. dollars to affiliates in Asia will rise. In the long run, Japanese multinationals should export goods destined for the U.S. or Europe to Asian affiliates which would result in a long run increase in Japanese trade balances with Asian nations.

Figure 14 confirms this prediction. However, there is likely a lot of underlying responsiveness in exports and imports. Looking at Japanese exports to and imports from Asian nations in Figure 15, trade with Asian nations responds is a significantly different way than trade with non-Asian nations. First, real depreciation increases exports to Non-Asian nations by more than exports to Asian nations. In the long run, exports to Asian nations increases by 0.3488% following real depreciation while exports to non-Asian nations increases by 0.4357%.

Second, imports from Asian nations fall by more in response to real depreciation than imports from non-Asian nations. In the long run, imports from Asian nations fall by 0.3116% while imports from non-Asian nations fall by 0.0797%. This result is likely correlated with comparative advantage. Japan relies heavily on imports of homogeneous goods such as raw materials. Many of these materials come from non-Asian nations, specifically the U.S. Hence, imports from non-Asian nations is likely more inelastic than imports from Asian nations.

Third, the currency invoicing environment can explain the different contemporaneous reactions in Asian and Non-Asian nation trade. Exports to Asian nations are likely invoiced in foreign currency while imports from Asian nations are likely invoiced in either U.S. dollars or yen. One would expect exports to Asian nations to increase contemporaneously with real depreciation, but imports to remain unchanged. Many of the non-Asian nations are economically large which suggests that transactions with non-Asian nations are invoiced in foreign currency. Hence, one would expect exports and imports with non-Asian nations to increase contemporaneously with real depreciation.

Conclusion

The current literature exploring the relationship between real exchange rate fluctuations and trade and trade balances suffers from an averaging effect generated by aggregating heterogeneous export and import transactions to country-level trade. These transactions have heterogeneous trading partner- and trading partner by product-specific responses to real exchange rate fluctuations. Data aggregation generates the mixed results that dominate the empirical literature. To my knowledge, this is the first paper exploring the implications of trading partner and product heterogeneity and accounting for heterogeneous currency invoicing on the dynamics of trade flows following a real exchange rate shock.

Using the theoretical literature and empirical contract invoicing literature, I identify trade flows likely to exhibit differential short run and long run responses to real exchange rate shocks. There is some evidence of differential effects in trade with the U.S. and Europe. Trade contracts between Japanese firms and the U.S. or European firms are likely invoiced in the U.S. dollar or the euro. This invoicing pattern would result in trade being very responsive to real yen fluctuations in the short run. Following yen depreciation in the short run, the value of imports from the U.S./Europe grows faster than the value of exports to the U.S./Europe which results in a negative Japanese trade balance response for one to two quarters. This greatly contrasts the response of Japanese trade balances with other countries, which increase in both the short and long run.

Overall, I find that trade responsiveness to real exchange rate fluctuations is likely correlated with comparative advantage. Japan is dependent on international trade to secure natural resources and similar homogeneous goods. My results suggest that firms trading in goods in which Japan has a comparative disadvantage respond less to real yen depreciation in the short run than goods in which Japan likely has a comparative advantage which results in large trade balance deteriorations in the long run.

CHAPTER IV

IMPLICATIONS OF THE JAPANESE “BIG BANG” FOR JAPANESE TRADE

Introduction

Following the Asian Financial Crisis of the mid-1990s, Japan undertook broad financial market reform known as the Japanese “Big Bang”. Prior to the “Big Bang”, Japanese financial markets were segmented. For instance, banks could not issue or sell securities and Japanese firms could not issue bonds as a means to fund operations. One specific aspect of the reform concerned the Foreign Exchange and Foreign Trade Control Law (FEFTCL), which prior to April 1998, restricted access to foreign exchange markets to foreign exchange banks. Firms wishing to conduct foreign exchange operations in Japan purchased foreign currency through these specific foreign exchange banks. Before finalizing the transaction, the foreign exchange bank would get the transaction approved by the Japanese Ministry of Finance (MOF). The lack of competition in the foreign exchange banking system resulted in high foreign exchange fees that drove Japanese multinationals to conduct foreign exchange operations in international markets, namely London and New York (Patrikis (1998)). The FEFTCL revisions allow all financial market participants to engage in foreign exchange operations, including buying and selling foreign currencies and derivative transactions (MOF (2015)).

The FEFTCL revisions, coupled with broad financial reform, have potentially large consequences for both the short run and long run responsiveness of Japanese trade to real exchange rate fluctuations. After the reforms, all financial institutions were granted access foreign currency markets which lowered transactions cost for firms and individuals seeking foreign currency and increased the ability of firms to use futures markets to hedge against exchange rate risk. FEFTCL reform should have enabled internationally trading firms to optimally hedge against real exchange rate risk. If this is true, then trade after the April 1998 reform should be less responsive to real yen fluctuations.

Identifying the consequences of FEFTCL reform on trade is valuable for both policy makers attempting to spur growth in trade and for internationally trading firms maximizing profits. Firms that are able to hedge against exchange rate risk are likely to participate more or continue to participate in international goods and services markets. In addition, firms who are not trading internationally may enter international markets when given the ability to hedge exchange rate risk.

To my knowledge, the implications of FEFTCL reform on the relationship between disaggregated trade and real yen fluctuations are largely unexplored. Shimizu and Sato (2013) is a country-level study that explores the implications of FEFTCL revisions on the responsiveness of country-level trade balances to real exchange rate fluctuations using time series methods. They find negative short run trade balance responses to real yen depreciation and positive long run trade balance responses, in the period prior to, but not after the revision. Other papers concerning FEFTCL reform examine its effects on yen volatility.

In contrast to the current literature on FEFTCL revisions, I use commodity-level trade data to examine if and how the responsiveness of Japanese trade flows to real yen fluctuations changed following the reform. There are two primary benefits to using commodity-level trade data to analyze the responsiveness of trade to real yen fluctuations. First, disaggregated data minimizes concerns of endogenity between trade, gross domestic product (GDP), and real exchange rates. While real exchange rates and GDP may inform the level of commodity trade, no one commodity trade category composes enough of total Japanese trade to influence GDP or real bilateral exchange rates. Second, panel data enables me to account for events and characteristics for which time series methods, such as vector error correction models, cannot. That is, I can use dummy variables to identify trading partners, characteristics of trading partners, characteristics of products, and major economic events.

I find that liberalization results in Japanese trade responding less to real exchange rate fluctuations which is likely due to the new ability of firms to quickly respond to real exchange rate fluctuations through participation in foreign exchange and futures markets. I also find that FEFTCL revisions may have eliminated the long run benefits of currency depreciation. These findings are consistent across good and trading partner characteristics.

Section 4.2 contains a review of the relevant literature. Section 4.3 describes the Foreign Exchange and Foreign Trade Control Law (FEFTCL). Section 4.4 describes the data and section 4.5 describes the estimation strategy. Section 4.6 contains the results and Section 4.7 concludes.

Literature Review

The current literature discussing the Foreign Exchange and Foreign Trade Control Law (FEFTCL) reform in Japan builds on academic work that estimates the relationship between international trade and exchange rates that emerged in the 1970s.[1] In the 1970s, the literature on international trade and exchanges rates developed into two strands. One strand, which includes Magee (1973), Krugman and Taylor (1978), and Gylfason and Risager (1984), characterize and explore the implications of bilateral exchange rate fluctuations on bilateral trade flows, while the other strand, which includes Hooper and Kohlhagen (1978), Kenen and Rodrik (1986), Thursby and Thursby (1987), and De Grauwe (1988), characterize and explore the implications of increasing volatility on bilateral exchange rates.

The literature on the relationship between trade and exchange rate volatility generally finds either no effect or that increasing exchange rate volatility results in slightly less international trade. Hooper and Kohlhagen (1978) tests how exchange rate volatility affects the volume of trade and finds no significant effect, while Kenen and Rodrik (1986) finds that exposure to volatility differs across countries, but on average, increasing exchange rate volatility depresses trade. Rose (2000) uses examines effects of currency unions on trade using a gravity model and finds a significant positive effect of currency unions on trade. Rose (2000) also finds a small negative effect of exchange rate volatility on trade. Teneryro (2006) finds no significant impact of exchange rate volatility on trade.

In contrast to the findings of more recent literature on trade and exchange rate volatility, Byrne, Darby, and MacDonald (2006) argues that sectoral price indices should be used to construct the real exchange rate rather than the consumer price index. When using sectoral price indices, Byrne, Darby, and MacDonald (2006) finds a large negative impact of exchange rate volatility on trade.

The other strand of literature that emerged in the 1970s focuses on the relationship between trade balances and exchange rate fluctuations. The primarily focus is the J-curve hypothesis. According to Magee (1973), the J-curve hypothesis states that currency depreciation will result in temporary trade balance deterioration before long run trade balance improvement. J-curve studies typically use time series methods to estimate the short run and long run

[1] Prior to the 1970s, this work was largely theoretical, dating back to the 1940s.

relationships between country-level trade and the real exchange rates and typically find mixed results concerning the presence of J-curves. For example, Miles (1979) finds that currency depreciation does not improve the trade balance, while Himarios (1985), using a subset of countries in Miles (1979), finds that currency depreciation improves the trade balance.

Deviating from the early J-curve literature, Rose and Yellen (1989) use panel data methods to estimate the relationship between real exchange rate fluctuations and trade and find no conclusive evidence that a relationship exists in the short run or the long run. Several studies adopted panel data methods following Rose and Yellen (1989) including Marwah and Klein (1996), who confirm the presence of J-curves using quarterly trade data between the United States and Canada, and Shirivani and Wilbratte (1997), who find a statistically significant relationship between the trade balance and the real exchange rate using country-level monthly bilateral trade data. These studies use similar estimation techniques and all employ country-level data.

Bahmani-Oskooee and Brooks (1999) was among the first J-curves studies to use vector error-correction models (VECMs) to eliminate the simultaneity bias and unit root/cointegration bias found in earlier empirical work. They find that U.S. dollar depreciation does not result in a J-curve effect but does result in a long run trade balance improvement. More recent studies continue to employ the VECM approach to examine J-curves. These include Bahmani-Oskooee and Goswami (2003), Hacker and Hatemi-J (2004), Dash (2005), and Bahmani-Oskooee and Harvey (2010). In general, these studies find evidence of cointegration between the aggregate trade balance, the real exchange rate, and national income and find mixed results concerning the presence of J-curves. Empirical work on the J-curve usually concludes that J-curves are country-specific.

This paper also differs substantially from the previous literature examining the effect of the FEFTCL reform on Japanese trade. Shimizu and Sato (2013) examine changes in in the relationship between country-level Japanese trade balances and real yen fluctuations using time series techniques. They find evidence of differential short run and long run trade balance responses to yen depreciation, specifically "J-curves" before FEFTCL reform, but not after.The scope of this paper is broader in that it considers the implications of FEFTCL reform on different types of Japanese trade and on Japanese exports, imports, and trade balances. In contrast to the current literature, this paper also employs panel data methods and uses commodity-level trade data.

There are a few studies concerning yen exchange rate volatility during the time of FEFTCL reform. Ito and Melvin (1999) find evidence of “a structural change in the wholesale exchange rate quotes consistent with lower transaction costs in Japan” and decreased volatility in yen exchange rates following deregulation of the foreign exchange market (13). In addition, Hillebrand and Schnabl (2004) find evidence for structural break in the volatility of yen-dollar exchange rates in the late 1990s. Prior to 1999, foreign exchange interventions increased yen volatility while after 1999, interventions decreased volatility.

This paper is also related to the exchange rate risk hedging literature. A subset of this literature examines the extent of firm exchange rate exposure and how firms manage against exchange rate risk. An existing puzzle that this subset of literature is primarily concerned is that lack of significance exchange rate volatility has on firm exports. To my knowledge, many papers use the “hedging hypothesis” to justify results confirming this puzzle. The hedging hypothesis refers to firms using hedging instruments to mitigate exchange rate risk. Allayannis and Offek (2011) is a recent example of one such paper. Allayannis and Offek (2011) finds that participation in international trade is linked with firm exposure to exchange rate risk and find that firms use currency derivatives to hedge against exchange rate risk rather than speculate in foreign currency markets. They state that the degree of hedging is consistent with the lack of relationship between exchange rate volatility and international exports. However, Wei (1999) explores the validity of the hedging hypothesis and finds no evidence to support the hypothesis and significant negative relationship between trade and exchange rate volatility.

Other work on hedging and exchange rate risk management includes He and Ng (1998) finds that firms who participate more in international trade and larger internationally trading firms are exposed to more exchange rate risk. Hutson and Stevenson (2010) find that firms operating in open economies are more exposed to exchange rate risk than those operating in less open economies. Jesswein, Kwok, and Folks (1995) examines the use of complex versus simple financial products to hedge against exchange rate risk and finds that multinational corporations tend to use simple hedging instruments such as forward contracts. Bartram, Brown, and Minton (2009) finds that firms hedge against exchange rate risk using both financial hedges and operational hedges and that operational hedging decreases firm exchange rate exposure by 10-15% and financial hedging decreases firm exchange rate exposure by about 40%.

Overview of the Foreign Exchange and Foreign Trade Control Law

The Foreign Exchange and Foreign Trade Control Law (FEFTCL) was implemented in Japan on December 1, 1949, during Allied occupation following World War II. FEFTCL initially prohibited all international transactions by Japanese citizens, firms, and banks unless authorized by the Japanese government, effectively forbidding private parties from holding foreign currency (Takagi (1996), Fukao (1990)). The implementation of this law led to the creation of foreign exchange banks whose sole purpose was to buy and sell foreign currency[2]. The FEFTCL "reflected the needs of the post-war reconstruction period with scarce foreign exchange under very severe economic conditions" (Fukao (1990), 143) Additionally, FEFTCL fixed the yen-U.S. dollar and yen-pound sterling exchange rates (Takagi (1996)).

Throughout the 1950s, there were some revisions to the foreign currency controls in the FEFTCL. In its earliest form, the FEFTCL allowed Japanese firms to obtain foreign currency for payments in "designated foreign currency" of which, there were only two: the U.S. dollar and pound sterling. However, as Japanese trade expanded to more European and Asian nations, the list of designated foreign currencies expanded (Takgi (1996)).

Major revision to the Foreign Currency Laws were made in the early 1960s as Japan sought to meet the general membership obligations of the International Monetary Fund's (IMF) Article VIII and to join the Organization for Economic Cooperation and Development (OECD). To meet these requirements, Japan abolished some of its foreign currency controls and foreign currency allocation procedures (Takgi (1996)). For example, in July 1960, free yen accounts were established for non-residents (Fukao (1990)). In April 1963, the Japanese government switched the yen exchange rate from a fixed exchange rate to a floating peg (Fukao (1990)). Japan officially met the IMF's Article VIII membership requirements and joined the OECD in late April 1964.

In the early 1970s, the U.S. suspended convertibility of the U.S. dollar to gold and officially adopted a floating exchange rate system. During 1971-1973, Japanese authorities tightly

[2]The original law required foreign exchange banks to buy foreign currency from the Foreign Exchange Control Board, selling foreign currency to customers with government approval of each transaction. The law was revised in July 1950 to allow foreign exchange banks to hold some dollar deposits (Takagi (1996)).

controlled exchange rates through aggressive interventions and exchange controls. During this time period, the band on the yen exchange rate doubled. Despite efforts to avoid a floating exchange rate system, the yen officially became a floating exchange rate on February 14, 1973 and was operated as a managed float until 1980. (Fukao (1990)) In December 1980, a revised Foreign Exchange Law came into effect. The new law removed government authorization of every exchange rate transaction except in a few circumstances. The new Foreign Exchange Law remained fairly unchanged until the Japanese "Big Bang" in 1998. (Fukao (1990))

According to Ito and Melvin (1999), the purpose of the Big Bang was to "make the Japanese financial markets more competitive [with world financial centers] and to provide Japanese institutions with more opportunities" (3). The Big Bang, in addition to other financial reforms, eliminated foreign exchange controls in April 1998 and abolished foreign exchange banks.

Data

The data used in this paper are available from the Organization for Economic Co-operation and Development (OECD) and various government websites. Japan's eighteen trading partners included in the final version of the dataset are China, the United States, South Korea, Hong Kong, Thailand, Germany, Singapore, Malaysia, Australia, Indonesia, the United Kingdom, Mexico, the Netherlands, Russia, Canada, France, India, and Brazil. These countries are among Japan's top trading partners and their inclusion in the dataset was ultimately determined by the availability of each country's gross domestic product (GDP) and consumer price index (CPI). The dataset is quarterly and runs from 1988:Q1 to 2013:Q4.

The export and import data is from the Japanese Ministry of Finance website "Trade Statistics of Japan". It was originally downloaded as monthly data from January 1988 to December 2013. The exchange rate series is from the Archive of the University of British Columbia's Sauder School of Business "PACIFIC Exchange Rate Service". GDP and CPI data is primarily from the OECD. GDP and CPI data for Hong Kong is from the Census and Statistical Department of Hong Kong, for Thailand is from the Bank of Thailand, for Singapore is from the Department of Statistics Singapore, and for Malaysia is from the Bank Negara Malaysia (Central Bank of Malaysia) Economic and Financial Data.

This paper employs the Rauch Index (Rauch (1999)). The Rauch Index classifies commodities based on whether the goods are traded on an organized exchange, the good's price is published in a trade journal, or the good has neither of these characteristics. Goods traded on organized exchanges are labelled homogeneous goods and goods with prices published in trade journals are labelled as reference priced goods. Goods with neither of these properties are labelled differentiated goods. I combine reference priced goods with homogeneous goods into one category referred to as homogeneous goods. The Rauch index was obtained from Jon Haveman's "International Trade Data" website.

Empirical Specification

For the following model, the subscript indices identify the following: 'i' denotes country, 'j' denotes commodity, 't' denotes time.

$$\begin{aligned} \Delta \ln Trade_{i,j,t} = \alpha + \beta_0 \Delta \ln GDP_{i,t} + \gamma_0 \Delta \ln RER_{i,t} \\ +\gamma_1 \Delta \ln RER_{i,t-1} + \gamma_2 \Delta \ln RER_{i,t-2} + ... + \gamma_8 \Delta \ln RER_{i,t-8} \\ +Z_{i,j,t} + \alpha_{i,j} + \tau_t + \varepsilon_{i,j,t} \end{aligned} \tag{4.1}$$

where $\Delta \ln Trade_{i,j,t}$ is the first difference of the natural log of the trade balance (defined as the ratio of export to imports), Japanese exports, or Japanese imports, $\Delta \ln GDP_{i,t}$ denotes the first difference of the natural log of country i's GDP,$\Delta \ln RER_{i,t-n}$ $(n = 0, ...6)$ is the first difference of the natural log of the real exchange rate (yen per foreign currency) at time $t - n$, $April98$ is a dummy variable identifying observations occurring after April 1998, $\alpha_{i,j}$ denotes country-commodity fixed effects, and τ denotes quarter-year fixed effects.

$Z_{i,j,t}$ is set of interactions terms of dummy variables with the real exchange rate and its lag. $Z_{i,j,t}$ varies based on the trade groups of interest. Dummy variables in $Z_{i,j,t}$ include a dummy for the period after April 1998 ($April98$), homogeneous goods, differentiated goods, trade with the U.S. and the sampled European countries, and trade with Asian nations. The following analysis also estimates Equation 4.1 using the value of exports and the value of imports as dependent variables.

Eight lags were selected by estimating Equation 4.1 with dummy variables for the period after April 1998 and interactions of these dummies with the real exchange rate and its lags using different lag lengths. After comparing the results across lag lengths, eight lags were selected because it yielded statistically significant coefficients whose values were consistent over different lag lengths.

Results

Responsiveness of Japanese Trade Before and After April 1998

The Foreign Exchange Law revision likely affected the responsiveness of firms to real exchange rate fluctuations; that is, now that firms have a greater access to foreign exchange markets, the responsiveness of trade to real exchange rate fluctuations has likely declined. Table 13 contains the estimation results of estimating Equation 4.1 including a dummy variable equal to one for observations appearing after April 1998.

Table 13 suggests that Japanese trade flows before and after April 1998 react in a significantly different manner in the short run. Trade balances in the period after April 1998 are much less response to one percent real yen depreciation than trade before April 1998. However, before and after FEFTCL reform, the estimated long run response to real depreciation is insignificant. Prior to reform, there is evidence of temporary short run improvements in the Japanese trade balance following real depreciation. After reform, these gains disappear.

The lack of responsiveness of trade to real yen fluctuations following FEFTCL revision is summarized in Figure 16. Figure 16 reinforces the idea that the trade balance response to real depreciation is substantially different before and after April 1998 in the short run. These results suggest that Japanese foreign exchange intervention policies likely have different effects post-reform than prior to reform. The Japanese government intervenes in foreign exchange markets fairly often over the sample period. The most recent large scale intervention occurred in 2012. The primary motivation for this intervention is to devalue the yen in order to increase net exports. However, these results suggest that the short run gains from yen devaluation that occurred prior to FEFTCL reform may no longer exist and large scale yen devaluation will have little effect on the Japanese trade balance.

In the previous chapters, there were heterogeneous responses of trade flows to real depreciation. These heterogeneous responses may look significantly different before and after FEFTCL reform. The following subsection investigates this heterogeneity.

Heterogeneity in Trade Responses Before and After April 1998

Heterogeneity within trade has been shown throughout the last two chapters to influence the responsiveness of trade flows to real depreciation. FEFTCL reform significantly altered the general relationship between trade and real fluctuations and likely significantly altered the heterogeneous trade responses to real fluctuations. Figure 17 summarizes the responsiveness of Japanese trade balances from Asian nations to real depreciation. The full estimation results are available in Table 14.

Compared to post-liberalization trade balances, pre-liberalization trade balances are more responsive to real exchange rate fluctuations and exhibit negative long run responses to real depreciation of an estimated 1.45%. After liberalization, the long run effect of real depreciation is an improvement of the trade balance by an estimated 0.47%. The FEFTCL likely limited Japanese firm access to foreign exchange markets, including access to forward and futures markets. Unable to hedge against exchange rate risk, any volatility in the yen exchange rate may have been perceived as cause for concern, resulting in exporting firms reducing exports to minimize exchange rate risk even if the yen fluctuation was favorable. The response of exports to real depreciation before and after FEFTCL reform is also indicative of this story. Prior to FEFTCL reform, the estimated long run response of Japanese exports to 1% real depreciation is approximately -2.02% while the estimated response after FEFTCL reform is 1.09%.

In addition, the responsiveness of trade flows with Asian nations and other nations is significantly different prior to FEFTCL reform. However, after the reform, the responsiveness of these trade flows becomes very similar. It's likely that enabling access to foreign exchange markets enabled Japanese firms to optimally hedge against exchange rate risk. According to the currency invoicing literature, a significant portion of Japanese trade with other Asian nations is denoted in U.S. dollars (Ito et al. (2012)). Prior to FEFTCL reform, these firms were likely unable to optimally hedge against exchange rate risk which made these transactions more expensive when the yen depreciated for both Japanese firms and firms from other Asian nations. This resulted in less trade with Asian nations, reducing exports and ultimately resulting in trade balance deterioration for Japan.

The composition of trade with Asian nations may also play a role in the responsiveness of trade before and after FEFTCL reform. Trade between Asian nations and Japan is largely affiliate trade (Ito et al. (2012)). Japanese firms export intermediate goods to affiliate firms in Asia who then assemble the goods into final products destined for other markets. Japanese firms may be able to put off these transactions until a later date. However trade with other nations, including the U.S. and Europe, may include more homogeneous goods for which there is no domestic market or may depend on prior Japanese affiliate trade with other nations. If this is the case, one may not expect to Japanese firms to immediately respond to real depreciation by reducing export and/or imports.

To further explore this explanation, Table 16 summaries the results of estimating the response of Japanese trade balances in intermediate goods with Asian and other trading partners. The full estimation output is contained in Table 15. The results suggest that intermediate goods trade with Asian nations is relatively unchanged by the FEFTCL revisions. Rather, intermediate goods trade with other nations exhibits different short run and long run responses to real depreciation before/after FEFTCL reform. Before FEFTCL, the short run and long run responses of intermediate goods trade balances to real depreciation is positive in the short run, but turns negative approximately one year following the depreciation. In contrast, after FEFTCL reform, the short and long run responses of intermediate good trade balances with other nations to real depreciation are positive. This suggests that FEFTCL revisions did not greatly impact intermediate goods trade with Asian nations. Differences in the composition of trade with Asian and non-Asian trading partners may not be driving the significant change in trade responsiveness following FEFTCL reform.

When including dummy variables and interaction terms to capture heterogeneous responses across homogeneous and differentiated goods to check for differential responses before and after FEFTCL reform, I find evidence that the long run effects of real depreciation prior to FEFTCL reform were insignificant. However, the long run effects after FEFTCL reform are positive, suggesting that reform may make currency interventions more effective in the long run. Figure 18 summarizes these estimation results. The full estimation output is contained in Table 17.

Conclusion

To my knowledge, the implications of FEFTCL reform on the relationship between disaggregated trade and real yen fluctuations have not previously been explored. However, identifying the consequences of FEFTCL reform on trade is valuable for both policy makers using currency interventions to increase export competitiveness. In contrast to the current literature discussing FEFTCL revisions, I use commodity trade data to examine if and how the responsiveness of Japanese trade flows to real yen fluctuations changed and if this policy changed affected the response of trade across product and trading partner characteristics.

I find that currency depreciation, on average, resulted in temporary short run improvements in Japanese trade balances prior to FEFTCL reform. However, after FEFTCL reform there is no evidence that real depreciation results in trade improvements. Contrary to the current literature, I find that real depreciation does not result in long run trade balance improvements. These findings suggest that the primary motivation for currency manipulation policies, increase export competitiveness and improve net exports, are flawed and that these policies no longer result in short run or long run gains.

Looking across product and trading partner characteristics, I find the FEFTCL reform eliminated long run trade balance deterioration following real depreciation in trade flows between Japan and other Asian nations and resulted in less short run responsiveness to real depreciation in homogeneous and differentiated goods trade. However, when looking across these product and trading partner characteristics, there still exists no evidence of long run gains resulting from currency depreciation.

CHAPTER V

CONCLUSION

The current literature finds mixed results concerning the relationship between trade and real exchange rate fluctuations. However, this relationship has potentially large consequences for policy makers considering policies to boost export competitiveness or manipulate the value of their domestic currency. The economic literature on trade and real exchange rates suggests that this relationship is trading partner-specific. In contrast, I find that this relationship is trading partner and product specific.

Using commodity-level trade data to explore the implications of trading partner and product characteristics on the relationship between trade and real exchange rate fluctuations, in Chapter 2, I find that trade responds heterogeneously to real depreciation across products and trading partner characteristics. More specifically, I find that homogeneous good trade responses to real depreciation are much more volatile than those of differentiated goods. This is likely due to homogeneous goods having more elastic demand which results in more frequent price changes than differentiated goods. Additionally, this suggests that homogeneous good contracts may be shorter than differentiated good contracts which may be driving the heterogeneous short run responses between these product types. Additionally, using an alternative classification system for commodities, I find that raw materials and consumer goods are less responsive to real depreciation than capital goods and intermediate goods. This lack of responsiveness is likely due to varying market structure and exchange rate pass-through across these good types. I also find that the formation of the Eurozone substantially reduced the responsiveness of U.S. trade balances to real U.S. dollar depreciation against European currencies. The smoothing of U.S. trade balance responsiveness is partially attributable to heterogeneous responses across types of goods.

U.S. trade data is largely invoiced in U.S. dollar which removes the implications of currency invoicing for the responsiveness of trade to real depreciation. However, other countries use a variety of currencies to invoice international trade contracts and currency invoicing practices should affect the relationship between trade and real exchange rate fluctuations. According to Magee (1973), trade flows invoiced in foreign currency should exhibit short run fluctuations in response to real depreciation while trade flows invoiced in domestic currency should not. In addition, particular currency invoicing patterns should result in different short run trade balance fluctuations. Under the right currency invoicing conditions, the short run trade balance responses to real depreciation may be negative, which is contrary to the predicted long run trade balance improvements following real depreciation.

In order to observe the implications of currency invoicing on the responsiveness of trade to real exchange rate fluctuations, I estimate this relationship using commodity-level Japanese trade data. I find some evidence of differential effects in Japanese trade with the U.S. and Europe. Trade contracts between Japanese firms and the U.S. or European firms are likely invoiced in the U.S. dollar or the euro. These invoicing patterns should result in trade being very responsive to real yen fluctuations in the short run. Following yen depreciation in the short run, the value of imports from the U.S./Europe grows faster than the value of exports to the U.S./Europe which results in a negative Japanese trade balance response for one to two quarters. This greatly contrasts the response of Japanese trade balances with other countries, which increase in both the short and long run.

I also find that trade responsiveness to real exchange rate fluctuations is likely correlated with comparative advantage. Japan is dependent on international trade to secure natural resources and similar homogeneous goods. My results suggest that firms trading in goods in which Japan has a comparative disadvantage are less responsive in the short run to real yen depreciation which results in the trade balance in these goods deteriorating in the long run. My results also suggest that trade responsiveness is trading partner-specific rather than product-specific which is consistent with the currency invoicing literature result that invoicing is largely related to trading partner characteristics.

In the final chapter, I explore the implications of financial system reform in Japan following the Asian financial crisis in the late 1990s. Foreign exchange reform and the accompanying financial system reforms substantially changed the way firms conduct international transactions and how well firms can adjust to real exchange rate fluctuations. As a result, firms are able to adjust more quickly to real exchange rate fluctuations which resulted in Japanese trade flows becoming less responsive to real fluctuations. These findings are consistent across good and trading partner characteristics. However, I find evidence that real depreciation resulted in temporary short run gains in trade prior to these reforms and that the gains disappear in the period after reform. I also find no evidence of long run gains in trade following real depreciation in the period before or in the period after these reforms. This suggests that currency manipulation policies aimed at increasing export competitiveness and improving net exports may be ineffective in both the short and long run.

APPENDIX

TABLES AND FIGURES

FIGURE 1. Response of U.S. Trade Balance to 1% Real Depreciation

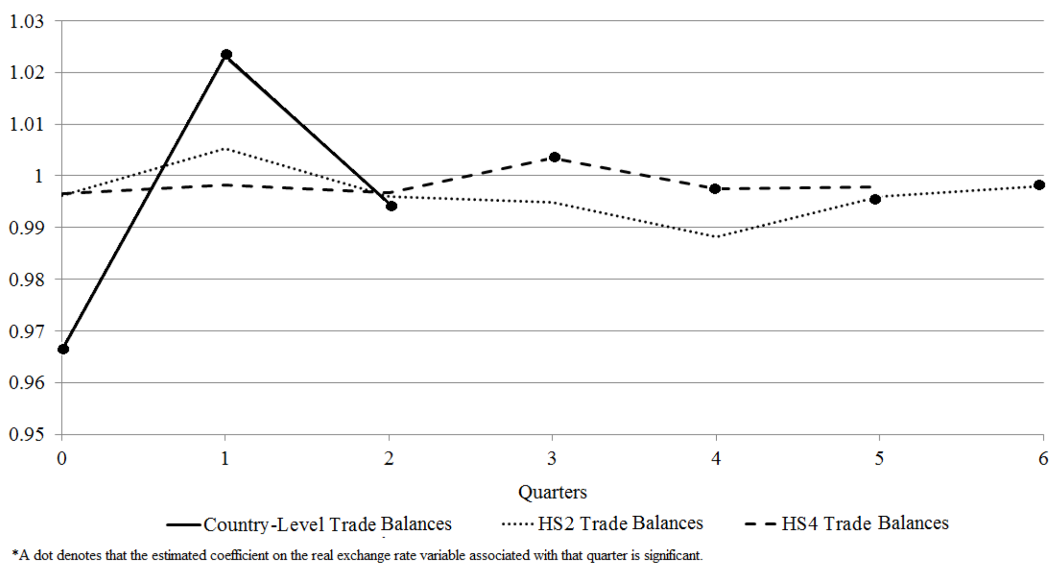


FIGURE 2. Response of Rauch Good Trade Balances to 1% Real Depreciation

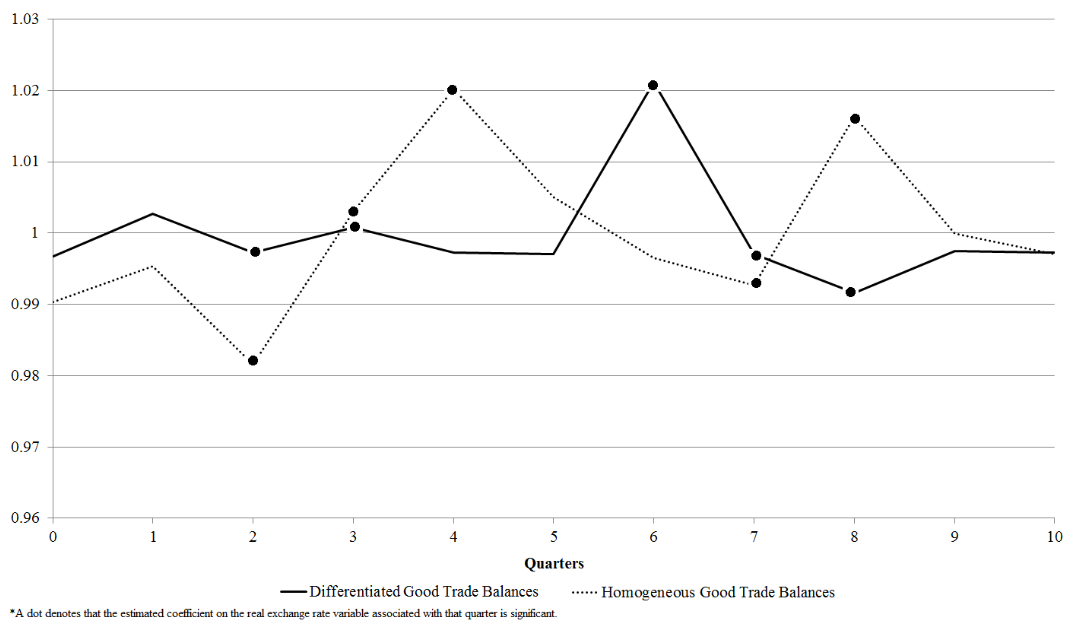
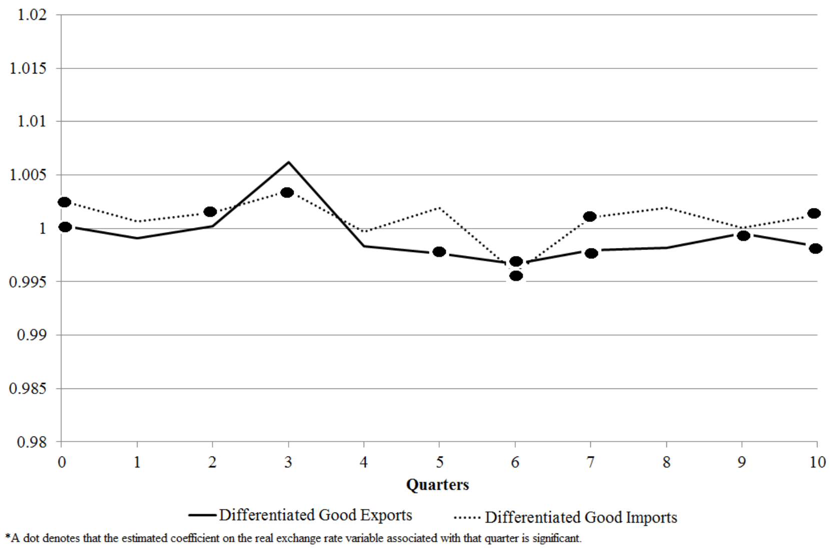


FIGURE 3. Response of Rauch Good Exports and Imports to 1% Real Depreciation



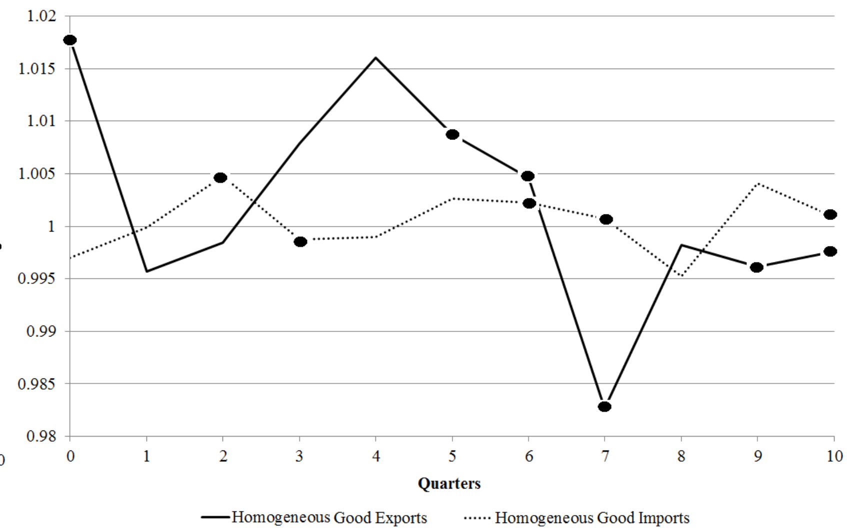
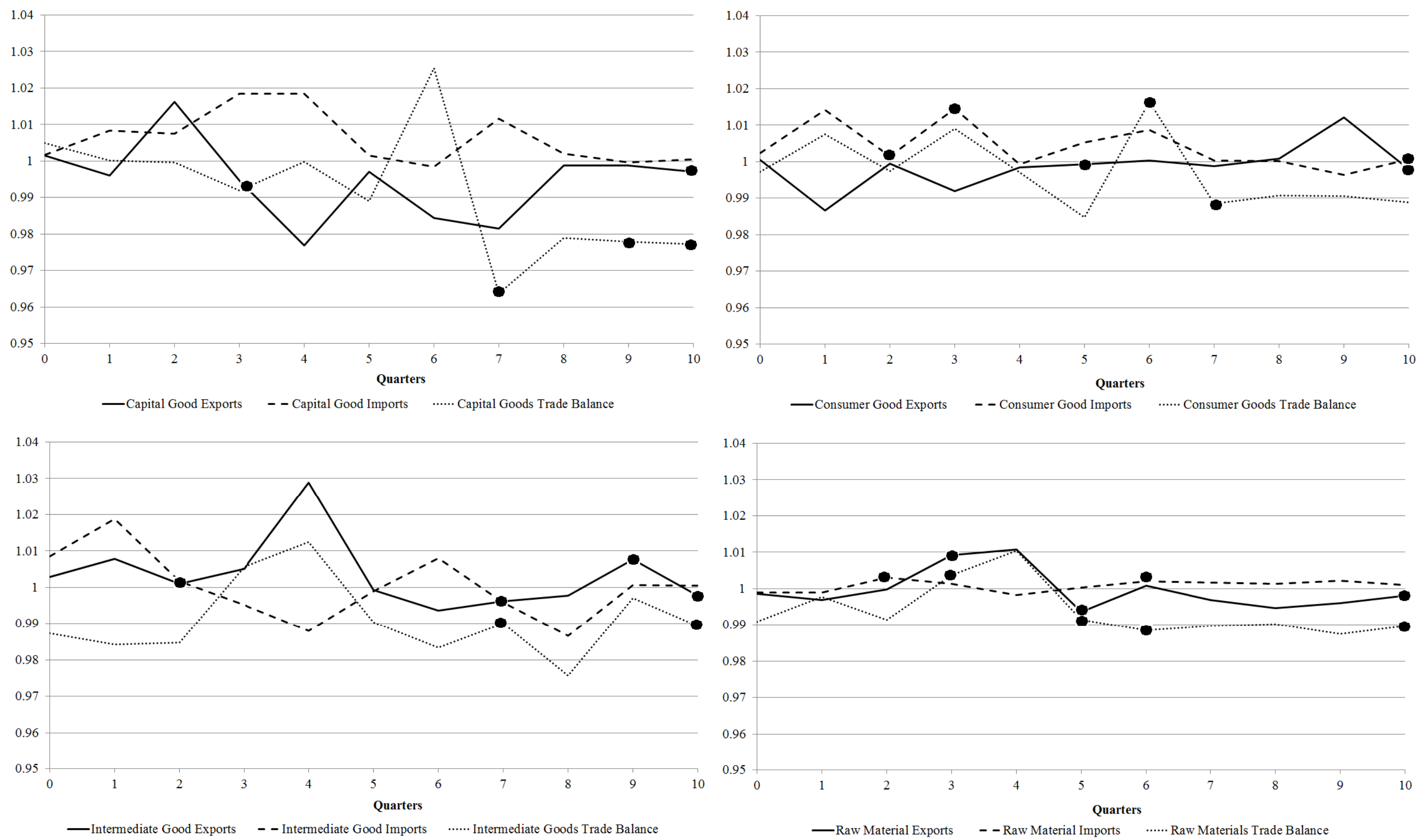
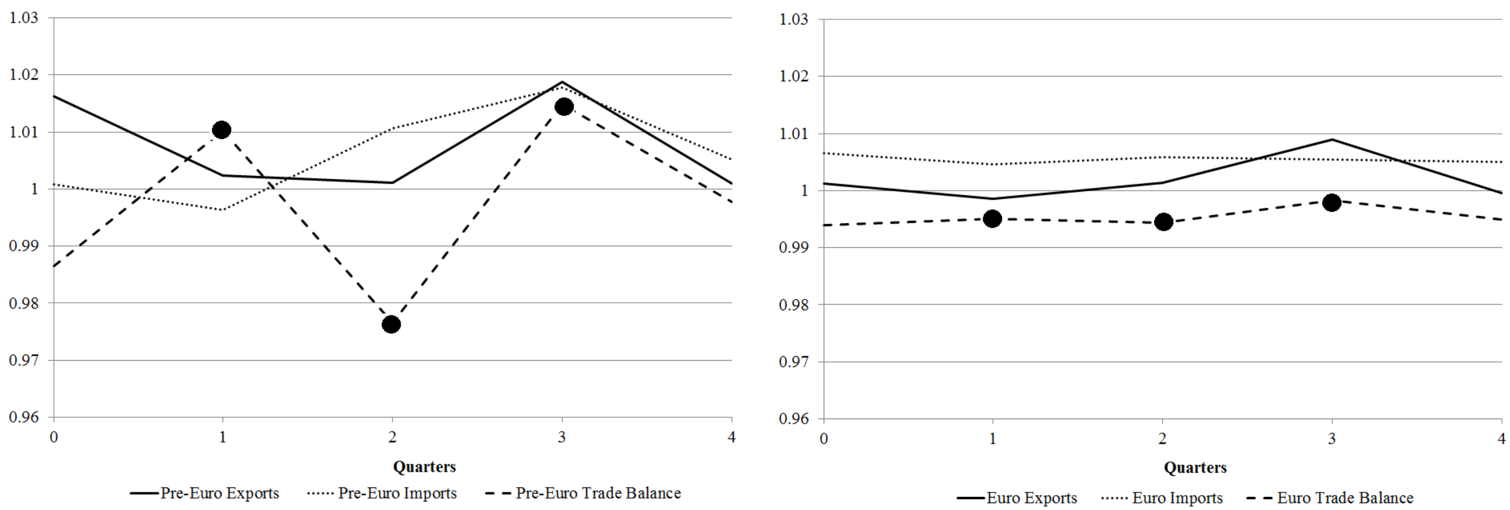


FIGURE 4. Response of Product Group Trade to 1% Real Depreciation



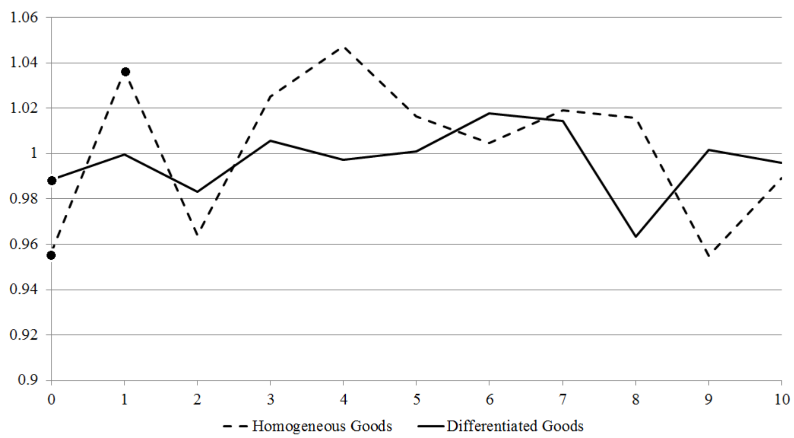
*A dot denotes that the estimated coefficient on the real exchange rate variable associated with that quarter is significant.

FIGURE 5. Response of Trade, Pre-/Post-Eurozone to 1% Real Depreciation

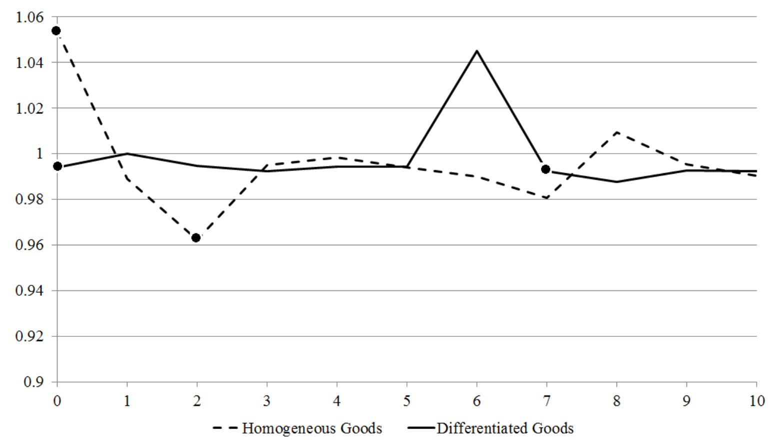


*A dot denotes that the estimated coefficient on the real exchange rate variable associated with that quarter is significant.

FIGURE 6. Response of Pre-/Post-Eurozone Trade Balances to 1% Real Depreciation



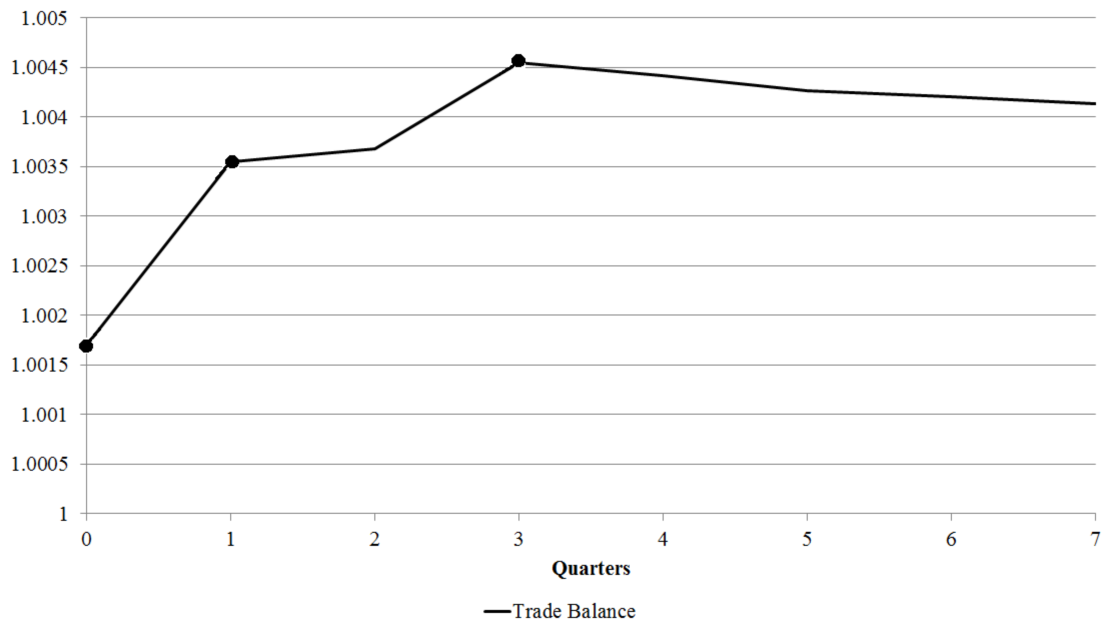
(a)
Before the Formation of the Eurozone



(b)
After the Formation of the Eurozone

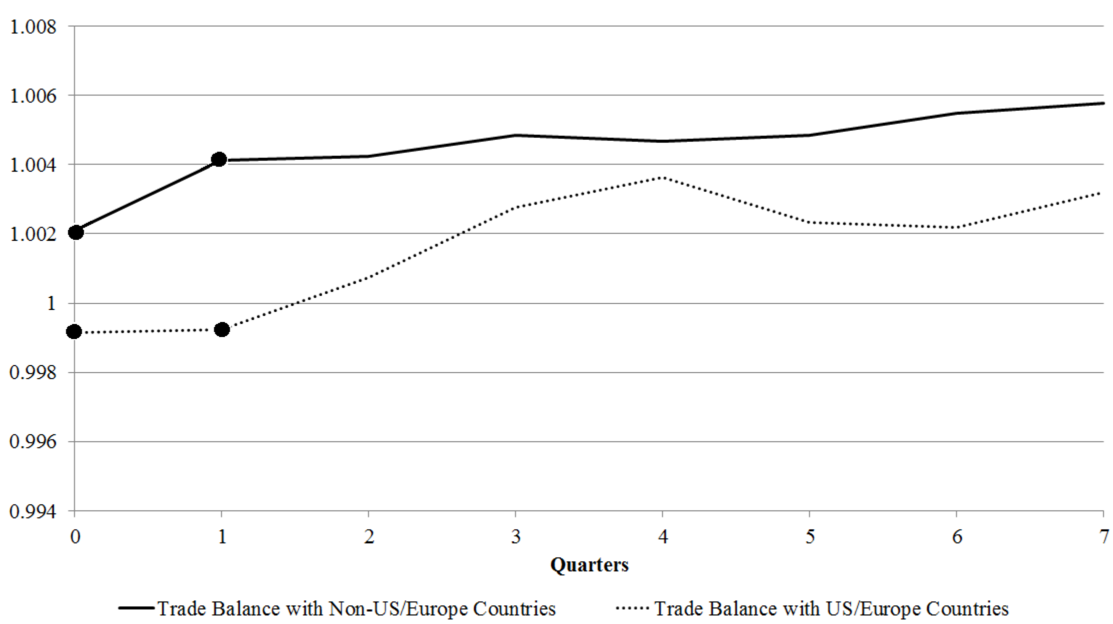
*A dot denotes that the estimated coefficient on the real exchange rate variable associated with that quarter is significant.

FIGURE 7. Response of Trade Balances to 1% Real Depreciation



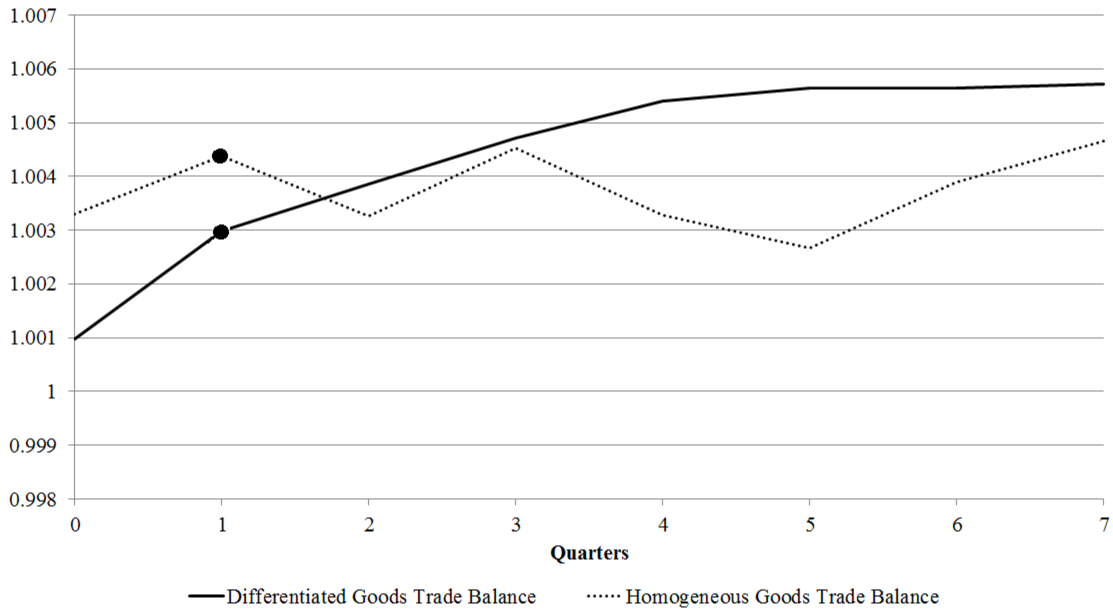
*A dot denotes that the estimated coefficient on the real exchange rate variable associated with that quarter is significant.

FIGURE 8. Response of Trade Balances with US/Europe to 1% Real Depreciation



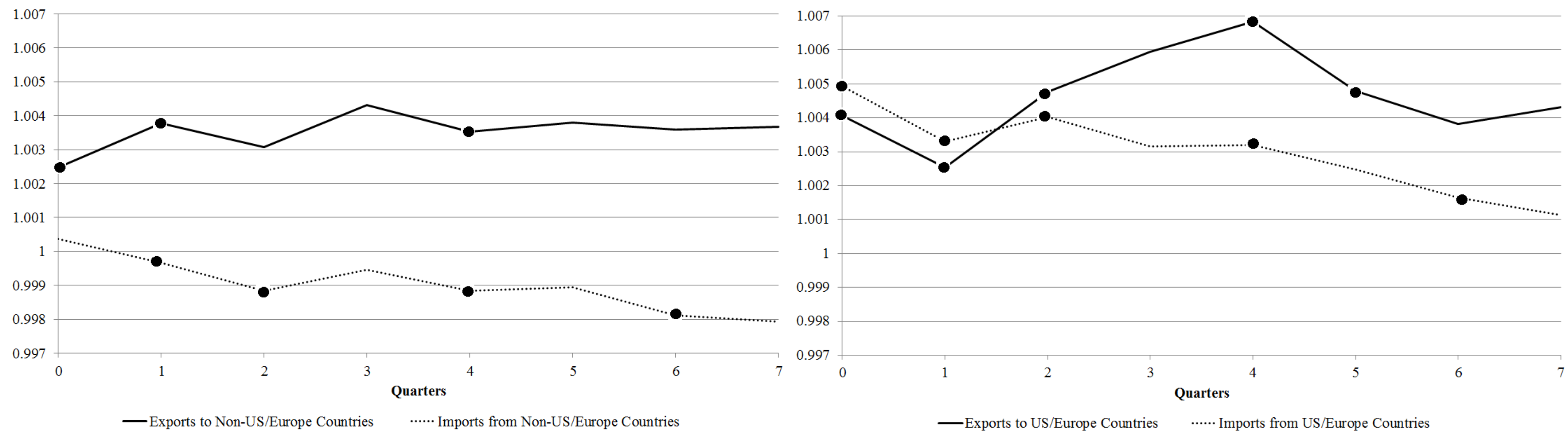
*A dot denotes that the estimated coefficient on the real exchange rate variable associated with that quarter is significant.

FIGURE 9. Response of Rauch Good Trade Balances to 1% Real Depreciation



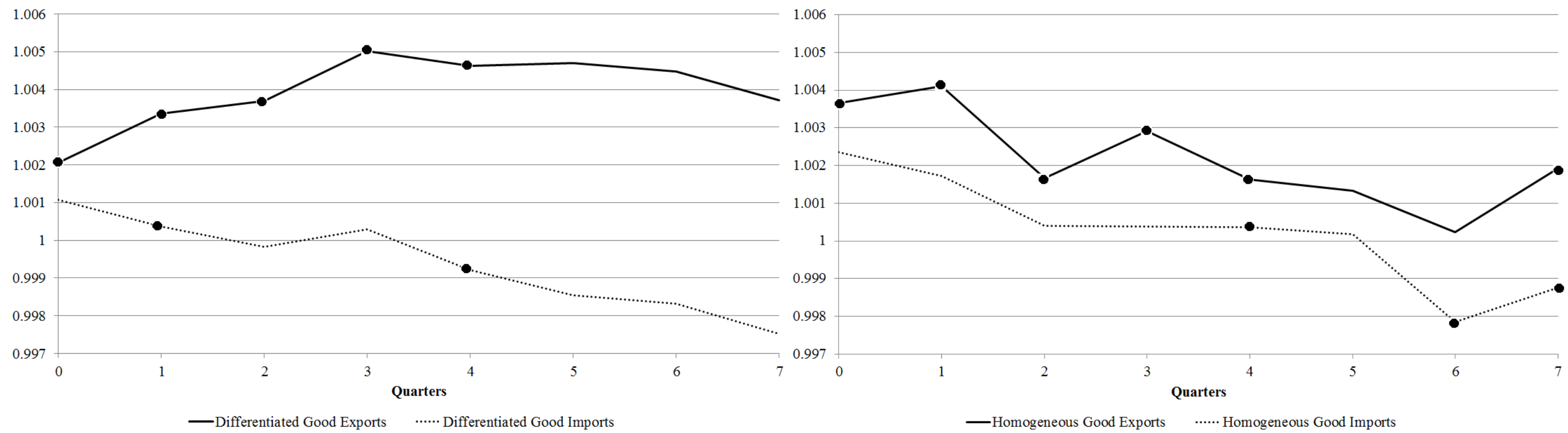
*A dot denotes that the estimated coefficient on the real exchange rate variable associated with that quarter is significant.

FIGURE 10. Response of Exports and Imports with U.S./Europe to 1% Real Depreciation



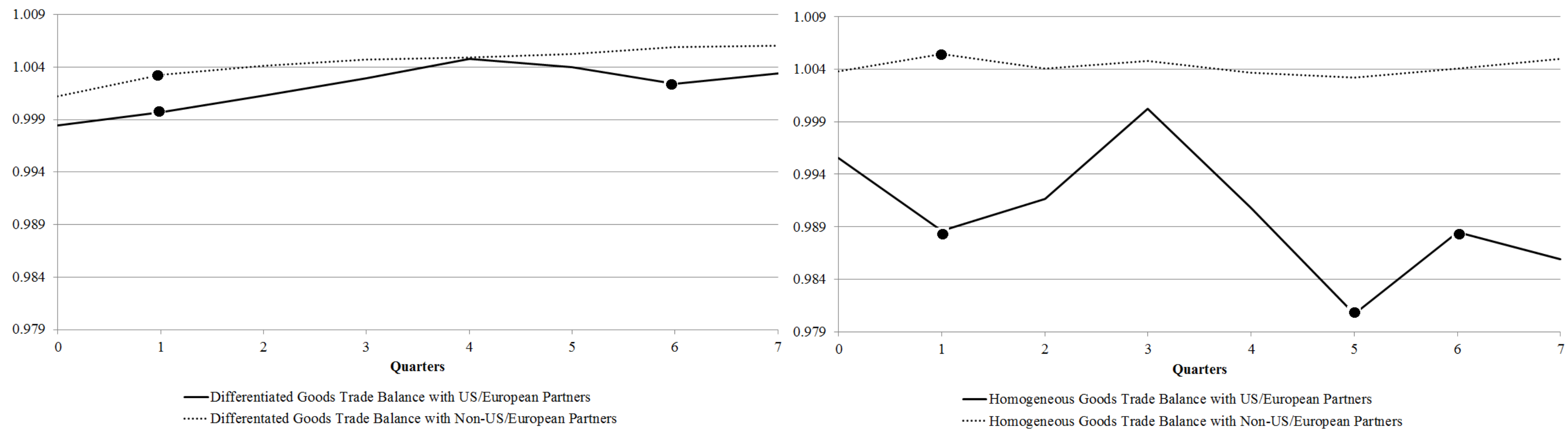
*A dot denotes that the estimated coefficient on the real exchange rate variable associated with that quarter is significant.

FIGURE 11. Response of Rauch Good Exports and Imports to 1% Real Depreciation



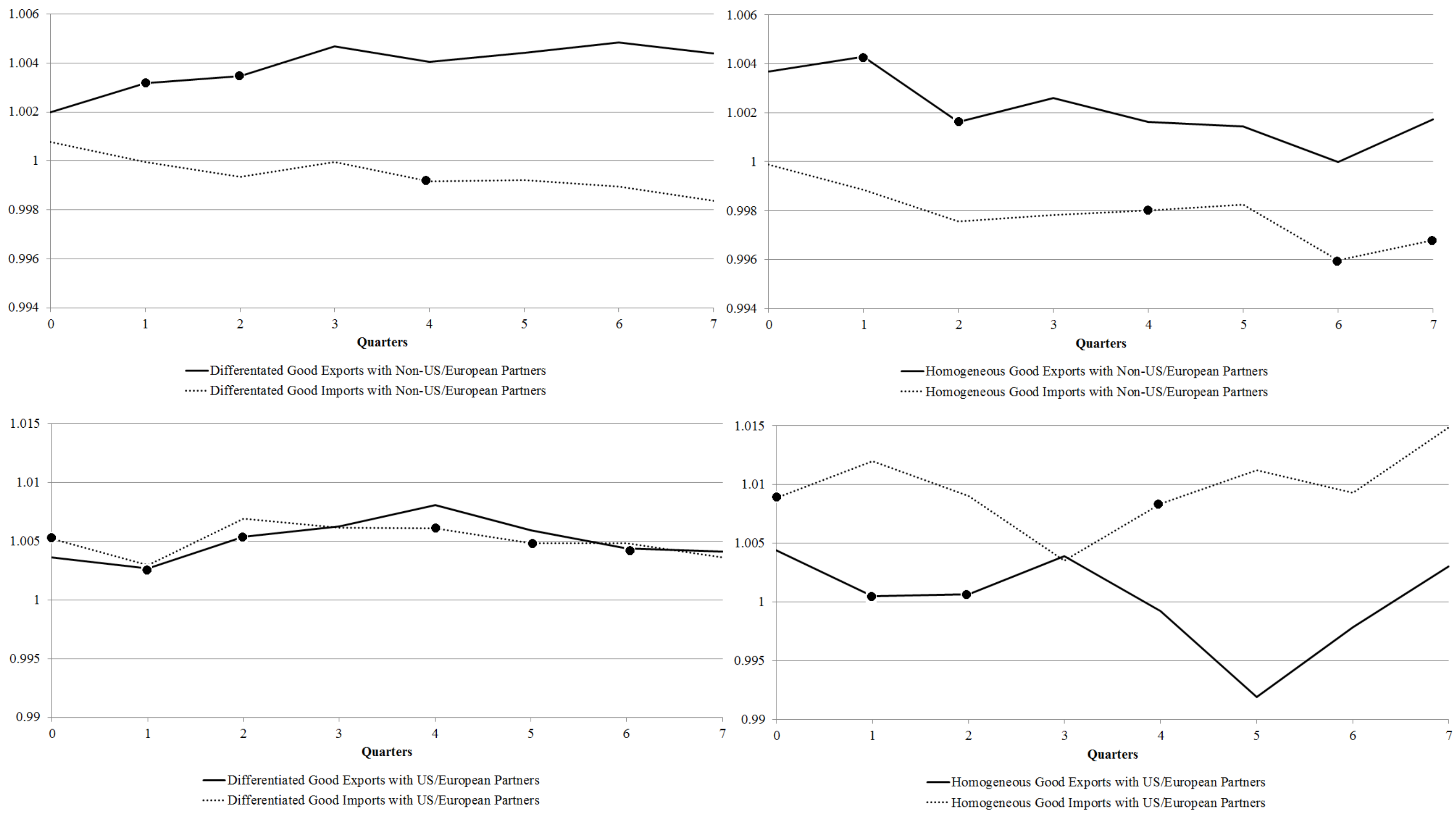
*A dot denotes that the estimated coefficient on the real exchange rate variable associated with that quarter is significant.

FIGURE 12. Response of Trade Balances with U.S./Europe to 1% Real Depreciation



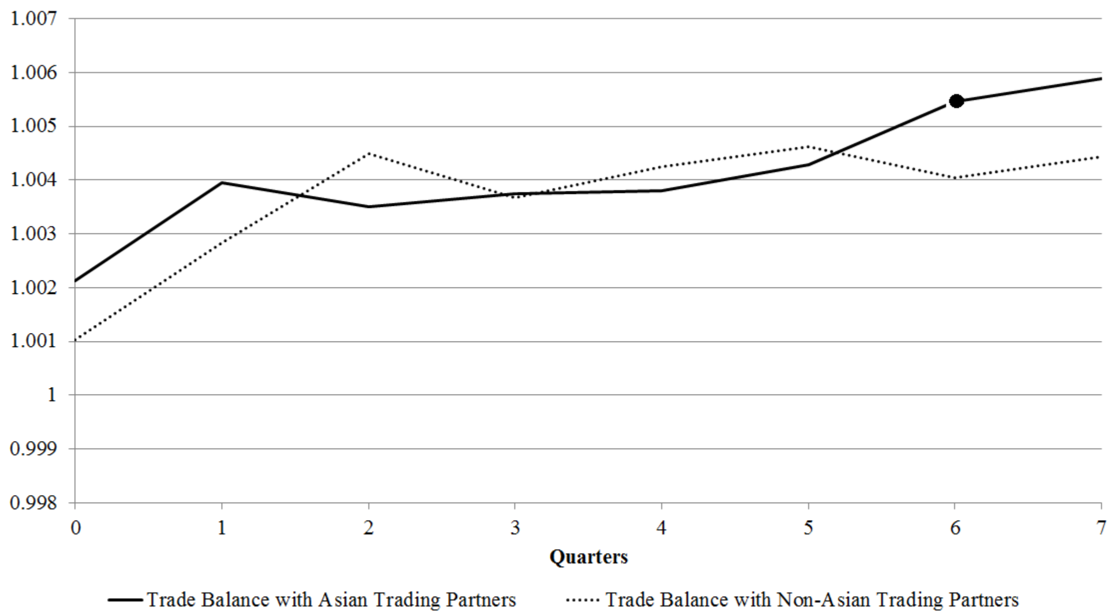
*A dot denotes that the estimated coefficient on the real exchange rate variable associated with that quarter is significant.

FIGURE 13. Response of Trade Balances with Non-U.S./Europe to 1% Real Depreciation



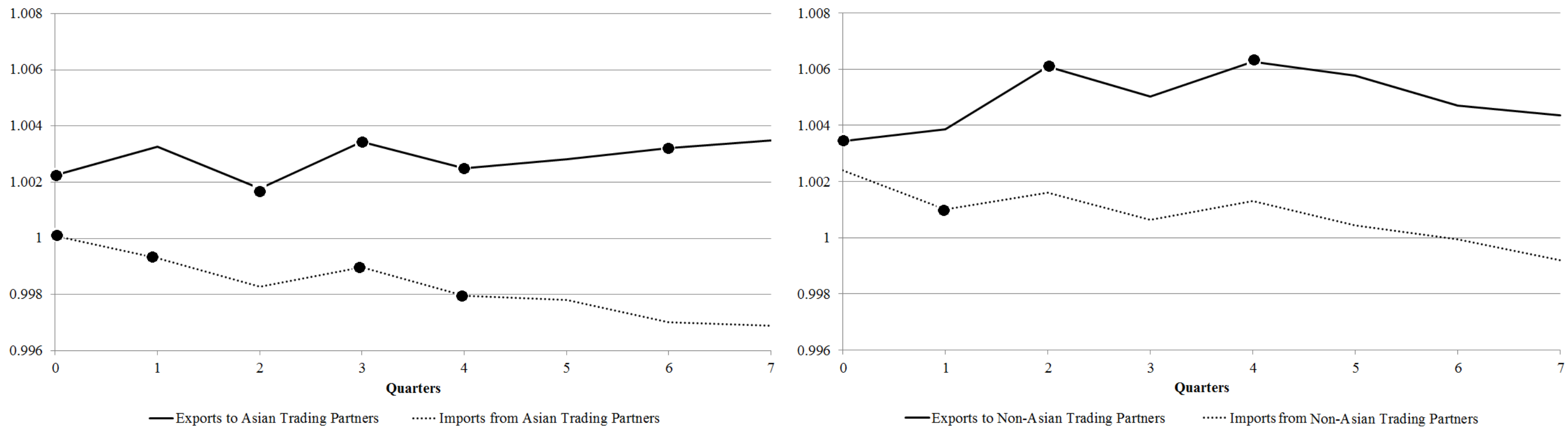
*A dot denotes that the estimated coefficient on the real exchange rate variable associated with that quarter is significant.

FIGURE 14. Response of Trade Balances with Asian Trading Partners to 1% Real Depreciation



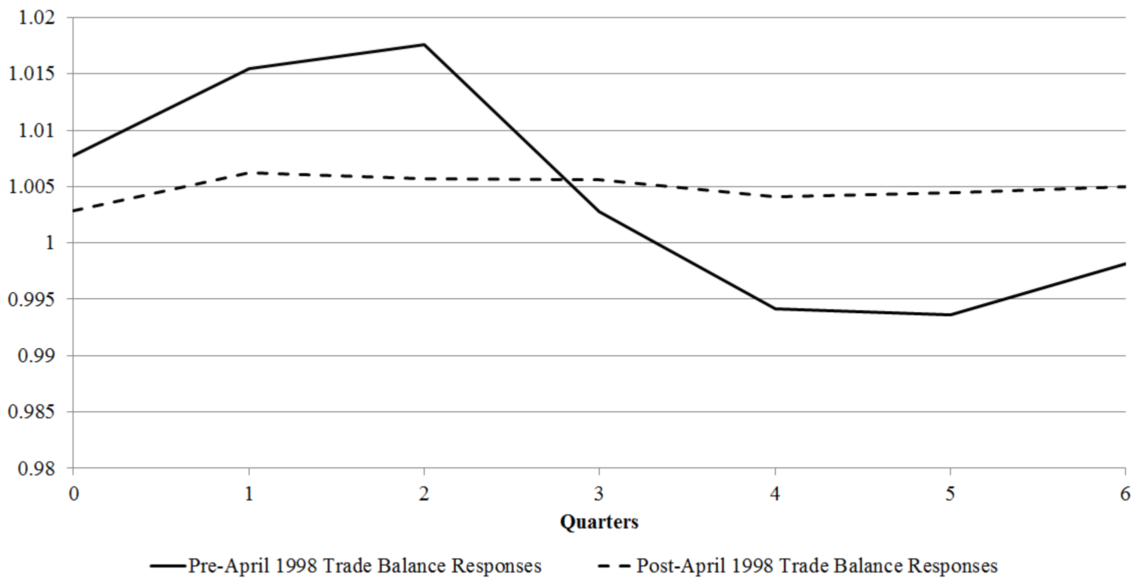
*A dot denotes that the estimated coefficient on the real exchange rate variable associated with that quarter is significant.

FIGURE 15. Response of Exports and Imports with Asian Nations to 1% Real Depreciation



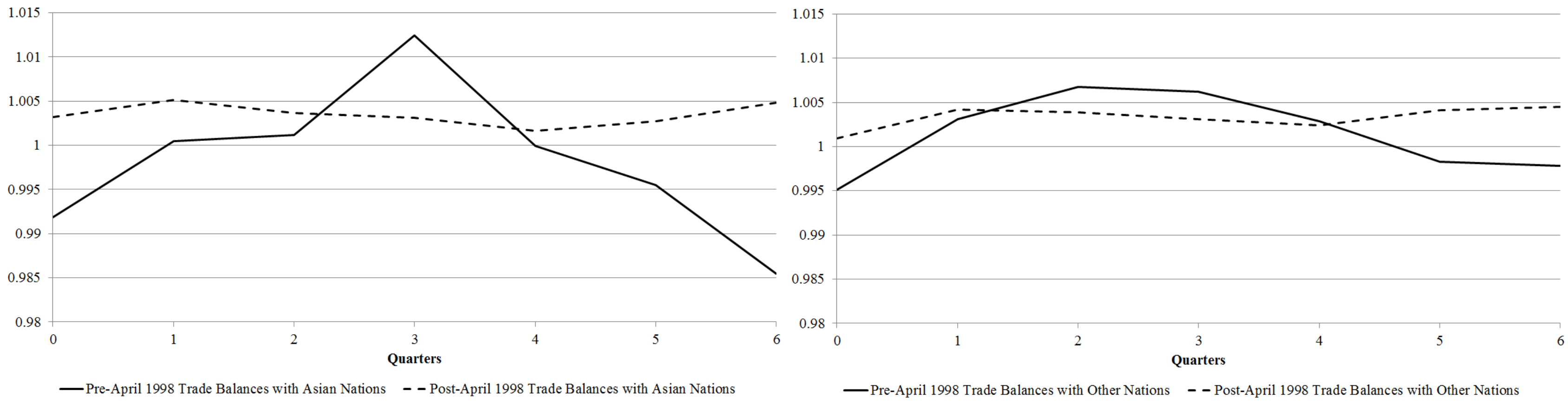
*A dot denotes that the estimated coefficient on the real exchange rate variable associated with that quarter is significant.

FIGURE 16. Response of the Trade Balance to 1% Real Depreciation



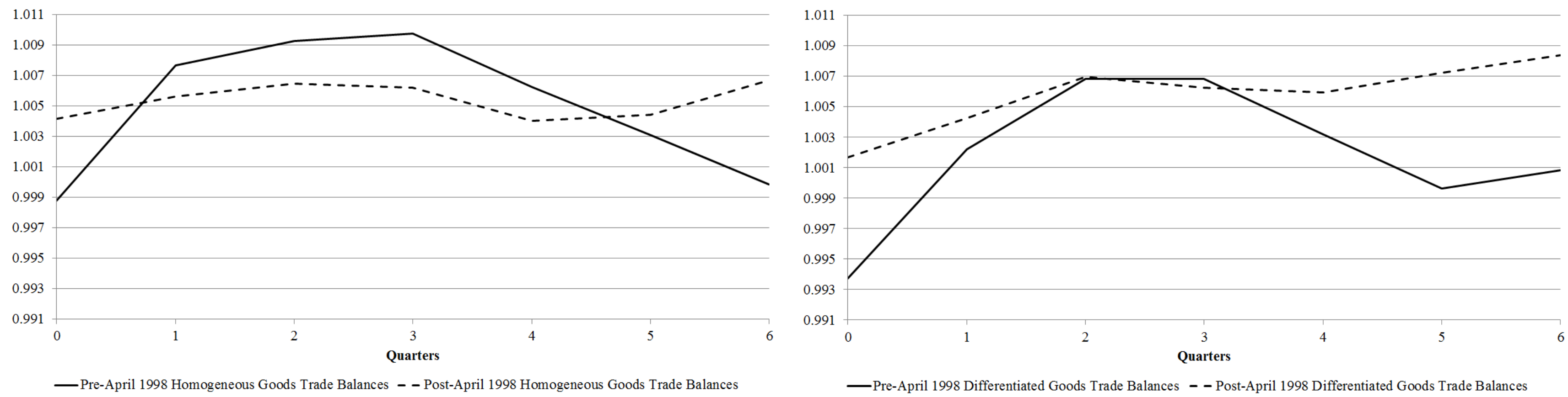
*A dot denotes that the estimated coefficient on the real exchange rate variable associated with that quarter is significant.

FIGURE 17. Response of Trade Balances with Asian Nations to 1% Real Depreciation Before April 1998



*A dot denotes that the estimated coefficient on the real exchange rate variable associated with that quarter is significant.

FIGURE 18. Response of Pre-April 1998 Rauch Good Trade Balance to 1% Real Depreciation



*A dot denotes that the estimated coefficient on the real exchange rate variable associated with that quarter is significant.

TABLE 1. Effect of U.S. Dollar Depreciation on U.S. Trade in the Short Run

Imports Price in	Exports Price in	
	U.S. Dollars	Foreign Currency
U.S. Dollars	No Change	Exports Increase Imports Unchanged Trade Balance Increases
Foreign Currency	Exports Unchanged Imports Increase Trade Balance Decreases	Exports Increase Imports Increase Trade Balance ?

TABLE 2. Estimate Results Using Different Levels of Data Aggregation

VARIABLES	(1) Bilateral Trade Balance	(2) HS2 Trade Balance	(3) HS4 Trade Balance
$\Delta \ln GDP_{i,t}$	0.272	0.210	0.214
	(0.301)	(0.310)	(0.329)
$\Delta \ln RER_{i,t}$	-3.370***	-0.385	-0.340
	(0.973)	(0.334)	(0.366)
$\Delta \ln RER_{i,t-1}$	5.881***	0.915	0.157
	(1.311)	(1.069)	(0.232)
$\Delta \ln RER_{i,t-2}$	-2.784***	-0.925	-0.140
	(0.670)	(1.058)	(0.193)
$\Delta \ln RER_{i,t-3}$		-0.0997	0.665*
		(2.905)	(0.321)
$\Delta \ln RER_{i,t-4}$		-0.688	-0.582**
		(2.768)	(0.259)
$\Delta \ln RER_{i,t-5}$		0.800**	0.0285
		(0.318)	(0.0317)
$\Delta \ln RER_{i,t-6}$		0.198*	
		(0.108)	
Constant	-0.0314	0.0143	0.0349
	(0.0563)	(0.437)	(0.0207)
Country X Commodity FE	Yes	Yes	Yes
Quarter X Year FE	Yes	Yes	Yes
Observations	1,562	119,352	898,982
Number of Id	19	1,751	17,230
R-Squared	0.083	0.004	0.002

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

TABLE 3. Heterogeneous Export and Import Responses Across Rauch Goods

VARIABLES	(1) Trade Balance	(2) Exports	(3) Imports
$\Delta \ln GDP_{i,t}$	0.213	0.180	-0.0905
	(0.328)	(0.218)	(0.141)
$\Delta \ln RER_{i,t}$	-0.258	-0.791*	-0.503
	(0.363)	(0.399)	(0.357)
$\Delta \ln RER_{i,t-1}$	0.0805	-0.580	0.886
	(0.633)	(1.174)	(0.662)
$\Delta \ln RER_{i,t-2}$	-1.431*	0.644	1.509**
	(0.741)	(1.835)	(0.672)
$\Delta \ln RER_{i,t-3}$	5.026**	-0.192	-1.767***
	(2.194)	(2.124)	(0.402)
$\Delta \ln RER_{i,t-4}$	-3.413	1.995	0.270
	(2.094)	(1.716)	(0.780)
$\Delta \ln RER_{i,t-5}$	-0.187	-1.227*	-0.0618
	(0.408)	(0.669)	(0.776)
$\Delta \ln RER_{i,t-6}$	-1.171***	-0.631*	0.907**
	(0.307)	(0.345)	(0.421)
$\Delta \ln RER_{i,t-7}$	1.413**	0.858**	-0.888*
	(0.568)	(0.381)	(0.487)
$\Delta \ln RER_{i,t-8}$	0.107	0.0519	0.497
	(0.409)	(0.311)	(2.131)
$\Delta \ln RER_{i,t-9}$	-0.0731	1.238**	-1.100
	(0.504)	(0.560)	(2.126)
$\Delta \ln RER_{i,t-10}$	-0.336	-1.561***	0.369***
	(0.519)	(0.433)	(0.0452)
Differentiated	-0.378	-0.345***	-
	(0.552)	(0.0423)	
$\Delta \ln RER_{i,t} \times Dif$	-0.0713	0.819**	0.767**

Continued on next page

Table 3 – *Continued from previous page*

VARIABLES	(1) Trade Balance	(2) Exports	(3) Imports
	(0.266)	(0.308)	(0.349)
$\Delta \ln RER_{i,t-1} \times Dif$	0.519	0.460	-1.085
	(0.743)	(1.174)	(0.733)
$\Delta \ln RER_{i,t-2} \times Dif$	0.894	-0.529	-1.429*
	(0.796)	(01.934)	(0.788)
$\Delta \ln RER_{i,t-3} \times Dif$	-4.674**	0.792	1.975***
	(2.170)	(2.218)	(0.463)
$\Delta \ln RER_{i,t-4} \times Dif$	3.062	-2.778	-0.681
	(2.127)	(1.705)	(0.798)
$\Delta \ln RER_{i,t-5} \times Dif$	0.159	1.161	0.288
	(0.409)	(0.680)	(0.771)
$\Delta \ln RER_{i,t-6} \times Dif$	3.589***	0.530	-1.516
	(1.019)	(0.606)	(1.239)
$\Delta \ln RER_{i,t-7} \times Dif$	-3.766***	-0.731	1.408
	(1.063)	(0.793)	(1.335)
$\Delta \ln RER_{i,t-8} \times Dif$	-0.657	-0.0295	-0.408
	(0.491)	(0.343)	(2.153)
$\Delta \ln RER_{i,t-9} \times Dif$	0.667	-1.099*	0.912
	(0.553)	(0.595)	(2.153)
$\Delta \ln RER_{i,t-10} \times Dif$	0.310	1.437***	-0.251**
	(0.545)	(0.424)	(0.101)
$\Delta \ln RER_{i,t} \times Hom$	-0.708	2.574**	0.200
	(1.363)	(1.176)	(1.859)
$\Delta \ln RER_{i,t-1} \times Hom$	0.425	-1.595	-0.594
	(1.562)	(1.832)	(1.929)

Continued on next page

Table 3 – *Continued from previous page*

VARIABLES	(1) Trade Balance	(2) Exports	(3) Imports
$\Delta \ln RER_{i,t-2} \times Hom$	0.0475	-0.365	-1.021
	(1.754)	(1.907)	(0.872)
$\Delta \ln RER_{i,t-3} \times Hom$	-2.839	1.137	1.171*
	(2.547)	(2.254)	(0.663)
$\Delta \ln RER_{i,t-4} \times Hom$	5.127*	-1.187	-0.252
	(2.522)	(2.154)	(0.896)
$\Delta \ln RER_{i,t-5} \times Hom$	-1.305	0.504	0.434
	(1.204)	(1.632)	(1.306)
$\Delta \ln RER_{i,t-6} \times Hom$	0.321	0.227	-0.949
	(0.694)	(0.724)	(0.644)
$\Delta \ln RER_{i,t-7} \times Hom$	-1.797*	-3.043**	0.739
	(1.017)	(1.174)	(1.203)
$\Delta \ln RER_{i,t-8} \times Hom$	2.277**	1.529	-1.047
	(1.052)	(1.105)	(2.092)
$\Delta \ln RER_{i,t-9} \times Hom$	-1.539	-1.444**	1.986
	(0.908)	(0.600)	(1.888)
$\Delta \ln RER_{i,t-10} \times Hom$	0.0463	1.709***	-0.685
	(0.676)	(0.451)	(0.397)
Constant	0.267	0.368**	0.0116
	(0.346)	(0.137)	(0.0459)
Country X Commodity FE	Yes	Yes	Yes
Quarter X Year FE	Yes	Yes	Yes
Observations	898,944	988,850	892,158
Number of Id	17,230	19,961	17,581
R-Squared	0.002	0.002	0.003

Continued on next page

Table 3 – *Continued from previous page*

VARIABLES	(1) Trade Balance	(2) Exports	(3) Imports

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

TABLE 4. Estimates with HS Product Group Defined Interactions

VARIABLES	(1) Trade Balance	(2) Exports	(3) Imports
$\Delta \ln GDP_{i,t}$	0.213	0.180	-0.0902
	(0.328)	(0.217)	(0.141)
$\Delta \ln RER_{i,t}$	-0.727	-0.264	-0.206
	(0.661)	(0.580)	(0.475)
$\Delta \ln RER_{i,t-1}$	0.495	-0.0342	0.0997
	(0.558)	(0.569)	(0.460)
$\Delta \ln RER_{i,t-2}$	-1.240***	0.377*	0.904***
	(0.411)	(0.203)	(0.277)
$\Delta \ln RER_{i,t-3}$	1.978***	1.743	-0.663**
	(0.915)	(1.112)	(0.244)
$\Delta \ln RER_{i,t-4}$	0.566	-0.917	-0.312
	(0.898)	(1.067)	(0.412)
$\Delta \ln RER_{i,t-5}$	-1.123	-1.594*	0.215
	(0.666)	(0.816)	(0.403)
$\Delta \ln RER_{i,t-6}$	-0.295**	0.657	0.0136
	(0.131)	(1.017)	(0.704)
$\Delta \ln RER_{i,t-7}$	0.130	-0.251	0.122
	(0.0966)	(1.021)	(0.696)
$\Delta \ln RER_{i,t-8}$	-0.127	-0.114	-0.274
	(0.207)	(0.292)	(0.509)
$\Delta \ln RER_{i,t-9}$	-0.155	0.0231	0.339
	(0.219)	(0.265)	(0.530)
$\Delta \ln RER_{i,t-10}$	0.289*	0.214*	-0.140
	(0.145)	(0.0809)	(0.121)
Consumer	0.0419	-0.00984	0.0298
	(0.0688)	(0.0632)	(0.0533)
$\Delta \ln RER_{i,t} \times Consumer$	0.454	0.310	0.449

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Table 4 – *Continued from previous page*

VARIABLES	(1) Trade Balance	(2) Exports	(3) Imports
	(0.502)	(0.507)	(0.415)
$\Delta \ln RER_{i,t-1} \times Consumer$	0.540	-1.357	1.075
	(1.245)	(1.183)	(0.732)
$\Delta \ln RER_{i,t-2} \times Consumer$	0.230	0.937	-2.153***
	(1.190)	(1.060)	(0.590)
$\Delta \ln RER_{i,t-3} \times Consumer$	-0.803	-2.498	1.966***
	(1.590)	(1.494)	(0.619)
$\Delta \ln RER_{i,t-4} \times Consumer$	-1.769	1.576	-1.201
	(1.599)	(1.583)	(0.822)
$\Delta \ln RER_{i,t-5} \times Consumer$	0.676	1.667*	0.397
	(0.646)	(0.808)	(0.398)
$\Delta \ln RER_{i,t-6} \times Consumer$	3.508**	-0.540	0.320
	(1.341)	(0.913)	(1.746)
$\Delta \ln RER_{i,t-7} \times Consumer$	-2.873**	0.0825	-0.954
	(1.254)	(0.888)	(1.725)
$\Delta \ln RER_{i,t-8} \times Consumer$	0.353	0.323	0.248
	(0.247)	(0.320)	(0.491)
$\Delta \ln RER_{i,t-9} \times Consumer$	0.132	1.099*	-0.716
	(0.361)	(0.559)	(0.473)
$\Delta \ln RER_{i,t-10} \times Consumer$	-0.453	-1.606***	0.577***
	(0.322)	(0.394)	(0.177)
Capital	-0.0403	-0.0263	-0.0525
	(0.0833)	(0.0708)	(0.0682)
$\Delta \ln RER_{i,t} \times Capital$	1.218	0.421	0.366
	(0.814)	(0.669)	(1.007)

Continued on next page

Table 4 – *Continued from previous page*

VARIABLES	(1) Trade Balance	(2) Exports	(3) Imports
$\Delta \ln RER_{i,t-1} \times Capital$	-0.977	-0.520	0.567
	(0.796)	(0.771)	(1.340)
$\Delta \ln RER_{i,t-2} \times Capital$	1.191	1.646	-0.974
	(1.430)	(1.317)	(1.506)
$\Delta \ln RER_{i,t-3} \times Capital$	-2.741	-3.864**	1.740
	(2.424)	(1.742)	(1.715)
$\Delta \ln RER_{i,t-4} \times Capital$	0.217	-0.873	0.320
	(4.691)	(2.625)	(2.191)
$\Delta \ln RER_{i,t-5} \times Capital$	0.833	3.671	-1.883
	(4.169)	(2.336)	(1.996)
$\Delta \ln RER_{i,t-6} \times Capital$	3.985	-1.928	-0.315
	(2.405)	(3.243)	(2.552)
$\Delta \ln RER_{i,t-7} \times Capital$	-6.157**	-0.0520	1.197
	(2.910)	(3.438)	(3.196)
$\Delta \ln RER_{i,t-8} \times Capital$	1.710	1.870	-0.671
	(1.665)	(1.342)	(1.885)
$\Delta \ln RER_{i,t-9} \times Capital$	1.056***	-0.00700	-0.577
	(0.243)	(0.231)	(0.549)
$\Delta \ln RER_{i,t-10} \times Capital$	-0.364**	-0.394***	0.223*
	(0.133)	(0.115)	(0.117)
Intermediate	-0.0835	-0.0206	0.122*
	(0.0676)	(0.0624)	(0.0544)
$\Delta \ln RER_{i,t} \times Interm$	-0.534	0.549	1.060
	(0.850)	(1.263)	(0.621)
$\Delta \ln RER_{i,t-1} \times Interm$	-0.815	0.535	0.913

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Table 4 – *Continued from previous page*

VARIABLES	(1) Trade Balance	(2) Exports	(3) Imports
	(1.361)	(1.451)	(1.595)
$\Delta \ln RER_{i,t-2} \times Interm$	1.294	-1.057*	-2.583
	(2.171)	(0.526)	(1.669)
$\Delta \ln RER_{i,t-3} \times Interm$	0.134	-1.341	0.0188
	(2.610)	(1.174)	(0.490)
$\Delta \ln RER_{i,t-4} \times Interm$	0.116	3.280*	-0.416
	(2.128)	(1.628)	(2.078)
$\Delta \ln RER_{i,t-5} \times Interm$	-0.274	-1.269	0.900
	(1.777)	(1.583)	(1.950)
$\Delta \ln RER_{i,t-6} \times Interm$	-0.415	-1.221	0.887
	(0.970)	(1.085)	(0.905)
$\Delta \ln RER_{i,t-7} \times Interm$	0.564*	0.511	-1.321
	(0.325)	(1.053)	(0.796)
$\Delta \ln RER_{i,t-8} \times Interm$	-1.337	0.253	-0.657
	(2.129)	(0.316)	(1.946)
$\Delta \ln RER_{i,t-9} \times Interm$	2.348	0.984*	1.078
	(2.047)	(0.481)	(2.054)
$\Delta \ln RER_{i,t-10} \times Interm$	-1.060*	-1.205***	0.131
	(0.526)	(0.353)	(0.298)
Raw	0.194	0.0439	-0.321**
	(0.133)	(0.156)	(0.147)
$\Delta \ln RER_{i,t} \times Raw$	-6.360	3.669	3.105
	(8.650)	(5.845)	(4.367)
$\Delta \ln RER_{i,t-1} \times Raw$	8.883	-8.613	-4.263
	(9.596)	(6.672)	(4.922)

Continued on next page

Table 4 – *Continued from previous page*

VARIABLES	(1) Trade Balance	(2) Exports	(3) Imports
$\Delta \ln RER_{i,t-2} \times Raw$	-1.521	4.343	0.465
	(3.966)	(3.034)	(1.979)
$\Delta \ln RER_{i,t-3} \times Raw$	-1.135	-0.346	-0.978
	(0.835)	(1.115)	(0.893)
$\Delta \ln RER_{i,t-4} \times Raw$	-0.500	4.668	1.692*
	(3.092)	(3.066)	(0.924)
$\Delta \ln RER_{i,t-5} \times Raw$	9.909	0.320	-0.464
	(9.806)	(7.146)	(1.021)
$\Delta \ln RER_{i,t-6} \times Raw$	-1.946	9.279	0.618
	(16.70)	(10.27)	(1.221)
$\Delta \ln RER_{i,t-7} \times Raw$	-9.689	-12.50*	0.984
	(10.99)	(6.318)	(5.736)
$\Delta \ln RER_{i,t-8} \times Raw$	3.908*	-2.388	0.0688
	(1.950)	(2.987)	(5.817)
$\Delta \ln RER_{i,t-9} \times Raw$	10.41	3.272	-5.864
	(7.298)	(5.217)	(4.659)
$\Delta \ln RER_{i,t-10} \times Raw$	-11.92	-1.712	4.637
	(7.145)	(4.510)	(4.676)
Constant	0.0371	0.0665***	0.0608**
	(0.0324)	(0.0218)	(0.0279)
Country X Commodity FE	Yes	Yes	Yes
Quarter X Year FE	Yes	Yes	Yes
Observations	898,944	988850	892,158
Number of Id	8,755	10,151	9,068

Continued on next page

Table 4 – *Continued from previous page*

VARIABLES	(1) Trade Balance	(2) Exports	(3) Imports
R-Squared	0.002	0.003	0.003

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

TABLE 5. Estimates for Pre-/Post-Eurozone Formation

VARIABLES	(1) Trade Balance	(2) Exports	(3) Imports
$\Delta \ln GDP_{i,t}$	0.503**	0.0583	-0.490
	(0.168)	(0.130)	(0.293)
$\Delta \ln RER_{i,t}$	-1.354	1.624	0.0836
	(1.484)	(1.221)	(1.545)
$\Delta \ln RER_{i,t-1}$	2.406**	-1.363	-0.445
	(1.055)	(1.555)	(1.779)
$\Delta \ln RER_{i,t-2}$	-3.326**	-0.131	1.435
	(1.381)	(1.972)	(1.664)
$\Delta \ln RER_{i,t-3}$	3.911**	1.766	0.699
	(1.560)	(2.008)	(1.704)
$\Delta \ln RER_{i,t-4}$	-1.681	-1.751	-1.236
	(1.075)	(1.653)	(0.917)
Euro	0.0218	-0.0431	-0.137***
	(0.0466)	(0.0377)	(0.0271)
$\Delta \ln RER_{i,t} \times Euro$	0.752	-1.495	0.574
	(1.558)	(1.120)	(0.1.432)
$\Delta \ln RER_{i,t-1} \times Euro$	-2.303*	1.094	0.245
	(1.022)	(1.527)	(1.804)
$\Delta \ln RER_{i,t-2} \times Euro$	3.262**	0.410	-1.311
	(1.360)	(1.899)	(1.662)
$\Delta \ln RER_{i,t-3} \times Euro$	-3.518**	-1.015	-0.729
	(1.540)	(1.975)	(1.683)
$\Delta \ln RER_{i,t-4} \times Euro$	1.347	0.822	1.188
	(1.051)	(1.617)	(0.896)
Constant	0.00279	0.0752***	0.116***
	(0.0235)	(0.0203)	(0.0167)

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Table 5 – *Continued from previous page*

VARIABLES	(1) Trade Balance	(2) Exports	(3) Imports
Country X Commodity FE	Yes	Yes	Yes
Quarter X Year FE	Yes	Yes	Yes
Observations	430,179	454,215	438,329
Number of Id	8,755	10,151	9,068
R-Squared	0.003	0.003	0.003

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

TABLE 6. Estimates for Rauch Goods, Pre-/Post-Eurozone Formation

VARIABLES	(1) Trade Balance	(2) Exports	(3) Imports
$\Delta \ln GDP_{i,t}$	0.504**	0.0575	-0.490
	(0.165)	(0.132)	(0.292)
$\Delta \ln RER_{i,t}$	5.238*	0.222	-4.968
	(2.452)	(3.536)	(3.302)
$\Delta \ln RER_{i,t-1}$	-6.383*	-5.482	10.66**
	(3.235)	(5.329)	(3.505)
$\Delta \ln RER_{i,t-2}$	-3.048	10.72**	-0.134
	(4.851)	(3.680)	(5.368)
$\Delta \ln RER_{i,t-3}$	7.493	-5.645	-5.973
	(4.328)	(4.378)	(4.221)
$\Delta \ln RER_{i,t-4}$	-3.843	1.032	6.505
	(4.421)	(4.101)	(4.985)
$\Delta \ln RER_{i,t-5}$	0.367	-0.384	-3.732
	(3.810)	(4.236)	(2.362)
$\Delta \ln RER_{i,t-6}$	2.122	5.204	0.665
	(3.891)	(4.002)	(3.940)
$\Delta \ln RER_{i,t-7}$	-4.136	-5.178	-1.633
	(5.716)	(4564)	(2.723)
$\Delta \ln RER_{i,t-8}$	2.853	1.606	-0.850
	(3.532)	(2.579)	(5.161)
$\Delta \ln RER_{i,t-9}$	-0.0614	-4.146	0.407
	(3.497)	(4.702)	(4.191)
$\Delta \ln RER_{i,t-10}$	-0.586	2.256	-0.360
	(2.806)	(3.198)	(1.632)
Euro	0.0317	-0.0415	-0.137***
	(0.0467)	(0.0501)	(0.0395)

Continued on next page

Table 6 – *Continued from previous page*

VARIABLES	(1) Trade Balance	(2) Exports	(3) Imports
$\Delta \ln RER_{i,t} \times Euro$	-5.923**	-0.704	5.218
	(2.372)	(3.499)	(3.292)
$\Delta \ln RER_{i,t-1} \times Euro$	6.129*	5.704	-9.997**
	(3.219)	(5.306)	(3.494)
$\Delta \ln RER_{i,t-2} \times Euro$	2.350	-15.05***	1.476
	(4.840)	(3.668)	(5.370)
$\Delta \ln RER_{i,t-3} \times Euro$	-6.829	10.10	4.260
	(4.586)	(5.620)	(4.227)
$\Delta \ln RER_{i,t-4} \times Euro$	4.577	0.189	-6.869
	(4.254)	(3.609)	(4.965)
$\Delta \ln RER_{i,t-5} \times Euro$	-0.523	-0.721	4.191
	(3.850)	(4.352)	(2.350)
$\Delta \ln RER_{i,t-6} \times Euro$	-3.443	-6.080	-0.0494
	(3.709)	(4.042)	(3.936)
$\Delta \ln RER_{i,t-7} \times Euro$	5.667	6.241	1.060
	(5.398)	(4.375)	(2.790)
$\Delta \ln RER_{i,t-8} \times Euro$	-3.021	-1.659	13.92**
	(3.534)	(2.585)	(5.287)
$\Delta \ln RER_{i,t-9} \times Euro$	-0.194	5.620	-14.02***
	(3.496)	(4.670)	(4.077)
$\Delta \ln RER_{i,t-10} \times Euro$	0.656	-3.922	0.748
	(2.785)	(3.172)	(1.627)
Differentiated	0.109	-0.600	-0.242
	(0.539)	(0.349)	(0.256)
$\Delta \ln RER_{i,t} \times Dif$	-6.385*	1.587	4.683

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Table 6 – *Continued from previous page*

VARIABLES	(1) Trade Balance	(2) Exports	(3) Imports
	(2.948)	(3.716)	(3.987)
$\Delta \ln RER_{i,t-1} \times Dif$	7.487	2.799	-10.37**
	(4.447)	(5.519)	(3.505)
$\Delta \ln RER_{i,t-2} \times Dif$	1.411	-9.970*	1.892
	(5.794)	(4.732)	(5.505)
$\Delta \ln RER_{i,t-3} \times Dif$	-5.216	8.556	7.254
	(5.061)	(6.297)	(4.772)
$\Delta \ln RER_{i,t-4} \times Dif$	3.039	-6.680	-9.579*
	(5.242)	(5.238)	(5.008)
$\Delta \ln RER_{i,t-5} \times Dif$	-0.00221	2.274	4.567
	(4.955)	(5.009)	(3.530)
$\Delta \ln RER_{i,t-6} \times Dif$	-0.462	-3.686	-1.924
	(4.315)	(4.520)	(4.482)
$\Delta \ln RER_{i,t-7} \times Dif$	3.801	5.392	2.964
	(5.571)	(5.489)	(2.848)
$\Delta \ln RER_{i,t-8} \times Dif$	-7.861	-0.326	3.188
	(5.379)	(2.838)	(5.580)
$\Delta \ln RER_{i,t-9} \times Dif$	4.020	0.719	-3.334
	(4.117)	(5.047)	(3.845)
$\Delta \ln RER_{i,t-10} \times Dif$	0.0286	-0.806	0.623
	(3.551)	(3.551)	(2.293)
$Euro \times Dif$	-0.00528	-0.0151	0.000345
	(0.0251)	(0.0216)	(0.0169)
$\Delta \ln RER_{i,t} \times Euro \times Dif$	6.466*	-0.959	-4.244
	(2.958)	(3.722)	(3.970)

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Table 6 – *Continued from previous page*

VARIABLES	(1) Trade Balance	(2) Exports	(3) Imports
$\Delta \ln RER_{i,t-1} \times Euro \times Dif$	-6.614	-3.037	9.494**
	(4.466)	(5.606)	(3.591)
$\Delta \ln RER_{i,t-2} \times Euro \times Dif$	-1.248	14.31**	-3.181
	(5.918)	(5.331)	(5.370)
$\Delta \ln RER_{i,t-3} \times Euro \times Dif$	4.299	-12.63	-5.385
	(5.528)	(7.520)	(4.754)
$\Delta \ln RER_{i,t-4} \times Euro \times Dif$	-3.554	4.908	9.621*
	(5.624)	(4.802)	(5.068)
$\Delta \ln RER_{i,t-5} \times Euro \times Dif$	0.136	-1.224	-4.808
	(5.005)	(4.928)	(3.544)
$\Delta \ln RER_{i,t-6} \times Euro \times Dif$	6.884	4.060	1.150
	(4.163)	(4.415)	(4.956)
$\Delta \ln RER_{i,t-7} \times Euro \times Dif$	-10.38*	-5.959	-2.333
	(5.285)	(5.122)	(3.352)
$\Delta \ln RER_{i,t-8} \times Euro \times Dif$	7.586	0.414	-16.26**
	(5.267)	(2.896)	(5.648)
$\Delta \ln RER_{i,t-9} \times Euro \times Dif$	-3.262	-2.026	16.87***
	(4.196)	(5.003)	(3.886)
$\Delta \ln RER_{i,t-10} \times Euro \times Dif$	-0.135	2.318	-0.903
	(3.550)	(3.564)	(2.296)
$\Delta \ln RER_{i,t} \times Hom$	-9.592*	1.395	7.578**
	(4.319)	(3.802)	(2.529)
$\Delta \ln RER_{i,t-1} \times Hom$	14.76**	8.228	-16.64***
	(4.650)	(5.797)	(4.243)
$\Delta \ln RER_{i,t-2} \times Hom$	-3.947	-17.15**	-0.0393

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Table 6 – *Continued from previous page*

VARIABLES	(1) Trade Balance	(2) Exports	(3) Imports
	(6.306)	(4.446)	(6.943)
$\Delta \ln RER_{i,t-3} \times Hom$	-1.170	8.462	9.438*
	(5.974)	(7.366)	(4.921)
$\Delta \ln RER_{i,t-4} \times Hom$	6.003	4.518	-7.949
	(4.402)	(7.080)	(5.229)
$\Delta \ln RER_{i,t-5} \times Hom$	-3.297	-3.198	4.640
	(3.858)	(5.027)	(3.431)
$\Delta \ln RER_{i,t-6} \times Hom$	-3.295	-10.80*	0.258
	(7.667)	(5.724)	(3.946)
$\Delta \ln RER_{i,t-7} \times Hom$	5.593	4.679	2.704
	(5.983)	(5.301)	(3.817)
$\Delta \ln RER_{i,t-8} \times Hom$	-3.206	4.357	-2.484
	(6.014)	(3.968)	(3.579)
$\Delta \ln RER_{i,t-9} \times Hom$	-5.921	3.263	-1.601
	(7.835)	(5.999)	(2.683)
$\Delta \ln RER_{i,t-10} \times Hom$	4.198	-3.655	3.981
	(4.035)	(3.455)	(2.635)
$Euro \times Hom$	-0.000447	0.0311	-0.0184
	(0.0259)	(0.0230)	(0.0396)
$\Delta \ln RER_{i,t} \times Euro \times Hom$	15.63***	17.82*	-12.48***
	(4.075)	(9.578)	(2.526)
$\Delta \ln RER_{i,t-1} \times Euro \times Hom$	-20.64***	-27.50**	21.07***
	(5.161)	(10.34)	(4.210)
$\Delta \ln RER_{i,t-2} \times Euro \times Hom$	1.957	22.00***	-0.334
	(6.290)	(4.828)	(6.874)

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Table 6 – *Continued from previous page*

VARIABLES	(1) Trade Balance	(2) Exports	(3) Imports
$\Delta \ln RER_{i,t-3} \times Euro \times Hom$	3.902	-12.21	-8.721
	(6.587)	(4.828)	(4.850)
$\Delta \ln RER_{i,t-4} \times Euro \times Hom$	-6.398	-5.438	8.773
	(4.557)	(6.749)	(5.069)
$\Delta \ln RER_{i,t-5} \times Euro \times Hom$	2.994	3.118	-5.408
	(3.869)	(5.328)	(3.302)
$\Delta \ln RER_{i,t-6} \times Euro \times Hom$	4.238	13.01*	-0.813
	(7.557)	(6.323)	(4.038)
$\Delta \ln RER_{i,t-7} \times Euro \times Hom$	-8.070	-6.789	-2.247
	(5.682)	(5.505)	(4.244)
$\Delta \ln RER_{i,t-8} \times Euro \times Hom$	6.308	-4.615	-10.41**
	(6.065)	(4.079)	(3.777)
$\Delta \ln RER_{i,t-9} \times Euro \times Hom$	4.761	-4.945	15.37***
	(7.919)	(5.904)	(2.620)
$\Delta \ln RER_{i,t-10} \times Euro \times Hom$	-4.762	5.473	-4.692*
	(4.019)	(3.483)	(2.510)
Constant	-0.0723	0.430*	0.275
	(0.352)	(0.202)	(0.0.166)
Country X Commodity FE	Yes	Yes	Yes
Quarter X Year FE	Yes	Yes	Yes
Observations	430,159	454,194	438,306
Number of Id	8,755	10,151	9,068
R-Squared	0.003	0.003	0.003

Robust standard errors in parentheses

Continued on next page

Table 6 – *Continued from previous page*

VARIABLES	(1) Trade Balance	(2) Exports	(3) Imports

*** p<0.01, ** p<0.05, * p<0.1

TABLE 7. Intersection of Currency Invoicing Characteristics

Characteristics of Trade	**LCP Exports**	**PCP Exports**	**PCP Imports**	**Intersection**
To advanced/larger countries	X	X	X	X
Differentiated goods	X	X	X	X
Homogeneous goods	X			
Yen more volatile currency	X			
Foreign affiliate	X			
Larger shipment	X			
Asian nations	X	X		
Less developed/smaller countries		X		
Countries with smaller trade share		X		
Countries with large market share			X	

TABLE 8. Estimation Results for Japanese Trade Balances

VARIABLES	(1) Trade Balance
$\Delta lnGDP_{i,j,t}$	0.0384***
	(0.0133)
$\Delta lnRER_{i,j,t}$	0.170***
	(0.0445)
$\Delta lnRER_{i,j,t-1}$	0.184***
	(0.0416)
$\Delta lnRER_{i,j,t-2}$	0.0133
	(0.0427)
$\Delta lnRER_{i,j,t-3}$	0.0865*
	(0.0451)
$\Delta lnRER_{i,j,t-4}$	-0.0132
	(0.0412)
$\Delta lnRER_{i,j,t-5}$	-0.0152
	(0.0424)
$\Delta lnRER_{i,j,t-6}$	0.0333
	(0.0485)
$\Delta lnRER_{i,j,t-7}$	-0.00586
	(0.0615)
Constant	-0.00677
	(5.170)
Country-Product FE	Yes
Quarter-Year FE	Yes
Observations	2,678,162
Number of id	66,244
R-squared	0.000

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

TABLE 9. Estimates of Trade Responses with U.S./European Trading Partners

VARIABLES	(1) Trade Balance	(2) Exports	(3) Imports
$\Delta lnGDP_{i,j,t}$	0.0337	0.0759***	0.0422***
	(0.0197)	(0.0185)	(0.0115)
$\Delta lnRER_{i,j,t}$	0.210**	0.248**	0.0376
	(0.0985)	(0.0944)	(0.0313)
$\Delta lnRER_{i,j,t-1}$	0.201***	0.129**	-0.0715***
	(0.0636)	(0.0607)	(0.0242)
$\Delta lnRER_{i,j,t-2}$	0.0113	-0.0699	-0.0812*
	(0.0472)	(0.0450)	(0.0463)
$\Delta lnRER_{i,j,t-3}$	0.0623	0.123	0.0607
	(0.0823)	(0.0774)	(0.0420)
$\Delta lnRER_{i,j,t-4}$	-0.0169	-0.0781**	-0.0612*
	(0.0361)	(0.0360)	(0.0320)
$\Delta lnRER_{i,j,t-5}$	0.0177	0.0283	0.0106
	(0.0750)	(0.0516)	(0.0267)
$\Delta lnRER_{i,j,t-6}$	0.0633	-0.0209	-0.0842***
	(0.0528)	(0.0633)	(0.0276)
$\Delta lnRER_{i,j,t-7}$	0.0265	0.008301	-0.0182
	(0.116)	(0.104)	(0.0451)
$\Delta lnRER_{i,j,t} \times USE$	-0.296	0.159	0.455***
	(0.181)	(0.130)	(0.104)
$\Delta lnRER_{i,j,t-1} \times USE$	-0.192	-0.282*	-0.0900
	(0.125)	(0.158)	(0.0888)
$\Delta lnRER_{i,j,t-2} \times USE$	0.140	0.293**	0.154
	(0.135)	(0.109)	(0.0987)
$\Delta lnRER_{i,j,t-3} \times USE$	0.141	-0.00654	-0.147

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Table 9 – *Continued from previous page*

VARIABLES	(1) Trade Balance	(2) Exports	(3) Imports
	(0.153)	(0.136)	(0.0867)
$\Delta lnRER_{i,j,t-4} \times USE$	0.102	0.166*	0.0643
	(0.0985)	(0.0881)	(0.0727)
$\Delta lnRER_{i,j,t-5} \times USE$	-0.147	-0.230**	-0.0834
	(0.0930)	(0.0887)	(0.0518)
$\Delta lnRER_{i,j,t-6} \times USE$	-0.0784	-0.0752	0.00320
	(0.0893)	(0.0617)	(0.0767)
$\Delta lnRER_{i,j,t-7} \times USE$	0.0738	0.0391	-0.0347
	(0.115)	(0.0942)	(0.0541)
Constant	-0.130**	-0.150**	0.0246
	(0.0500)	(0.0403)	(0.0273)
Country X Product FE	Yes	Yes	Yes
Quarter X Year FE	Yes	Yes	Yes
Observations	2,460,802	2,460,802	2,460,802
Number of id	65,662	65,662	65,662
R-squared	0.000	0.002	0.000
Number of id	65,662	65,662	65,662

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

TABLE 10. Estimate Results of the Response of Rauch Good Trade

VARIABLES	(1) Trade Balance	(2) Exports	(3) Imports
$\Delta lnGDP_{i,j,t}$	0.0371*	0.0813***	0.0443***
	(0.0188)	(0.0192)	(0.0112)
$\Delta lnRER_{i,j,t}$	0.233	0.247*	0.0137
	(0.150)	(0.123)	(0.0627)
$\Delta lnRER_{i,j,t-1}$	0.204*	0.237**	0.0330
	(0.104)	(0.0882)	(0.0463)
$\Delta lnRER_{i,j,t-2}$	-0.0190	-0.0983	-0.0793
	(0.0893)	(0.0656)	(0.0760)
$\Delta lnRER_{i,j,t-3}$	0.0796	0.181*	0.102
	(0.147)	(0.101)	(0.0743)
$\Delta lnRER_{i,j,t-4}$	0.01508	-0.126*	-0.141***
	(0.0801)	(0.0636)	(0.0403)
$\Delta lnRER_{i,j,t-5}$	0.0667	0.0662	-0.000497
	(0.106)	(0.0647)	(0.0608)
$\Delta lnRER_{i,j,t-6}$	0.0373	-0.0476	-0.0849
	(0.0601)	(0.0745)	(0.0635)
$\Delta lnRER_{i,j,t-7}$	-0.0180	-0.0475	-0.0296
	(0.149)	(0.110)	(0.0677)
$\Delta lnRER_{i,j,t} \times Dif$	-0.136	-0.0419	0.0938
	(0.100)	(0.0547)	(0.0668)
$\Delta lnRER_{i,j,t-1} \times Dif$	-0.00309	-0.107**	-0.104*
	(0.0693)	(0.0421)	(0.0581)
$\Delta lnRER_{i,j,t-2} \times Dif$	0.106	0.132***	0.0254
	(0.0742)	(0.0447)	(0.0660)
$\Delta lnRER_{i,j,t-3} \times Dif$	0.00684	-0.0492	-0.0561

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Table 10 – *Continued from previous page*

VARIABLES	(1) Trade Balance	(2) Exports	(3) Imports
	(0.109)	(0.0376)	(0.0904)
$\Delta lnRER_{i,j,t-4} \times Dif$	0.0523	0.0865	0.0342
	(0.0842)	(0.0702)	(0.0704)
$\Delta lnRER_{i,j,t-5} \times Dif$	-0.0421	-0.0587	-0.0166
	(0.0937)	(0.0597)	(0.0591)
$\Delta lnRER_{i,j,t-6} \times Dif$	-0.0370	0.0251	0.0621
	(0.0790)	(0.0620)	(0.0661)
$\Delta lnRER_{i,j,t-7} \times Dif$	0.0242	-0.0267	-0.0509
	(0.0990)	(0.0748)	(0.0508)
Homogeneous	0.175***	0.261***	0.0855***
	(0.0399)	(0.0309)	(0.0176)
$\Delta lnRER_{i,j,t} \times Hom$	0.0970	0.119	0.0221
	(0.126)	(0.0790)	(0.0758)
$\Delta lnRER_{i,j,t-1} \times Hom$	-0.0974	-0.192**	-0.0945
	(0.133)	(0.0734)	(0.0849)
$\Delta lnRER_{i,j,t-2} \times Hom$	-0.0919	-0.145**	-0.0527
	(0.106)	(0.0607)	(0.0669)
$\Delta lnRER_{i,j,t-3} \times Hom$	0.0472	-0.0576	-0.105
	(0.133)	(0.0937)	(0.0732)
$\Delta lnRER_{i,j,t-4} \times Hom$	-0.140	-0.000794	0.139**
	(0.0943)	(0.0637)	(0.0612)
$\Delta lnRER_{i,j,t-5} \times Hom$	-0.127	-0.0960	0.0314
	(0.0911)	(0.0562)	(0.0611)
$\Delta lnRER_{i,j,t-6} \times Hom$	0.0849	-0.0621	-0.147*
	(0.0994)	(0.0771)	(0.0820)

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Table 10 – *Continued from previous page*

VARIABLES	(1) Trade Balance	(2) Exports	(3) Imports
$\Delta lnRER_{i,j,t-7} \times Hom$	0.0949	0.216*	0.121**
	(0.136)	(0.113)	(0.0569)
Constant	-0.184***	-0.151***	0.0327
	(0.0472)	(0.0433)	(0.0267)
Country X Product FE	Yes	Yes	Yes
Quarter X Year FE	Yes	Yes	Yes
Observations	2,460,802	2,460,802	2,460,802
Number of id	65,662	65,662	65,662
R-squared	0.000	0.002	0.000

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

TABLE 11. Estimate Results for Rauch Goods Trade with U.S/Europe to Real Depreciation

VARIABLES	(1) Trade Balance	(2) Exports	(3) Imports
$\Delta lnGDP_{i,j,t}$	0.0342	0.0764***	0.0422***
	(0.0199)	(0.0186)	(0.0115)
$\Delta lnRER_{i,j,t}$	0.270	0.247*	-0.0232
	(0.157)	(0.125)	(0.0580)
$\Delta lnRER_{i,j,t-1}$	0.250**	0.252**	0.00264
	(0.108)	(0.0946)	(0.0439)
$\Delta lnRER_{i,j,t-2}$	-0.0403	-0.126*	-0.0857
	(0.0863)	(0.0718)	(0.0805)
$\Delta lnRER_{i,j,t-3}$	0.0337	0.155	0.122
	(0.158)	(0.103)	(0.0865)
$\Delta lnRER_{i,j,t-4}$	0.00145	-0.110	-0.111***
	(0.0897)	(0.0700)	(0.0415)
$\Delta lnRER_{i,j,t-5}$	0.0666	0.06750.0662	0.000848
	(0.120)	(0.0696)	(0.0691)
$\Delta lnRER_{i,j,t-6}$	0.0147	-0.0633	-0.0780
	(0.0768)	(0.0857)	(0.0683)
$\Delta lnRER_{i,j,t-7}$	-0.0187	-0.0407	-0.0219
	(0.149)	(0.112)	(0.0750)
$\Delta lnRER_{i,j,t} \times Dif$	-0.149	-0.0494	0.0994
	(0.0984)	(0.0571)	(0.0611)
$\Delta lnRER_{i,j,t-1} \times Dif$	-0.0486	-0.133**	-0.0841
	(0.585)	(0.0474)	(0.0496)
$\Delta lnRER_{i,j,t-2} \times Dif$	0.128*	0.156**	0.0271
	(0.0711)	(0.0596)	(0.0602)
$\Delta lnRER_{i,j,t-3} \times Dif$	0.0293	-0.0333	-0.0627

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Table 11 – *Continued from previous page*

VARIABLES	(1) Trade Balance	(2) Exports	(3) Imports
	(0.123)	(0.0419)	(0.103)
$\Delta lnRER_{i,j,t-4} \times Dif$	0.0157	0.0469	0.0312
	(0.112)	(0.0858)	(0.0827)
$\Delta lnRER_{i,j,t-5} \times Dif$	-0.0367	-0.00315	0.00519
	(0.111)	(0.0656)	(0.0719)
$\Delta lnRER_{i,j,t-6} \times Dif$	0.0543	0.106	0.0518
	(0.106)	(0.0614)	(0.0706)
$\Delta lnRER_{i,j,t-7} \times Dif$	0.0321	-0.00499	-0.0371
	(0.125)	(0.0999)	(0.0566)
Homogeneous	0.388	0.227	-0.161
	(0.368)	(0.120)	(0.174)
$\Delta lnRER_{i,j,t} \times Hom$	0.107	0.120	0.0121
	(0.124)	(0.0774)	(0.0767)
$\Delta lnRER_{i,j,t-1} \times Hom$	-0.0838	-0.190**	-0.106
	(0.131)	(0.0716)	(0.0819)
$\Delta lnRER_{i,j,t-2} \times Hom$	-0.0968	-0.141**	-0.0446
	(0.109)	(0.0616)	(0.0703)
$\Delta lnRER_{i,j,t-3} \times Hom$	0.0384	-0.0579	-0.0962
	(0.130)	(0.0895)	(0.0737)
$\Delta lnRER_{i,j,t-4} \times Hom$	-0.116	0.0136	0.130*
	(0.0915)	(0.0588)	(0.0615)
$\Delta lnRER_{i,j,t-5} \times Hom$	-0.108	-0.0861	0.0224
	(0.0911)	(0.0564)	(0.0602)
$\Delta lnRER_{i,j,t-6} \times Hom$	0.0683	-0.0813	-0.150*
	(0.102)	(0.0785)	(0.0855)

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Table 11 – *Continued from previous page*

VARIABLES	(1) Trade Balance	(2) Exports	(3) Imports
$\Delta lnRER_{i,j,t-7} \times Hom$	0.109	0.214*	0.105*
	(0.142)	(0.115)	(0.0573)
$\Delta lnRER_{i,j,t} \times USE$	-0.279	0.165	0.443***
	(0.184)	(0.131)	(0.104)
$\Delta lnRER_{i,j,t-1} \times USE$	-0.352**	-0.388**	-0.0360
	(0.125)	(0.158)	(0.117)
$\Delta lnRER_{i,j,t-2} \times USE$	0.232	0.370***	0.138
	(0.156)	(0.117)	(0.143)
$\Delta lnRER_{i,j,t-3} \times USE$	0.159	0.0300	-0.129
	(0.147)	(0.124)	(0.103)
$\Delta lnRER_{i,j,t-4} \times USE$	0.0466	0.0605	0.0140
	(0.111)	(0.100)	(0.0785)
$\Delta lnRER_{i,j,t-5} \times USE$	-0.152	-0.160	-0.00773
	(0.137)	(0.0991)	(0.0761)
$\Delta lnRER_{i,j,t-6} \times USE$	0.122	0.0645	-0.0576
	(0.145)	(0.0862)	(0.0877)
$\Delta lnRER_{i,j,t-7} \times USE$	0.0942	0.0884	-0.00575
	(0.165)	(0.132)	(0.0767)
$\Delta lnRER_{i,j,t-1} \times Dif \times USE$	0.279	0.175**	-0.104
	(0.202)	(0.0778)	(0.138)
$\Delta lnRER_{i,j,t-2} \times Dif \times USE$	-0.164	-0.132	0.0316
	(0.111)	(0.113)	(0.0895)
$\Delta lnRER_{i,j,t-3} \times Dif \times USE$	-0.0579	-0.0659	-0.00798
	(0.151)	(0.122)	(0.122)
$\Delta lnRER_{i,j,t-4} \times Dif \times USE$	0.123	0.184	0.0617

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Table 11 – *Continued from previous page*

VARIABLES	(1) Trade Balance	(2) Exports	(3) Imports
	(0.115)	(0.138)	(0.115)
$\Delta lnRER_{i,j,t-5} \times Dif \times USE$	0.0413	-0.0861	-0.127*
	(0.131)	(0.0970)	(0.0698)
$\Delta lnRER_{i,j,t-6} \times Dif \times USE$	-0.347**	-0.259*	0.0878
	(0.156)	(0.134)	(0.0711)
$\Delta lnRER_{i,j,t-7} \times Dif \times USE$	-0.0110	-0.0704	-0.0594
	(0.217)	(0.211)	(0.0857)
Homogeneous $\times USE$	-0.309	-0.00407	0.305
	(0.392)	(0.186)	(0.207)
$\Delta lnRER_{i,j,t} \times Hom \times USE$	-0.543	-0.0909	0.452**
	(0.350)	(0.265)	(0.214)
$\Delta lnRER_{i,j,t-1} \times Hom \times USE$	-0.512	-0.0633	0.449
	(0.581)	(0.276)	(0.355)
$\Delta lnRER_{i,j,t-2} \times Hom \times USE$	0.211	-0.0862	-0.298
	(0.755)	(0.505)	(0.403)
$\Delta lnRER_{i,j,t-3} \times Hom \times USE$	0.638	0.196	-0.442
	(0.755)	(0.574)	(0.472)
$\Delta lnRER_{i,j,t-4} \times Hom \times USE$	-0.878	-0.433	0.445
	(0.637)	(0.646)	(0.319)
$\Delta lnRER_{i,j,t-5} \times Hom \times USE$	-0.825*	-0.552	0.273
	(0.422)	(0.597)	(0.296)
$\Delta lnRER_{i,j,t-6} \times Hom \times USE$	0.589***	0.681	0.0926
	(0.200)	(0.403)	(0.449)
$\Delta lnRER_{i,j,t-7} \times Hom \times USE$	-0.488	0.0254	0.473
	(0.482)	(0.263)	(0.399)

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Table 11 – *Continued from previous page*

VARIABLES	(1) Trade Balance	(2) Exports	(3) Imports
Constant	-0.221***	-0.161***	0.0603
	(0.0908)	(0.0607)	(0.0397)
Country X Product FE	Yes	Yes	Yes
Quarter X Year FE	Yes	Yes	Yes
Observations	2,460,802	2,460,802	2,460,802
Number of id	65,662	65,662	65,662
R-squared	0.000	0.002	0.000

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

TABLE 12. Estimate Results for Trade with Asia to Real Depreciation

VARIABLES	(1) Trade Balance	(2) Exports	(3) Imports
$\Delta lnGDP_{i,j,t}$	0.0433*	0.0868***	0.0435***
	(0.0244)	(0.0213)	(0.0116)
$\Delta lnRER_{i,j,t}$	0.104	0.343***	0.239**
	(0.161)	(0.115)	(0.105)
$\Delta lnRER_{i,j,t-1}$	0.179	0.0420	-0.137**
	(0.137)	(0.140)	(0.0520)
$\Delta lnRER_{i,j,t-2}$	0.166	0.224**	0.0584
	(0.140)	(0.0917)	(0.0958)
$\Delta lnRER_{i,j,t-3}$	-0.00817	-0.106	-0.0983
	(0.142)	(0.101)	(0.0776)
$\Delta lnRER_{i,j,t-4}$	0.0576	0.123*	0.0652
	(0.0799)	(0.0689)	(0.0565)
$\Delta lnRER_{i,j,t-5}$	0.0358	-0.0495	-0.0853
	(0.100)	(0.0861)	(0.0536)
$\Delta lnRER_{i,j,t-6}$	-0.0575	-0.106	-0.0489
	(0.0709)	(0.0739)	(0.0518)
$\Delta lnRER_{i,j,t-7}$	0.0401	-0.0347	-0.0748
	(0.145)	(0.115)	(0.0496)
$\Delta lnRER_{i,j,t} \times Asia$	0.109	-0.119	-0.229**
	(0.195)	(0.144)	(0.104)
$\Delta lnRER_{i,j,t-1} \times Asia$	0.00275	0.0608	0.0580
	(0.111)	(0.119)	(0.0583)
$\Delta lnRER_{i,j,t-2} \times Asia$	-0.211	-0.373***	-0.162
	(0.135)	(0.0705)	(0.0930)
$\Delta lnRER_{i,j,t-3} \times Asia$	0.107	0.273***	0.165**

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Table 12 – *Continued from previous page*

VARIABLES	(1) Trade Balance	(2) Exports	(3) Imports
	(0.132)	(0.0895)	(0.0741)
$\Delta lnRER_{i,j,t-4} \times Asia$	-0.0532	-0.219***	-0.166**
	(0.0847)	(0.0594)	(0.0627)
$\Delta lnRER_{i,j,t-5} \times Asia$	0.0120	0.0837	0.0717
	(0.0698)	(0.0710)	(0.0562)
$\Delta lnRER_{i,j,t-6} \times Asia$	0.175**	0.144**	-0.0312
	(0.0740)	(0.0530)	(0.0517)
$\Delta lnRER_{i,j,t-7} \times Asia$	0.00167	0.0625	0.0608
	(0.110)	(0.0924)	(0.0507)
Constant	-0.143***	-0.111***	0.0323
	(0.0493)	(0.0418)	(0.0257)
Country X Product FE	Yes	Yes	Yes
Quarter X Year FE	Yes	Yes	Yes
Observations	2,460,802	2,460,802	2,460,802
Number of id	65,662	65,662	65,662
R-squared	0.000	0.002	0.000

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

TABLE 13. Estimate Results for Trade Pre-/Post-1998 Law Revision

VARIABLES	(1) Trade Balance	(2) Exports	(3) Imports
$\Delta lnGDP_{i,j,t}$	0.0713***	0.124***	0.0526***
	(0.0123)	(0.00926)	(0.00876)
$\Delta lnRER_{i,j,t}$	0.774***	1.241***	0.468***
	(0.158)	(0.111)	(0.114)
$\Delta lnRER_{i,j,t-1}$	0.769***	0.701***	-0.0677
	(0.148)	(0.111)	(0.0989)
$\Delta lnRER_{i,j,t-2}$	0.212	0.147	-0.0655
	(0.151)	(0.113)	(0.100)
$\Delta lnRER_{i,j,t-3}$	-1.459***	-1.672***	-0.214**
	(0.159)	(0.119)	(0.103)
$\Delta lnRER_{i,j,t-4}$	-0.865***	-0.909***	-0.0434
	(0.147)	(0.108)	(0.101)
$\Delta lnRER_{i,j,t-5}$	-0.0463	-0.197*	-0.151
	(0.147)	(0.107)	(0.0998)
$\Delta lnRER_{i,j,t-6}$	0.451***	0.561***	0.110
	(0.141)	(0.101)	(0.0971)
April98	-0.00256	-0.00331	0.00584
	(6.743)	(2.817)	
$\Delta lnRER_{i,j,t} \times April98$	-0.484***	-0.683***	-0.200*
	(0.162)	(0.113)	(0.116)
$\Delta lnRER_{i,j,t-1} \times April98$	-0.441***	-0.0935	0.348***
	(0.152)	(0.114)	(0.101)
$\Delta lnRER_{i,j,t-2} \times April98$	-0.259*	-0.102	0.157
	(0.154)	(0.116)	(0.103)
$\Delta lnRER_{i,j,t-3} \times April98$	1.451***	1.717***	0.267**

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Table 13 – *Continued from previous page*

VARIABLES	(1) Trade Balance	(2) Exports	(3) Imports
	(0.163)	(0.122)	(0.106)
$\Delta lnRER_{i,j,t-4} \times April98$	0.709***	0.730***	0.0214
	(0.152)	(0.111)	(0.104)
$\Delta lnRER_{i,j,t-5} \times April98$	0.0812	0.248**	0.166
	(0.151)	(0.110)	(0.103)
$\Delta lnRER_{i,j,t-6} \times April98$	-0.393***	-0.605***	-0.212**
	(0.145)	(0.105)	(0.100)
Constant	-0.0793	-0.0286	-0.0206
	(6.582)	(0.2.943)	
Country X Product FE	Yes	Yes	Yes
Quarter X Year FE	Yes	Yes	Yes
Observations	3,244,117	3,244,117	3,244,117
Number of id	75,872	75,872	75,872
R-squared	0.001	0.002	0.000

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

TABLE 14. Estimate Results for Trade with Asian nations Pre-/Post-1998 Law Revision

VARIABLES	(1) Trade Balance	(2) Exports	(3) Imports
$\Delta lnGDP_{i,j,t}$	0.0788***	0.132***	0.0531***
	(0.0129)	(0.00975)	(0.00919)
$\Delta lnRER_{i,j,t}$	-0.488**	-0.144	0.343*
	(0.247)	(0.172)	(0.176)
$\Delta lnRER_{i,j,t-1}$	0.799***	0.703***	-0.0952
	(0.183)	(0.142)	(0.115)
$\Delta lnRER_{i,j,t-2}$	0.368**	0.340**	-0.0285
	(0.186)	(0.143)	(0.119)
$\Delta lnRER_{i,j,t-3}$	-0.0570	-0.0191	0.0379
	(0.208)	(0.154)	(0.136)
$\Delta lnRER_{i,j,t-4}$	-0.332*	-0.319**	0.0122
	(0.182)	(0.136)	(0.124)
$\Delta lnRER_{i,j,t-5}$	-0.451**	-0.580***	-0.129
	(0.200)	(0.148)	(0.132)
$\Delta lnRER_{i,j,t-6}$	-0.0534	-0.0395	0.0140
	(0.191)	(0.139)	(0.130)
April98	0.0990***	0.0522***	-0.0468**
	(0.0284)	(0.0200)	(0.0202)
$\Delta lnRER_{i,j,t} \times April98$	0.585**	0.635***	0.0500
	(0.253)	(0.177)	(0.180)
$\Delta lnRER_{i,j,t-1} \times April98$	-0.475**	-0.160	0.316**
	(0.195)	(0.151)	(0.124)
$\Delta lnRER_{i,j,t-2} \times April98$	-0.397**	-0.143	0.254**
	(0.199)	(0.152)	(0.128)
$\Delta lnRER_{i,j,t-3} \times April98$	-0.0266	-0.226	-0.200

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Table 14 – *Continued from previous page*

VARIABLES	(1) Trade Balance	(2) Exports	(3) Imports
	(0.220)	(0.163)	(0.145)
$\Delta lnRER_{i,j,t-4} \times April98$	0.267	0.414***	0.147
	(0.196)	(0.146)	(0.133)
$\Delta lnRER_{i,j,t-5} \times April98$	0.616***	0.685***	0.0691
	(0.211)	(0.156)	(0.140)
$\Delta lnRER_{i,j,t-6} \times April98$	0.0946	-0.0183	-0.113
	(0.200)	(0.146)	(0.137)
$\Delta lnRER_{i,j,t} \times Asia$	-0.331	-1.001***	-0.670***
	(0.325)	(0.232)	(0.230)
$\Delta lnRER_{i,j,t-1} \times Asia$	0.0700	-0.0177	-0.0877
	(0.329)	(0.238)	(0.233)
$\Delta lnRER_{i,j,t-2} \times Asia$	-0.296	-0.411*	-0.115
	(0.342)	(0.235)	(0.248)
$\Delta lnRER_{i,j,t-3} \times Asia$	1.188***	1.374***	0.186
	(0.350)	(0.255)	(0.250)
$\Delta lnRER_{i,j,t-4} \times Asia$	-0.909***	-0.893***	0.0163
	(0.319)	(0.232)	(0.224)
$\Delta lnRER_{i,j,t-5} \times Asia$	0.0120	-0.264	-0.276
	(0.328)	(0.233)	(0.245)
$\Delta lnRER_{i,j,t-6} \times Asia$	-0.956***	-0.746***	0.210
	(0.304)	(0.213)	(0.222)
$April98 \times Asia$	-0.0637***	-0.0392***	0.0245***
	(0.0122)	(0.00893)	(0.00838)
$\Delta lnRER_{i,j,t} \times April98 \times Asia$	0.554*	1.021***	0.467**
	(0.333)	(0.238)	(0.236)

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Table 14 – *Continued from previous page*

VARIABLES	(1) Trade Balance	(2) Exports	(3) Imports
$\Delta lnRER_{i,j,t-1} \times April98 \times Asia$	-0.201	-0.105	0.0960
	(0.337)	(0.245)	(0.239)
$\Delta lnRER_{i,j,t-2} \times April98 \times Asia$	0.176	0.138	-0.0380
	(0.351)	(0.242)	(0.254)
$\Delta lnRER_{i,j,t-3} \times April98 \times Asia$	-1.157***	-1.056***	0.101
	(0.360)	(0.261)	(0.257)
$\Delta lnRER_{i,j,t-4} \times April98 \times Asia$	0.824**	0.623***	-0.201
	(0.329)	(0.239)	(0.230)
$\Delta lnRER_{i,j,t-5} \times April98 \times Asia$	-0.0672	0.314	0.381
	(0.337)	(0.240)	(0.251)
$\Delta lnRER_{i,j,t-6} \times April98 \times Asia$	1.122***	0.983***	-0.139
	(0.313)	(0.219)	(0.228)
Constant	-0.0791***	-0.0537***	0.0254
	(0.0279)	(0.0196)	(0.0198)
Country X Product FE	Yes	Yes	Yes
Quarter X Year FE	Yes	Yes	Yes
Observations	2,916,212	2,916,212	2,916,212
Number of id	74,993	74,993	74,993
R-squared	0.000	0.001	0.000

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

TABLE 15. Estimate Results for Trade with Asian Nations in Intermediate Goods Pre-/Post-1998 Law Revision

VARIABLES	(1) Trade Balance	(2) Exports	(3) Imports
$\Delta lnGDP_{i,j,t}$	0.0861***	0.142***	0.0563***
	(0.0129)	(0.00973)	(0.00917)
$\Delta lnRER_{i,j,t}$	0.615***	1.219***	0.604***
	(0.168)	(0.117)	(0.121)
$\Delta lnRER_{i,j,t-1}$	0.688***	0.611***	-0.0773
	(0.155)	(0.115)	(0.104)
$\Delta lnRER_{i,j,t-2}$	0.221	0.178	-0.0431
	(0.158)	(0.117)	(0.106)
$\Delta lnRER_{i,j,t-3}$	-1.549***	-1.747***	-0.198*
	(0.167)	(0.124)	(0.109)
$\Delta lnRER_{i,j,t-4}$	-0.839***	-0.789***	0.0502
	(0.155)	(0.112)	(0.107)
$\Delta lnRER_{i,j,t-5}$	-0.167	-0.347***	-0.181*
	(0.153)	(0.111)	(0.106)
$\Delta lnRER_{i,j,t-6}$	0.405***	0.514***	0.109
	(0.149)	(0.107)	(0.104)
April98	-0.00292	0.00323	0.00612
	–	(2.410)	–
$\Delta lnRER_{i,j,t} \times April98$	-0.585***	-0.769***	-0.184
	(0.178)	(0.125)	(0.128)
$\Delta lnRER_{i,j,t-1} \times April98$	-0.197	0.107	0.305***
	(0.170)	(0.127)	(0.115)
$\Delta lnRER_{i,j,t-2} \times April98$	-0.300*	-0.0208	0.279**
	(0.174)	(0.130)	(0.117)

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Table 15 – *Continued from previous page*

VARIABLES	(1) Trade Balance	(2) Exports	(3) Imports
$\Delta lnRER_{i,j,t-3} \times April98$	1.553***	1.603***	0.0503
	(0.183)	(0.136)	(0.120)
$\Delta lnRER_{i,j,t-4} \times April98$	0.681***	0.774***	0.0933
	(0.172)	(0.125)	(0.119)
$\Delta lnRER_{i,j,t-5} \times April98$	0.338**	0.424***	0.0854
	(0.169)	(0.123)	(0.116)
$\Delta lnRER_{i,j,t-6} \times April98$	-0.538***	-0.719***	-0.181
	(0.162)	(0.116)	(0.113)
$\Delta lnRER_{i,j,t} \times Asia$	-0.0563	-0.685***	-0.629***
	(0.250)	(0.179)	(0.177)
$\Delta lnRER_{i,j,t-1} \times Asia$	-0.168	-0.356*	-0.188
	(0.278)	(0.199)	(0.195)
$\Delta lnRER_{i,j,t-2} \times Asia$	-1.080***	-1.489***	-0.409*
	(0.303)	(0.214)	(0.217)
$\Delta lnRER_{i,j,t-3} \times Asia$	1.671***	1.771***	0.100
	(0.291)	(0.211)	(0.209)
$\Delta lnRER_{i,j,t-4} \times Asia$	-0.993***	-1.226***	-0.233
	(0.262)	(0.189)	(0.186)
$\Delta lnRER_{i,j,t-5} \times Asia$	1.922***	1.980***	0.0580
	(0.249)	(0.176)	(0.178)
$\Delta lnRER_{i,j,t-6} \times Asia$	-0.163	-0.0949	0.0676
	(0.225)	(0.161)	(0.162)
Intermediate	0.192	0.117	-0.0751
	(0.119)	(0.0833)	(0.0844)
$\Delta lnRER_{i,j,t} \times Int$	0.00975	-0.315**	-0.325**

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Table 15 – *Continued from previous page*

VARIABLES	(1) Trade Balance	(2) Exports	(3) Imports
	(0.215)	(0.153)	(0.151)
$\Delta lnRER_{i,j,t-1} \times Int$	0.205	0.305*	0.0997
	(0.232)	(0.166)	(0.160)
$\Delta lnRER_{i,j,t-2} \times Int$	-0.134	-0.170	-0.0357
	(0.242)	(0.173)	(0.170)
$\Delta lnRER_{i,j,t-3} \times Int$	0.149	0.191	0.0426
	(0.256)	(0.187)	(0.176)
$\Delta lnRER_{i,j,t-4} \times Int$	0.0453	-0.155	-0.200
	(0.237)	(0.175)	(0.163)
$\Delta lnRER_{i,j,t-5} \times Int$	0.00303	0.396***	0.393**
	(0.233)	(0.170)	(0.160)
$\Delta lnRER_{i,j,t-6} \times Int$	-0.160	-0.137	0.0230
	(0.202)	(0.147)	(0.141)
$April98 \times Asia$	-0.0402***	-0.0224***	0.0178***
	(0.00681)	(0.00507)	(0.00456)
$\Delta lnRER_{i,j,t} \times April98 \times Asia$	0.361	0.777***	0.416**
	(0.261)	(0.187)	(0.185)
$\Delta lnRER_{i,j,t-1} \times April98 \times Asia$	-0.0600	0.152	0.212
	(0.290)	(0.208)	(0.203)
$\Delta lnRER_{i,j,t-2} \times April98 \times Asia$	1.050***	1.317***	0.267
	(0.315)	(0.223)	(0.224)
$\Delta lnRER_{i,j,t-3} \times April98 \times Asia$	-1.680***	-1.478***	0.202
	(0.304)	(0.220)	(0.218)
$\Delta lnRER_{i,j,t-4} \times April98 \times Asia$	0.955***	0.976***	0.0211
	(0.275)	(0.198)	(0.195)

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Table 15 – *Continued from previous page*

VARIABLES	(1) Trade Balance	(2) Exports	(3) Imports
$\Delta lnRER_{i,j,t-5} \times April98 \times Asia$	-2.070***	-2.005***	0.0657
	(0.261)	(0.186)	(0.187)
$\Delta lnRER_{i,j,t-6} \times April98 \times Asia$	0.462*	0.433**	-0.0286
	(0.238)	(0.171)	(0.171)
$April98 \times Int$	-0.0220***	-0.0123***	0.00970**
	(0.00554)	(0.00398)	(0.00381)
$\Delta lnRER_{i,j,t} \times April98 \times Int$	0.353	0.482**	0.130
	(0.256)	(0.188)	(0.176)
$\Delta lnRER_{i,j,t-1} \times April98 \times Int$	-0.379	-0.391*	-0.0120
	(0.281)	(0.204)	(0.194)
$\Delta lnRER_{i,j,t-2} \times April98 \times Int$	0.168	0.0829	-0.0854
	(0.292)	(0.212)	(0.201)
$\Delta lnRER_{i,j,t-3} \times April98 \times Int$	-0.0756	-0.111	-0.0356
	(0.312)	(0.228)	(0.212)
$\Delta lnRER_{i,j,t-4} \times April98 \times Int$	-0.114	0.0677	0.182
	(0.293)	(0.217)	(0.198)
$\Delta lnRER_{i,j,t-5} \times April98 \times Int$	-0.346	-0.567***	-0.221
	(0.282)	(0.207)	(0.192)
$\Delta lnRER_{i,j,t-6} \times April98 \times Int$	0.580**	0.261	-0.319*
	(0.248)	(0.181)	(0.172)
$April98 \times Asia \times Int$	0.0165	0.000864	-0.0156*
	(0.0144)	(0.0112)	(0.00912)
$\Delta lnRER_{i,j,t} \times April98 \times Asia \times Int$	-0.181	-0.0356	0.145
	(0.175)	(0.129)	(0.117)
$\Delta lnRER_{i,j,t-1} \times April98 \times Asia \times Int$	0.267	0.129	-0.138

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Table 15 – *Continued from previous page*

VARIABLES	(1) Trade Balance	(2) Exports	(3) Imports
	(0.186)	(0.139)	(0.126)
$\Delta lnRER_{i,j,t-2} \times April98 \times Asia \times Int$	-0.0322	0.00647	0.0387
	(0.196)	(0.146)	(0.128)
$\Delta lnRER_{i,j,t-3} \times April98 \times Asia \times Int$	-0.0826	-0.190	-0.107
	(0.201)	(0.148)	(0.133)
$\Delta lnRER_{i,j,t-4} \times April98 \times Asia \times Int$	-0.0336	0.138	0.171
	(0.197)	(0.147)	(0.132)
$\Delta lnRER_{i,j,t-5} \times April98 \times Asia \times Int$	0.359*	0.201	-0.158
	(0.189)	(0.141)	(0.127)
$\Delta lnRER_{i,j,t-6} \times April98 \times Asia \times Int$	-0.609***	-0.357***	0.251**
	(0.182)	(0.135)	(0.124)
Constant	-0.0256	-0.0397	-0.0141
	–	(2.298)	–
Country X Product FE	Yes	Yes	Yes
Quarter X Year FE	Yes	Yes	Yes
Observations	3,244,117	3,244,117	3,244,117
Number of id	75,872	75,872	75,872
R-squared	0.001	0.002	0.000

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

TABLE 16. Intermediate Good Trade Balance Responses to Real Depreciation

	Pre-April 1998				Post-April 1998			
Trade In:	Intermediate Goods		Other Goods		Intermediate Goods		Other Goods	
Trade with:	Asia	Other	Asia	Other	Asia	Other	Asia	Other
Quarters Past Depreciation								
0	1.006	1.007	1.006	1.006	1.009	1.004	1.003	1
1	1.013	1.016	1.011	1.013	1.008	1.007	1.006	1.005
2	1.003	1.017	1.002	1.015	1.009	1.007	1.005	1.004
3	1.006	1.003	1.003	1	1.008	1.007	1.005	1.004
4	0.988	0.995	0.985	0.991	1.004	1.005	1.003	1.003
5	1.006	0.993	1.003	0.99	1.001	1.003	1.003	1.005
6	1.007	0.996	1.005	0.994	1.007	1.006	1.005	1.003
Long Run Effect(%)	0.655	-0.440	0.538	-0.650	0.651	0.630	0.477	0.325

TABLE 17. Estimates for Rauch Goods Trade Pre-/Post-1998 Law Revision

VARIABLES	(1) Trade Balance	(2) Exports	(3) Imports
$\Delta lnGDP_{i,j,t}$	0.0652***	0.115***	0.0498***
	(0.0123)	(0.00928)	(0.00878)
$\Delta lnRER_{i,j,t}$	-0.894*	-0.497	0.397
	(0.540)	(0.359)	(0.397)
$\Delta lnRER_{i,j,t-1}$	0.597	0.505	-0.0913
	(0.459)	(0.327)	(0.322)
$\Delta lnRER_{i,j,t-2}$	0.397	-0.0302	-0.427
	(0.490)	(0.357)	(0.329)
$\Delta lnRER_{i,j,t-3}$	-0.300	0.0334	0.333
	(0.539)	(0.386)	(0.367)
$\Delta lnRER_{i,j,t-4}$	-0.0545	-0.428	-0.374
	(0.485)	(0.344)	(0.349)
$\Delta lnRER_{i,j,t-5}$	-0.986**	-0.678**	0.308
	(0.496)	(0.345)	(0.366)
$\Delta lnRER_{i,j,t-6}$	0.471	0.359	-0.112
	(0.463)	(0.315)	(0.340)
April98	0.0730*	0.0230	-0.0500**
	(0.0320)	(0.0226)	(0.0228)
$\Delta lnRER_{i,j,t} \times April98$	1.200**	0.993***	-0.207
	(0.545)	(0.363)	(0.400)
$\Delta lnRER_{i,j,t-1} \times April98$	-0.331	0.133	0.464
	(0.465)	(0.332)	(0.327)
$\Delta lnRER_{i,j,t-2} \times April98$	-0.252	0.00474	0.530
	(0.495)	(0.361)	(0.332)
$\Delta lnRER_{i,j,t-3} \times April98$	0.217	-0.00357	-0.221

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Table 17 – *Continued from previous page*

VARIABLES	(1) Trade Balance	(2) Exports	(3) Imports
	(0.545)	(0.390)	(0.372)
$\Delta lnRER_{i,j,t-4} \times April98$	-0.0655	0.262	0.327
	(0.493)	(0.350)	(0.354)
$\Delta lnRER_{i,j,t-5} \times April98$	1.145**	0.866**	-0.279
	(0.504)	(0.350)	(0.371)
$\Delta lnRER_{i,j,t-6} \times April98$	-0.351	-0.315	0.0362
	(0.472)	(0.321)	(0.346)
$\Delta lnRER_{i,j,t} \times Dif$	0.267	0.189	-0.0783
	(0.520)	(0.343)	(0.385)
$\Delta lnRER_{i,j,t-1} \times Dif$	0.256	0.177	-0.0792
	(0.456)	(0.322)	(0.323)
$\Delta lnRER_{i,j,t-2} \times Dif$	0.0625	0.486	0.424
	(0.483)	(0.349)	(0.329)
$\Delta lnRER_{i,j,t-3} \times Dif$	0.301	0.0332	-0.268
	(0.532)	(0.377)	(0.365)
$\Delta lnRER_{i,j,t-4} \times Dif$	-0.306	0.101	0.408
	(0.486)	(0.340)	(0.351)
$\Delta lnRER_{i,j,t-5} \times Dif$	0.630	-0.00912	-0.639*
	(0.492)	(0.339)	(0.366)
$\Delta lnRER_{i,j,t-6} \times Dif$	-0.352	-0.265	0.0868
	(0.452)	(0.305)	(0.333)
Homogeneous	-0.231***	0.168***	0.399***
	(0.0217)	(0.0155)	(0.0152)
$\Delta lnRER_{i,j,t} \times Hom$	0.771	0.158	-0.613
	(0.548)	(0.365)	(0.404)

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Table 17 – *Continued from previous page*

VARIABLES	(1) Trade Balance	(2) Exports	(3) Imports
$\Delta lnRER_{i,j,t-1} \times Hom$	0.294	0.457	0.162
	(0.486)	(0.344)	(0.342)
$\Delta lnRER_{i,j,t-2} \times Hom$	-0.238	0.118	0.356
	(0.510)	(0.367)	(0.348)
$\Delta lnRER_{i,j,t-3} \times Hom$	0.346	-0.113	-0.460
	(0.559)	(0.398)	(0.384)
$\Delta lnRER_{i,j,t-4} \times Hom$	-0.293	-0.0862	0.207
	(0.513)	(0.362)	(0.370)
$\Delta lnRER_{i,j,t-5} \times Hom$	0.675	0.493	-0.182
	(0.521)	(0.360)	(0.384)
$\Delta lnRER_{i,j,t-6} \times Hom$	-0.795*	-0.553*	0.241
	(0.474)	(0.321)	(0.349)
$Homogeneous \times April98$	0.000801	0.0113	0.0105
	(0.0172)	(0.0118)	(0.0125)
$\Delta lnRER_{i,j,t} \times Hom \times April98$	-0.661	-0.00935	0.652
	(0.557)	(0.372)	(0.409)
$\Delta lnRER_{i,j,t-1} \times Hom \times April98$	-0.413	-0.690**	-0.276
	(0.496)	(0.352)	(0.349)
$\Delta lnRER_{i,j,t-2} \times Hom \times April98$	0.176	-0.259	-0.435
	(0.518)	(0.373)	(0.354)
$\Delta lnRER_{i,j,t-3} \times Hom \times April98$	-0.289	0.0714	0.360
	(0.569)	(0.405)	(0.391)
$\Delta lnRER_{i,j,t-4} \times Hom \times April98$	0.197	0.112	-0.0852
	(0.524)	(0.370)	(0.377)
$\Delta lnRER_{i,j,t-5} \times Hom \times April98$	-0.793	-0.584	0.209

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Table 17 – *Continued from previous page*

VARIABLES	(1) Trade Balance	(2) Exports	(3) Imports
	(0.533)	(0.367)	(0.392)
$\Delta lnRER_{i,j,t-6} \times Hom \times April98$	0.899*	0.514	-0.385
	(0.488)	(0.330)	(0.357)
Differentiated $\times April98$	0.0187	0.0274**	0.00868
	(0.0163)	(0.0112)	(0.0119)
$\Delta lnRER_{i,j,t} \times Dif \times April98$	-0.406	-0.215	0.192
	(0.527)	(0.349)	(0.389)
$\Delta lnRER_{i,j,t-1} \times Dif \times April98$	-0.263	-0.309	-0.0460
	(0.464)	(0.328)	(0.329)
$\Delta lnRER_{i,j,t-2} \times Dif \times April98$	0.0604	-0.350	-0.410
	(0.489)	(0.354)	(0.333)
$\Delta lnRER_{i,j,t-3} \times Dif \times April98$	-0.288	-0.0888	0.199
	(0.539)	(0.383)	(0.371)
$\Delta lnRER_{i,j,t-4} \times Dif \times April98$	0.393	-0.00740	-0.401
	(0.495)	(0.347)	(0.358)
$\Delta lnRER_{i,j,t-5} \times Dif \times April98$	-0.659	-0.0373	0.621*
	(0.502)	(0.345)	(0.372)
$\Delta lnRER_{i,j,t-6} \times Dif \times April98$	0.346	0.290	-0.0563
	(0.463)	(0.313)	(0.339)
Constant	-0.0308	-0.101***	-0.0700***
	(0.0284)	(0.0201)	(0.0202)
Country X Product FE	Yes	Yes	Yes
Quarter X Year FE	Yes	Yes	Yes
Observations	2,916,212	2,916,212	2,916,212

Continued on next page

Table 17 – *Continued from previous page*

VARIABLES	(1) Trade Balance	(2) Exports	(3) Imports
Number of id	74,993	74,993	74,993
R-squared	0.000	0.001	0.000

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

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