

THE EFFECTS OF EXCHANGE RATE VOLATILITY ON COMMODITY
TRADE FLOWS BETWEEN THE U.S. AND THAILAND

by

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ABSTARCT

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It is theoretically supported that the volatility of exchange rate may deter trade flows in the case of high risk aversion. Previous empirical literatures studying the effect of exchange rate volatility on trade flows for Thailand mostly have used aggregate trade data. To minimize the aggregation bias, which may occur by offsetting between a significant effect of depreciation on certain industries and an insignificant effect on the others, this paper thus emphasizes on employing disaggregated bilateral trade data between the U.S. and Thailand at commodity level. Using the annual trade data between the U.S. and Thailand from 1971 to 2012 of all commodities available, this dissertation investigates the effect of exchange rate volatility on imports and exports separately to reveal the entire perspective of such relationship. An autoregressive distributed lag (ARDL) approach to cointegration, notably the bounds testing approach to cointegration, within an error-correction modeling framework has been employed for empirical analysis to distinguish the short run effects from the long run effects in each commodity. The findings indicate that in the short run, the volatility of the real Baht-U.S. dollar exchange rate has a significant mixed impact on the trade flows in most commodities. However, less than half of these commodities carry the effect into the long run.

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1. Introduction

There have been major developments in the international monetary system, i.e. the shift from the fixed rates of currencies to floating exchange rate regimes, after the end of the Bretten Woods system in 1971-1973. Since then, the impacts of exchange rate volatility^{1/} on economic activities, especially on trade flows, has been addressed extensively and received a great deal of attention from international research studies.

The key advantage of a fixed exchange rate regime is that it often provides stable and predictable arrangements favorable to long-term contracts in international trade. However, in the presence of globalization and the current free trade era, most countries are trapped in a wave of highly mobile financial capital and relatively higher level of exchange rate volatility under flexible exchange rate regimes. There are a number of postulations in literature as to why an increase in exchange rate volatility is broadly believed to have adverse effects on the volume of international trade. Therefore, this thesis will emphasize the importance of the impacts from inevitable exchange rate volatility on commodity trade between the United States and Thailand.

^{1/} Throughout this paper, the terms “*volatility*”, “*uncertainty*”, “*fluctuation*”, and “*variability*” may be used interchangeably.

2. Literature Review

2.1 Theoretical Literature

Theoretical justification for the impacts of exchange rate volatility on trade flows has never reached a consensus for the sign of the relationship. In fact, the results of theoretical studies have been mixed, conditionally depended upon various factors the studies have assumed, such as the degree of risk aversion (De Grauwe, 1988), hedging possibilities (Sercu and Vanhulle, 1992), the specification of forward exchange markets (Caporale and Doroodian, 1994), especially in a general equilibrium setting where other variables change along with exchange rates.^{2/}

In the early theoretical literature, a number of models support the negative relationship between exchange rate volatility and the level of international trade. More precisely, the very first theoretical study by Clark (1973) described the simplest case considering a competitive exporting firm with no market power producing only one commodity in order to sell entirely to a foreign market. The firm is paid in foreign currency and converts it at the current exchange rate, which could be volatile in an unpredictable manner, as there is assumed to be no hedging mechanism in this model. Moreover, the firm is assumed no import of any intermediate inputs. However, there are adjustment costs in production scale, so that the firm has to make its production decisions in advance of the realization of the exchange rate, and hence cannot adjust its output in response to shifts in the firm's profits arising from the exchange rate movements. In this

^{2/} See Clark, Tamirisa, Wei, Sadikov, and Zeng (2004).

circumstance, the variable profitability of the firm's exports arises solely from the exchange rate. Therefore, the firm is adversely affected by currency risk because greater variability in the exchange rate, with no change in its average level, leads to a decrease in output, and hence in exports, in order to reduce the exposure to risk.^{3/}

Ethier (1973) includes the effects of forward cover on the level of trade.^{4/} The analysis also shows the negative relationship such that the volume of trade will be reduced when the traders were uncertain regarding the exchange rate effects on their firm's revenue. Since then, there has been some elaboration of the basic model by a number of authors. An influential paper by Hooper and Kohlhagen (1978) allows for differences in risk aversion or risk bearing between importers and exporters. In their model, the impacts of exchange rate uncertainty on the prices as well as the volume of trade are determined by the risk preferences of both importers and exporters, the proportion of risk born by each side of the market, and the proportion of forward hedging. They find that while exchange rate uncertainty should lead to a decrease in the volume of trade, it can lead to either an increase or decrease in the export price depending upon whether the exporter or the importer bears the greater burden of exchange rate risk.

In an earlier paper, Baron (1976) also analyzes the effects of exchange rate fluctuations on the export price, but the study assumes that prices are set in one period while orders placed and payments made in another, thus leaving importers with no exchange risk. Furthermore, the paper notes that traders may still be uncertain of how much foreign exchange they want to cover since the forward markets may not be

^{3/} See, for example, Leland (1972), Sandmo (1971), and Holthausen (1976) for more general analyses of the effect of uncertainty on the theory of the firm.

^{4/} More analysis of the forward currency effects on the level of trade are available: Kawai and Zilcha (1986), Viaene and de Vries (1992), and Wei (1999).

sufficiently developed. While the results on the export prices are similar to Hooper and Kohlhagen (1978), the methodology and the implications of the model concerning the volume of trade are quite different.

Caballero and Corbo (1989) also presented a simple model giving theoretical justification for circumstances under which export levels are an increasing function of the real exchange rate and a decreasing function of the variance in the real exchange rate. However, this is true only under the conditions of risk aversion and that aggregate activity is positively correlated with innovations in the real exchange rate or terms of trade. Moreover, the degree of risk aversion has to be sufficiently large to offset the positive effect from Jensen's inequality and the convex curve of the profit function in terms of prices. In addition to the degree of risk aversion, the direct effect may depend on other factors such as the currency denomination of contracts, the availability of hedging opportunities, and the presence of other types of business risk (Sauer and Bohara, 2001).

Gagnon (1993) extends previous theoretical research by Lucas and Prescott (1971) and Hansen and Sargent (1980) in the model of risk averse traders under uncertainty. The theoretical model constructs dynamics explicitly in a framework of intertemporal optimization. As in earlier work, uncertainty about the real exchange rate serves to depress the volume of trade.

In spite of a large number of studies indicating negative relationship, there are also a number of theoretical studies that point out to different directions by predicting a positive effect, or no significant effect of exchange rate volatility on trade flows.

Franke (1991), Sercu (1992), and Sercu and Vanhulle (1992) theoretically demonstrate that under some conditions, exchange rate volatility might benefit an exporting firm and thus encourage the volume of its exports. Krugman (1989) and Dixit (1989) have shown that even when exporters are risk-neutral, exchange rate variability could also influence international trade, if there were sufficient *sunk cost*^{5/} involved in international transactions.

Finally, some other studies, Willett (1986) as an example, concludes that exchange rate volatility has no significant impact on the volume of international trade. Sercu and Uppal (2003) developed a model of a stochastic general-equilibrium economy with international commodity markets, and endogenously determine the exchange rate in a complete financial market. Their simple model shows ambiguous results that it is possible to have either a negative or a positive relation between exchange rate volatility and the volume of international trade, depending on the source underlying the increase in exchange rate volatility.

Therefore, determining the direction and magnitude of the link between the exchange rate volatility and foreign trade flows is ultimately an empirical issue because previous theoretical analysis cannot provide clear-cut conclusions in terms of the sign of this relationship. In fact, most theoretical results are conditional on the assumptions about attitudes towards risk, functional forms, type of trader, presence of adjustment costs, market structure and availability of hedging opportunities. Nevertheless, most recent empirical evidence suggest that a negative relationship often prevails.

^{5/} In example, high fixed costs associated with establishing an export market.

2.2 Empirical Literature

Although the empirical literature on the impacts of exchange rate volatility is extensive, overall, the evidence of this direct effect is still conflicting and inconclusive.^{6/}

Apparently, the majority of empirical work related to this issue clearly produce the negative relationship between exchange rate uncertainty and trade flows supporting a range of theoretical models that conventionally predict such an effect. These studies include Abrams (1980); Arize (1995, 1996, 1997); Arize and Ghosh (1994); Arize, Osang, and Slottje (2000); Arize and Shwiff (1998); Asseery and Peel (1991); Bahmani-Oskooee (1996, 2002); Belanger *et al.* (1988); Bini – Smaghi (1991); Caballero and Corbo (1989); Caporale and Doroodian (1994); Chowdhury (1993); De Grauwe and Verfaillie (1988); Dell’ Ariccia (1999); Doganlar (2002); Doroodian (1999); Feenstra and Kendall (1991); Frankel and Wei (1993); Kenen and Rodrick (1986); Kim and Lee (1996); Koray and Lastrapes (1989); May (2007); Peree and Steinherr (1989); Poon, Choong and Habibullah (2005); Pozo (1992); Savvides (1992); Sukar and Hassan (2001); Thursby and Thursby (1987); Vergil (2002).

Nonetheless, numerous studies yielded positive or mixed results. The papers detecting a significantly positive relationship include Asseery and Peel (1991); McKenzie and Brooks (1997). The papers that come out with both mixed positive and negative relationships include Arize (1998); Arize and Malindretos (1998); Cushman (1983, 1986,

^{6/} For surveys of early literature, see International Monetary Fund (1984), Belanger and Gutierrez (1990), and Cote (1994); for detailed reviews of more recent studies, see International Monetary Fund (2004) and Bahmani-Oskooee and Hegerty (2007).

1988); De Vita and Abbott (2004); Kroner and Lastrapes (1993); Kumar (1992); Sauer and Bohara (2001); Thursby and Thursby (1985).

Finally, some empirical studies indicate no significance of the exchange rate volatility effect on trade flows. Some examples of these papers are Aristotelous (2001); Bahmani-Oskooee and Payesteh (1993); Bailey and Tavlas (1988); Belanger *et al.* (1992); Chan and Wong (1985); De Vita and Abbott (2004); Gagnon (1993); Goture (1985); Medhora (1990); and Tenreyro (2004).

2.3 Literature related to Thailand's Exchange Rate Volatility and Trade Flows

Since the early 1970s, most empirical studies about the role of exchange rate volatility have focused on developed countries in North America and Western Europe (Rahmatsyah, Rajaguru and Siregar (2002)). This is because during the early part of the post-Bretton Wood system, the developed countries experienced new uncertainties associated with higher exchange rate volatility of a more flexible regime, due to the nature of their economic developments and levels of economic openness. On the other hand, less developed countries (LDCs), especially in Asia, have implemented export-oriented economic policies since their early stages of development as exports have been the major component driving economic growth of the countries. Unfortunately, the impact of exchange rate volatility on exports and imports has been rarely investigated for most Asian countries.

Nevertheless, there has been some research that attended to these developing countries in comparison with developed countries as far as the topic has been concerned. McKinnon (2001); Calvo and Reinhart (2000); Prasad *et al.* (2003) pointed out that adverse consequences of exchange rate volatilities on trade and inflation are found to be more damaging to the emerging economies, with unsophisticated capital markets and unstable economic policies, than developed market economies. However, there is no sufficient empirical evidence prepared to support their arguments.

With respect to a small less-developed economy such Thailand's, there have been only a few studies that intensively considered this relationship. Caballero and Corbo (1989)'s study is one of the very first that provided both theoretical and empirical analysis of how the uncertainty about the real exchange rate affect exports of six developing countries, including Thailand. Theoretically motivated by risk aversion, they construct a simple two-period model in which export levels are an increasing function of the variance in the real exchange rate.^{7/} In order to test the qualitative implications of their theoretical model, they present OLS (Ordinary Least Squares) and IV (Instrumental Variables) estimates, showing a strong negative effect of real exchange rate uncertainty. The results also indicate that increases as small as five percentage points in the annual standard deviation of real exchange rates can shrink Thailand's exports sector by 30 percent.

^{7/} Particularly, if the return on export investment projects are, on average, positively correlated with aggregate activity (consumption), and the degree of risk aversion is sufficiently large to offset the convexity of the profit function with respect to prices, exports are reduced when there is a sudden increase in real exchange rate volatility.

At the beginning of the 1997 financial crisis in East Asia ^{8/}, Thailand, as one of the crisis-affected economies, signed the Letter of Intent (LOIs) with the International Monetary Fund (IMF) to specify the commitment to adopt a more flexible exchange rate regime ^{9/} to mitigate the pressure from outside currency speculators under fixed exchange rate policy. Moreover, McKinnon (2001) reveals that after the break of the 1997 crisis, most East Asian economies had temporarily relaxed their rigid policy against the U.S. dollar. The soft-dollar pegged become the exchange rate regime of these countries, including Thailand, to satisfy the needs to stabilize their national currencies from the volatilities of the foreign exchange market. Regarding Thailand's exchange rate policy, the country has adopted three types of exchange rate regimes over the past four decades. From 1970 to 1984, Thailand changed back and forth between pegged to the U.S. dollar policy and pegged to a basket of currency regimes. From 1984 to 1997, the Baht currency policy was pegged to a basket of major trading partners' currencies. Finally, from June 1997 until recently, the Baht has been effective under “*managed-floating*” exchange rate policy ^{10/}.

Almost all empirical literature that includes Thailand's economic information generally share two similarities. First, they mostly employ aggregate trade data, either the bilateral trade data between the studied countries and their major trading partners (Baak, Al-Mahmood and Vixathep (2007); Jiranyakul (2010); Rahmatsyah, Rajaguru and Siregar (2002)), or the aggregate data between the studied countries and the rest of the

^{8/} The 1997 Financial Crisis in Asia, which started in Thailand, is sometimes referred to as the "Tom Yam Kung" Crisis. "Tom yum Kung" is in fact the name for a spicy Thai (typically clear) soup with shrimp, well known served in most Thai restaurants around the world.

^{9/} For a complete draft of Thailand's first Letter of Intent (August 14, 1997), visit the IMF website: <http://www.imf.org/external/np/loi/081497.htm>.

^{10/} Source: Bank of Thailand.

world (Arize, Osang and Slottje (2000); Cabballero and Corbo (1989); Chit, Rizov and Willenbockel (2008); Poon, Choong and Habibullah (2005); Sauer and Bohara (2001)). Second, their empirical evidence usually indicates the negative relationship supporting the common hypothesis that this detrimental effect of exchange rate volatility may lead to a negative economic impact.

However, literature concerning Thailand and this topic may technically vary in several aspects, for instance, measures of exchange rate volatility, model specifications, and econometric methods. Investigating exchange rate volatility of 13 trading LDCs against the rest of the world, Arize, Osang, and Slottje (2000)'s quarterly data set starts to cover Thailand's floating exchange rate period after 1997, and allows the analysis to justify the stability over time of the estimated dynamic models. They ensure the existence of the long-run relationship among variables by using Johansen's multivariate procedure for testing cointegration. Their estimated short-run dynamics from the error-correction modeling technique show that in each of the 13 LDC's, increases in the volatility of the real effective exchange rate exert a significant negative effect on export demand in both the short-run and also in the long-run. Similarly, Poon, Choong, and Habibullah (2005) examine the same issues but only specific to five East Asian economies: Indonesia, Japan, South Korea, Singapore and Thailand. In addition to presenting error-correction modeling (ECM), Vector Autoregression (VAR) and Variance Decomposition (VD) are performed to characterize the joint dynamics of variables in both the short and long run. Consequently, the relationship between real exports and exchange rate volatility is detected as significantly negative in the long term in three out of the five economies:

Japan, South Korea and Singapore, and in the short term on four out of the five studying economies: Indonesia, Japan, South Korea and Thailand.

It has been mentioned by Baltagi (2001) that Panel-data estimation may have advantages for analysis since unobserved individual heterogeneity can be controlled. (i.e. Cross-country structural and policy differences may have impact on trade flows.) The studies involved large panel data of many countries including Thailand are limited. Sauer and Bohara (2001) use fixed- and random- effects models to capture cross-country differences of 22 industrialized countries (OECD countries) and 69 LDCs to investigate the link of this relationship. The evidence supports the view that the detrimental effects of real exchange rate volatility are more pronounced in Latin America and Africa than in the Asian LDCs or OECD countries. Chit, Rizov and Willenbockel (2008) analyze the impacts of real exchange rate volatility on exports of five emerging East Asian countries including Thailand to their trading partners, which consist of thirteen industrialized countries as well as among themselves. Their long-run model specification is employed similarly to the generalized Gravity model used by Bergstrand (1989) and Aristotelous (2001). They also verify the occurrence of long-run relationships among the variables by performing Panel Unit Root and cointegration tests followed by the fixed-effect estimations in order to reveal the significantly negative results. Furthermore, the GMM-IV estimations in this study confirm that this negative relationship is not driven by simultaneous causality bias.

As far as its major trading partners are concerned, there is some research investigating this issue using bilateral aggregate data between East Asian countries and their major trading partners: Japan and the U.S. Rahmatsyah, Rajaguru and Siregar

(2002) readdress the “fear of floating” and “fixing for life” phenomena^{11/} in Thailand, by testing the impact of real Thailand’s Baht volatilities against the Japanese Yen and the U.S. dollar on the performance of the country’s bilateral trade flows with Japan and the U.S. They conducted the Johansen cointegration test procedures to examine the existence of cointegrating relationship among these variables. Their empirical work from the long-run export- and import- demand models as well as the short-run Autoregressive Distributed Lags (ARDL) showed adverse consequences from rising exchange rate volatility on both exports and imports of Thailand with the Japanese market, and the imports of Thailand from the U.S. Baak, Al-Mahmood and Vixathep (2007) used similar time-series techniques such as error-correction (EC) models but determined the effects of real exchange rate volatility only on exports from four East Asian countries to Japan and the U.S. With respect to Thailand, exchange rate volatility has negative long-run impacts and positive short-run impacts on the exports of Thailand, regardless of whether the importing country is Japan or the U.S. Jiranyakul (2010) also aims to focus only on Thailand’s exports to Japan and the U.S. using more recent bilateral trade data. By incorporating various time-series methods including Bounds testing for Cointegration, the empirical results show the potential of a negative impact of real exchange rate uncertainty on exports to Japan, but no impact on exports to the U.S.

In contrast to most studies that employ aggregate trade data, May (2007) evaluates the effect of real exchange rate volatility on Thailand’s five key agricultural commodities, which are maize, rice, rubber, sugar, and tapioca. Point estimates suggest

^{11/} Originally mentioned by Calvo and Reinhart (2000).

that the commodity exporters may suffer from negative effects of greater volatility of the real exchange rate, supporting the conventional assumption in this topic.

2.4 Research Question and Objectives

Considering the review of literature from the last section, it is essential to underline two apparent drawbacks of previous literature. First, the majority of the empirical studies employ aggregate data, either bilateral trade data between the country pairs (the focusing country and its trading partners) or aggregate trade data between the focusing country and the rest of the world. As a results, using aggregate trade data may potentially introduce a problem of aggregation bias, where a significant relation between a measure of exchange rate volatility and the imports (or exports) of one industry could be offset by an insignificant relation between the same variables of another industry, with the net outcome being an insignificant relation between aggregate imports (or exports) and exchange rate volatility (Bahmani-Oskooee and Wang (2007)). Second, some empirical specification from previous studies may lead to the problem of non-stationary and spurious regression.

Given the two main concerns created from earlier empirical literature, the contribution of this thesis will be to address the question of how the exchange rate volatility affect the U.S.-Thailand disaggregated trade flows, by providing advanced time-series analysis based on a recent econometric methodology. This thesis aims to extend the nature and importance associated with this issue differently from the previous work, by utilizing commodity trade data between Thailand and the U.S. In particular, the

data of 119 U.S. commodity exports to Thailand and 43 U.S commodity imports from Thailand are employed to evaluate the impact of such uncertainty.

3. Model and Methodology

3.1 Model Specification and Estimation Method

Following the above empirical background, this paper will distinctively examine the short run as well as the long run effects of exchange rate volatility on disaggregated US-Thailand bilateral trade flows in an error correction model framework. Standard import and export demand functions are employed by including a scale variable and a relative price term. Additionally, a measure of exchange rate volatility is added to these models in assessing the impact of exchange rate risk on trade flows. However, due to the fact that price data at industry level are currently not available, such models used by Kenen and Rodrik (1986); Bahmani-Oskooee and Payesteh (1993) are applied. As trade data at commodity levels are reported by the U.S., the trade flow models are introduced from the U.S. perspective. Hence, the long-run export demand function at the commodity level between the U.S. and Thailand yields the following log-linear specification:

$$\ln X_{it}^{US} = \alpha_0 + \alpha_1 \ln Y_t^{TH} + \alpha_2 \ln RER_t + \alpha_3 \ln Vol_t + \mu_t \quad (1.)$$

where X_i is the export volume of commodity i by the U.S. to Thailand; Y^{TH} denotes a measure of Thailand income; RER is the real bilateral exchange rate between U.S. dollar and Thai Baht; Vol is a measure of exchange rate volatility which is actually a volatility measure of RER ; and finally μ is an error term. As far as the expected signs of these

estimated coefficients are concerned, in equation (1.) it is assumed that American exports of commodity i to Thailand (X_i) is positively related to the level of Thailand's economic activity (Y^{TH}); therefore, an estimate of α_1 is expected to be positive. As defined in the Chapter 3.2.3, a real depreciation of the U.S. dollar (i.e. a decrease in RER) is expected to encourage U.S. exports to Thailand, implying that an estimate of α_2 is expected to be negative. Finally, since exchange rate volatility could result in a positive or a negative effect, an estimate of α_3 could also be positive or negative respectively.

The recent literature applying cointegration analysis (e.g. Bahmani-Oskooee and Payesteh (1993); Doyle (2001); De Vita and Abbot (2004); Bahmani-Oskooee and Tanku (2008)) suggest that the volatility measure is stationary, while other variables in (1.) are non-stationary. Hence, a cointegration methodology is considered appropriate to use in this paper. Rather than such long-run relationships expressed in equation (1.), it is proper to incorporate the short-run dynamics of the adjustment mechanism into the estimation process by specifying it in an error-correction format. According to Engle-Granger's (1987) error-correction terminology, equation (1.) can be applied as:

$$\begin{aligned} \Delta \ln X_{it}^{US} = & a_0 + \sum_{k=1}^{n1} a_{1k} \Delta \ln X_{it-k}^{US} + \sum_{k=0}^{n2} a_{2k} \Delta \ln Y_{t-k}^{TH} + \sum_{k=0}^{n3} a_{3k} \Delta \ln RER_{t-k} \\ & + \sum_{k=0}^{n4} a_{4k} \Delta \ln Vol_{t-k} + \alpha \mu_{t-1} + V_t \end{aligned}$$

(2.)

If all variables adjust toward their long-run equilibrium values, the deviation between the dependent and independent variables, measured by lagged value of μ in this case, should decrease. In other words, the speed of adjustment (the estimate of α in equation (2.)) should be negative and significant as the adjustment of variables is converging toward long-run equilibrium. Alternatively, the dependent and independent variables are cointegrated. However, the requirement is that all variables have to be non-stationary in level or be stationary after first differencing, i.e. they are integrated of order one or I(1), μ_t must be stationary or I(0). To deal with this problem in which some of variables are integrated of order one, I(1), while the others could be integrated of order zero, I(0), Pesaran et al. (2001) introduce the bounds testing approach for cointegration which is a standard autoregressive distributed lag (ARDL) model with the additional lagged level variables. Under this method, the pre-unit root testing is required only on the first-differences to ensure that the variables are integrated of order one, I(1), or order zero, I(0). The μ_{t-1} in equation (2.) is then replaced by the lagged-linear combination of the four variables, which is obtained from solving equation (1.) for μ_t and then lagging the solution by one period. For deriving demonstration, solving equation (1.) for μ_t , we have:

$$\mu_t = \ln X_{it}^{US} - \alpha_0 - \alpha_1 \ln Y_t^{TH} - \alpha_2 \ln RER_t - \alpha_3 \ln Vol_t$$

Lagging the solution by one period, this yields:

$$\mu_{t-1} = \ln X_{it-1}^{US} - \alpha_0 - \alpha_1 \ln Y_{t-1}^{TH} - \alpha_2 \ln RER_{t-1} - \alpha_3 \ln Vol_{t-1}$$

Then, equation (3.) is obtained by substituting μ_{t-1} into equation (2.) as the following:

$$\begin{aligned} \Delta \text{Ln } X_{it}^{US} = & a_0 + \sum_{k=1}^{n1} a_{1k} \Delta \text{Ln } X_{it-k}^{US} + \sum_{k=0}^{n2} a_{2k} \Delta \text{Ln } Y_{t-k}^{TH} + \sum_{k=0}^{n3} a_{3k} \Delta \text{Ln } RER_{t-k} \\ & + \sum_{k=0}^{n4} a_{4k} \Delta \text{Ln } Vol_{t-k} + \delta_0 \text{Ln } X_{it-1} + \delta_1 \text{Ln } Y_{t-1}^{TH} + \delta_2 \text{Ln } RER_{t-1} + \delta_3 \text{Ln } Vol_{t-1} + V_t \end{aligned} \quad (3.)$$

In estimating equation such (3.), Pesaran et al. (2001) suggest estimating it by OLS, and using the familiar F-test to determine the joint significance of the lagged level variables as a sign of cointegration. However, unlike the standard F-test, the Pesaran et al. (2001)'s new critical values are tabulated. By using Monte Carlo application, an upper bound critical value is provided when all variables are assumed to be integrated of order one. A lower bound critical value is provided when all variables are assumed to be integrated of order zero. In order for cointegration to be hold, the calculated F-statistic for joint significance of lagged level variables must be greater than the upper bound critical value. If it is below the lower bound critical value, however, it is implied that they are not cointegrated.

Furthermore, equation (3.) also demonstrates both the short-run and the long-run effects of exchange rate volatility simultaneously, after adjustment is completed. The short-run effects between the exchange rate volatility and the U.S. exports are measured by the estimates of a_{4k} 's while the long-run effects are inferred by the estimate of δ_3 that is normalized on the estimate of δ_0 . Finally, after cointegration among all variables is established through a significant F-statistic, the next step is to determine whether adjustment of the variables is toward their long-run equilibrium or disequilibrium. To

pursue this answer, estimation of a lagged error-correction term (ECM_{t-1}) is performed by using estimates of $\delta_0 - \delta_3$. For the last procedure, the linear combination of lagged level variables is replaced by ECM_{t-1} and then re-estimated using the same lag structure as before. A negative and significant result of estimated coefficient of ECM_{t-1} will indicate adjustment toward long-run equilibrium. Moreover, Bahmani-Oskooee and Ardalain (2006) also interpret this as another way of supporting cointegration among the variables.

Once the effects of exchange rate volatility on the U.S. commodity exports have been estimated in equations such (1.), (2.), and (3.), the procedures to test the impacts of exchange rate volatility on the U.S. commodity imports are to be assessed as well. Specifically, from the U.S. perspective, the long-run import demand function at the commodity level between the U.S. and Thailand yields the following log-linear form:

$$\ln M_{it}^{US} = \beta_0 + \beta_1 \ln Y_t^{US} + \beta_2 \ln RER_t + \beta_3 \ln Vol_t + \varepsilon_t \quad (4.)$$

where M_i is the import volume of commodity i by the U.S. from Thailand; Y^{US} denotes a measure of U.S. income; RER is the real bilateral exchange rate between U.S. dollar and Thai Baht; Vol is a measure of exchange rate volatility which is a volatility measure of RER ; and finally ε is an error term. Since American imports of commodity i from Thailand (M_i) is assumed to be positively related to the level of American economic activity (Y^{US}), an estimate of β_1 is expected to be positive. Provided the definition of RER in the Chapter 3.2.3, a real depreciation of the U.S. dollar (i.e. a decrease in RER) is expected to decrease U.S. imports of commodity i from Thailand, implying that an estimate of β_2 is expected to be positive. Finally, an estimate of β_3

could be positive or negative as exchange rate volatility could have a positive or a negative effect on the U.S. import demand respectively.

In an attempt to incorporate the short-run dynamics of the adjustment mechanism into the long-run specification (4.), an error-correction modeling format is specifying here as the following:

$$\begin{aligned} \Delta Ln M_{it}^{US} = & b_0 + \sum_{k=1}^{n5} b_{1k} \Delta Ln M_{it-k}^{US} + \sum_{k=0}^{n6} b_{2k} \Delta Ln Y_{t-k}^{US} + \sum_{k=0}^{n7} b_{3k} \Delta Ln RER_{t-k} \\ & + \sum_{k=0}^{n8} b_{4k} \Delta Ln Vol_{t-k} + \beta \varepsilon_{t-1} + \omega_t \end{aligned} \quad (5.)$$

Following the procedures in acquiring equation (3.), substituting ε_{t-1} by the linear combination of 1-period lagged variables, equation (5.) becomes:

$$\begin{aligned} \Delta Ln M_{it}^{US} = & b_0 + \sum_{k=1}^{n5} b_{1k} \Delta Ln M_{it-k}^{US} + \sum_{k=0}^{n6} b_{2k} \Delta Ln Y_{t-k}^{US} + \sum_{k=0}^{n7} b_{3k} \Delta Ln RER_{t-k} \\ & + \sum_{k=0}^{n8} b_{4k} \Delta Ln Vol_{t-k} + \varphi_0 Ln M_{it-1} + \varphi_1 Ln Y_{t-1}^{US} + \varphi_2 Ln RER_{t-1} \\ & + \varphi_3 Ln Vol_{t-1} + \omega_t \end{aligned} \quad (6.)$$

Repeating the same procedures of the bounds testing approach, the F-statistic is to be considered to determine the joint significance of the lagged level variables for establishing cointegration. The short-run effects between the exchange rate volatility and the U.S. imports are measured by the estimate of b_{4k} 's, whereas the long-run effects are inferred by the estimate of φ_3 that is normalized on the estimate of φ_0 .

3.2 Data and Variables

3.2.1 Data Sources:

The data used in this paper are annual over the period of 1971 to 2012, and come from the following sources:

- (a.) World Bank's WITS system, which in turn receives the data from United Nations COMTRADE data base.
- (b.) International Financial Statistics of the IMF.

3.2.2 Industry Classification and Trade Share:

The annual bilateral export and import data from World Bank are three-digit SITC^{12/} (Standard International Trade Classification) base. The classification scheme consists roughly of the following sections (the first digit of each code): Section 0 - Food and live animals; Section 1 - Beverages and tobacco; Section 2 - Crude materials, inedible, except fuels; Section 3 - Mineral fuels, lubricants and related materials; Section 4 - Animal and vegetable oils, fats and waxes; Section 5 - Chemicals and related products; Section 6 - Manufactured goods classified chiefly by material; Section 7 - Machinery and transport equipment; Section 8 - Miscellaneous manufactured articles; Section 9 - Commodities and transactions not classified elsewhere in the SITC. Additionally, the higher number of SITC digits translate to more detailed structure of

^{12/} SITC (Standard International Trade Classification), Statistics Division, Department of Economic and Social Affairs, United Nations.

commodities. For example, Section 0- *Food and live animals* is 1-digit SITC; Division 01- *Meat and meat preparations* is 2-digit SITC; Group 011- *Meat of bovine animals, fresh, chilled or frozen* is 3-digit SITC; Subgroups 011.1 - *Meat of bovine animals, fresh or chilled* is 4-digit SITC; and Basic headings 011.11 - *Meat of bovine animals, fresh or chilled, with bone in* is 5-digit SITC.

To analyze the relative size for each commodity in comparison to the total trade flow, trade share and share rank are provided in Tables 1 and 2 corresponding with the lists of exporting and importing industries respectively under this study. Trade share for each industry is defined as each industry's exports as a percent of total exports from the U.S. to Thailand in 2012. From Table 1, the five largest U.S. exporting industries account for 38% of total exports from the U.S. to Thailand. These industries consist of 729- Other electrical machinery and apparatus (with 12.9% of total trade share), 931- Special transactions not classified according to kind (with 9.2% of total trade share), 719- Machinery and appliances, non-electrical (with 7.17% of total trade share), 861- Scientific, medical, optical, means/controlling instruments and apparatus (with 4.12% of total trade share), and 581- Plastic materials, regenerated cellulose (with 4.11% of total trade share). Also noted that most of these industries are durable goods.

Defined in the same manner as export trade share, from Table 2, the five largest U.S. importing industries account for 22% of total imports from Thailand to the U.S. These industries are 841- Clothing except fur clothing (with 6.79% of total trade share), 032- Fish, in airtight containers (with 4.77% of total trade share), 897- Jewellery, goldsmiths' and silversmiths' wares (with 4.27% of total trade share), 031- Fish, fresh and simply preserved (with 3.14% of total trade share), and 231- Crude rubber including

synthetic and reclaimed (with 2.75% of total trade share). Included among these industries are both durable and non-durable goods.

3.2.3 Variables Description:

X_i^{US} = Volume of American exports of commodity i to Thailand. Export value data in U.S. dollars for each commodity come from source (a.). Since price level for each commodity is not available, as a second best deflator this thesis follows Bahmani-Oskooee and Ardalani (2006) by using aggregate export price index for the U.S. to deflate the nominal exports of each commodity. The aggregate export price index is however obtained from source (b.).

M_i^{US} = Volume of American imports of commodity i from Thailand. Import value data in U.S. dollars for each commodity come from source (a.). In the same manner, due to the absence of price level for each commodity, this paper uses aggregate import price index for the U.S. to deflate the nominal imports of each commodity, as a second best deflator. Again, the aggregate import price index is obtained from source (b.).

Y^{US} = Measure of the United States income, proxied by the U.S. real GDP. The data come from source (b.).

Y^{TH} = Measure of Thailand's real income, proxied by Thailand's real GDP. The data also come from source (b.).

RER = Real bilateral exchange rate between the Thai Baht and the U.S. dollar, defined as $(P^{US} \cdot NER / P^{TH})$, where P^{US} is the price level in the U.S. measured by the U.S. CPI;

P^{TH} is the price level in Thailand measured by Thailand's CPI; and finally NER is the nominal bilateral exchange rate, defined as number of Baht per U.S. dollar. The data for all three variables come from source (b.). Noted that, for example, an increase in NER reflects a real depreciation of the Thai Baht.

Vol = Volatility measure of real bilateral Baht-dollar rate (NER). Following De Vita and Abbott (2004), Bahmani-Oskooee and Wang (2007), Bahmani-Oskooee and Mitra (2008), and Bahmani-Oskooee and Hegerty (2009), for each year Vol is defined as standard deviation of the 12 monthly real bilateral exchange rate (NER) within that year. All monthly CPI and nominal exchange rate data come from source (b.).

4. Empirical Results

In this procedure, the annual export and import data between the U.S and Thailand over the period 1971-2012 has been employed. Equation (3.) and (6.) are estimated for 119 U.S. exporting industries and 43 U.S. importing industries, respectively. These industries are categorized based on SITC, and thus arranged by 3-digit codes correlated to it. Following the methodology in the previous section, a maximum of four lags are imposed on all first-differenced variables, and the optimum number of lags is selected by Akaike's Information Criterion (AIC). Because of vast volume of short-run results, only the optimum models of the short-run coefficient estimates for the exchange rate volatility are selected to report in Table 9 (Exports) and Table 13 (Imports), while all variables of the long-run coefficient estimates are reported in Table 10 and Table 14 respectively. Table 12 and Table 16 reveal all the diagnostic statistics.

4.1 Unit Root Tests:

A prerequisite prior to applying the Pesaran *et al.* (2001)'s bounds testing approach of cointegration is that all variables must be either stationary series, $I(0)$, or integrated of first order, $I(1)$, which contains only one unit root. To ensure this condition, the Dickey-Fuller (DF) test for a unit root on the first-differenced variables is performed as the first step in order to eliminate the possibility of any variable that could be integrated of order two, $I(2)$, or higher. The Dickey-Fuller test is for testing the null

hypothesis that series contains a unit root, against the one-sided alternative that series is stationary. The DF test statistic does not follow the usual t-distribution, and the critical values are derived from Monte Carlo experiments, for example, Dickey and Fuller (1979), (1981). Tables 3 and 4 show all DF test statistics for U.S. export and U.S. import commodities respectively. The results indicate that all variables including explanatory variables have the DF test statistics more negative than the critical values without trend, -2.94, and with trend, -3.53, in both cases, signifying that the null hypothesis of a unit root is rejected in favor of the stationary alternative. Therefore, this means all the variables in this paper are not integrated of a higher order than one, i.e., $I(2)$ or higher.

4.2 Cointegration Tests:

Once all the variables under this study are assured to be either $I(0)$ or $I(1)$, next step is to test the validity of the long-run estimates. In order to archive this, the cointegration -- the existence of a long-run relationship among the variables -- must be established. Table 5 yields the cointegration test results for the U.S. export function. Provided the upper bound critical value of the F-statistics at 3.77, there are 59 out of 119 exporting industries indicating significant F-statistic at optimum lags^{13/}. This means that the lagged level variables in this export model are jointly significant, which supports cointegration among the variables in the export demand.

^{13/} The upper bound critical value of the F-statistics comes from Pesaran *et al.* (2001), which tabulated by using a Monte Carlo experiment. Specifically in this paper, the critical value of 3.77 comes from Table CI(iii) Case III: Unrestricted intercept and no trend, with the numbers of explanatory variables (K) = 3, at the 10% level of significance.

In addition to the Pesaran *et al.* (2001)'s F-test of cointegration, an alternative cointegration test can be applied by constructing an error correction term (ECM), using the linear combination of the lagged variables in equation (2.). The short-run export model can be re-estimated using the same number of optimum lags of each variable and the ECM_{t-1} term. By this method, a cointegration among the variables can be achieved only if the coefficient estimate of ECM_{t-1} is negative and statistically significant. These conditions are necessary to establish the validity of a cointegration confirming that the variables are adjusting towards their long-run equilibrium. The results of this alternative ECM_{t-1} test suggest that 114 out of 119 exporting industries pass this test, including all the 59 industries mentioned earlier in which the calculated F-statistic is greater than its critical value of 3.77. There are only five export equations that the null hypothesis of no cointegration cannot be rejected, which are the following industries: 044- Maize (not including sweet corn), unmilled, 665- Glassware, 667- Pearls and precious of semi-precious stones, unworked or worked, 821- Furniture, and 861- Scientific, medical, optical, means/controlling instruments.

The same procedures are applied for testing cointegration among import variables, and the results from both tests are reported in Table 6. Provided the same upper bound critical value of Pesaran *et al.* (2001)'s F-statistics at 3.77, the results show that 26 out of 43 importing industries exhibit significant F-test, supporting the long-run relationship in the import demand model. Alternatively, using ECM_{t-1} testing method as described by Bahmani-Oskooee and Ardalain (2006), almost all cases indicate the existence of cointegration by having negatively significant coefficients of ECM_{t-1} . In

sum, there is only one importing industry, coded 632- Wood manufactures, that fails both of the cointegration tests.

Once the strong evidence of a cointegration relationship among the variables is presented for nearly all exporting and importing industries, as shown in Tables 5 and 6, the next step is to analyze the short-run as well as the long-run effects of exchange rate volatility.

4.3 Aggregate Trade Results:

One of the main objectives of this study includes comprehensive investigation in disaggregated bilateral trade between the U.S. and Thailand, since the assumption predicted that the results from aggregate trade data would imply aggregation bias in some way. To emphasize the problem, this section concentrates on employing annual aggregate bilateral trade data between the two countries from 1971-2012. Table 7 illustrates the results estimated from equations (1.) and (3.) using aggregate U.S. exports to Thailand. Following the methodology and procedures described in section 3, Panels A and B in Table 7 show that at the 10% level of significant exchange rate volatility has positively significant impact on aggregate U.S. exports in the short run, while having negatively significant impact in the long run. Panel B also reports the long-run results showing that the coefficient of Thailand's economic activity support the assumption by having positively significant impact on the aggregate U.S. exports, while the real exchange rate also has positively significant impact, which is the opposite to its expected sign. Further,

the aggregate U.S. exports are not significantly affected by the 1997 Asian financial crisis, as reflected by the coefficient of Dummy. Panel C in Table 7 reports diagnostic statistics including the indication that the cointegration among the variables is established by the negatively significant ECM_{t-1} coefficient.

Table 8, Panels A and B, show that at the 10% level of significant exchange rate volatility has positively significant impact on aggregate U.S. imports in the short run, but it has no significant impact in the long run. Panel B in Table 8 also reports the long-run results showing that the coefficient of the U.S. economic activity support the assumption by having significantly positive impact on the aggregate U.S. imports, while the real exchange rate and the 1997 Asian financial crisis have no significant impact. In the same manner, Panel C in Table 8 reports diagnostic statistics indicating that the cointegration among the variables is established due to the negatively significant ECM_{t-1} coefficient. However, the high value of the Lagrange Multiplier statistic (LM) exceeds the critical value of 3.84 at 5% confidence level, suggesting an existence of autocorrelation residuals of the model.

4.4 American Export Demand at Commodity Level:

To examine closely the issue of aggregation bias, the disaggregated bilateral trade data at the commodity level are employed using the same methodology and procedures. As reported in Table 9, the short-run results reveal 87 out of 119 exporting industries carried at least one significant coefficient of volatility effect ($\Delta \ln Vol_{t-i}$) at least at ten percent level of confidence, implying that exchange rate volatility has short-run effects

on approximately 73% of all exporting industries. Only 32 exporting industries are not responsive to this measure of exchange rate volatility. Regarding the sign of the short-run effects in the responsive exporting industries, the results indicate mixed impact on trade flows as some coefficients are positive while some are negative.

To investigate in how many of these 87 industries the short-run effects will last into the long run, Table 10 provides the detail of long-run coefficient estimates for all variables. It appears that the long-run coefficients are less affected by exchange rate volatility. There are 29 industries that the exchange rate volatility carries a significant coefficient into the long run at least at ten percent level. Furthermore, 22 industries show negatively significant effects, while the rest of 7 industries have positively significant effects, as separately presented in Table 11, Panels A and B, respectively. Almost all of these 29 affected industries are fairly small as their trade share combined altogether account for only 14% of total trade share^{14/}. Regarding the rank of trade share, it is noted that all the top five exporting industries, which already mentioned in Section 3.2.2, are not affected by exchange rate volatility in the long run. However, the sixth largest exporting industry, 512- Organic chemicals (with 3.67% of total trade share) is negatively affected by the volatility^{15/}. Moreover, as classified in detail in Table 11, Panels A and B, most exporting industries that both negatively and positively affected by exchange rate volatility are intermediate goods mainly used for industrial supplies. Meanwhile, as far as durability of commodities is concerned, most of the industries negatively affected by exchange rate volatility are durable goods. This result is consistent with the findings of

^{14/} Trade share (or market share) for each industry is defined as each industry's exports as a percent of total exports from the U.S. to Thailand. These shares are for year 2012.

^{15/} Noted that more than 40% of total U.S. exports to Thailand are from top 6 exporting industries combined.

Bahmani-Oskooee and Bolhasani (2012). However, most of the industries positively affected by exchange rate volatility are also durable goods, which is contradict to the results of Bonroy (2007) that exchange rate volatility has a positive effect on non-durable goods such as agricultural and primary product.

As the theory predicted, the results of long-run coefficient estimates for equation (1.) show that Thailand's real income (Y^{TH}) has a significant effect on the U.S. exports to Thailand for 85 industries, and 82 of these carry the expected positive signs, as can be seen in Table 10. This strong evidence of positive income effect emphasizes the importance of Thailand's economic growth as a key determinant of the United States' bilateral export demand.

Table 10 also demonstrates the substitution effects in export demand as the exports of 47 American industries have significant long-run response to the real bilateral exchange rate between U.S. dollar and Thai Baht (RER). Furthermore, the model postulated in equation (1.) predicts that a real depreciation of the U.S. dollar against Thai Baht (as reflected in a decrease in RER) would increase the United States' exports to Thailand, as a result of lower relative price for American merchandises. Only 13 American exporting industries carry the expected negative sign in the long run supporting the hypothesis of the U.S. dollar depreciation, while 34 industries show a positive sign. In other words, the policy of U.S. dollar depreciation to encourage more American exports would be favorably effective for only 13 industries under investigation, whereas the 34 industries would be adversely affected by this policy. Also noted that most of the industries, on which such policy would be successful if implemented and practiced, are intermediate, non-durable goods. For the last remark on the RER variable, all the 13

favorably affected industries (in which the estimated elasticity is significantly negative) are small since all of them together account for only 8.9% of the total trade share, while all the 34 adversely affected industries (in which the estimated elasticity is significantly positive) occupies more than 16% of the total trade share. Also note that none of the five largest exporting industries is significantly affected by the long-run influence of the real bilateral exchange rate.

In order to capture the effects of the 1997 financial crisis in Asia, the dummy variable, i.e. Dummy, is added into each model. As the long-run results identified in Table 10, the Dummy variable carries a significant coefficient in 47 exporting industries signifying the influence of the 1997 events on these exporting industries. Moreover, while 33 industries are positively affected, only 14 industries are negatively affected. It is worth noting that most of the affected industries are small, since the four largest industries are unaffected^{16/}. In general, the 1997 Asian crisis presented opportunities for the United States to export more to Thailand for some industries, especially in manufacturing sector and intermediate goods.

4.5 American Import Demand at Commodity Level:

Similar procedures are performed for import models, and the results associated are shown in Tables 13, 14, 15, and 16. Starting with the short-run results from Table 13, there are 27 out of 43 importing industries carrying at least one significant lagged

^{16/} The fifth largest exporting industry, 581-*Plastic materials, regenerated cellulose* (with 4.11% of total trade share), is positively affected by the exchange rate volatility.

coefficient of volatility effect ($\Delta \ln Vol_{t-i}$) at least at a ten percent level of confidence, implying that exchange rate volatility has short-run effects on the majority of all importing industries under this study. Consistent with a number of previous studies, the signs of the short-run impact on the import flows are mixed, as the results indicate both positive and negative coefficients.

However, there are only 10 importing industries where the short-run effects remain into the long run, as investigated further in Table 14. More particularly, at least at 10% percent level, the exchange rate volatility carries a negatively significant coefficient into the long run for 8 industries, while only 2 industries show a positively significant coefficient, as presented in Table 15, Panels A and B. With regards to the size of each industry quantified by calculated trade share^{17/}, the fifth largest importing industry, coded 231- *Crude rubber including synthetic and reclaimed* (with about 2.75% of total trade share), is included among the 8 negatively affected industries. Meanwhile, the 2 positively affected industries are small, since they both together possess only 0.43% of total trade share. Apparently, Table 15 also reveals that most of the industries that respond to the exchange rate volatility in the long run are durable goods.

The long-run influence of the U.S. real income (Y^{US}) on its own imports from Thailand seems to be standing out, supporting the theoretical framework. More precisely, as reported in Table 14, the U.S. income variable carries the expected positive sign of the long-run coefficient estimates for equation (4.) in 30 industries (or more than two-third of

^{17/} Noted that due to limited numbers of importing industries available with continuous data, all the 43 industries account for only 37.28% of total trade share that the United States imports from Thailand in 2012.

all importing industries under investigation)^{18/}. Similar to the export model, this positive income effect signifies that the level of U.S. economic activity is an important determinant of the United States' import demand.

Focusing on the substitution effects in import demand, from equation (4.), the theory predicts that a real appreciation of the U.S. dollar against Thai Baht (as reflected in an increase in *RER*), would stimulate the United States' imports from Thailand, because the relative price for Thai products becomes lower. This is the case for 10 U.S. importing industries, in which the real exchange rate (*RER*) indicates an expected positively significant coefficient in the long run, while only 2 industries show negatively significant results. It is also worth noting that the majority of the importing industries (31 out of 43 industries) have no response to the *RER* variable as indicated by 31 insignificant coefficients. This evidence suggests that the U.S. import demand is inelastic, which is consistent with the findings by Bahmani-Oskooee and Ardalani (2006), Bahmani-Oskooee and Bolhasani (2012), and Bahmani-Oskooee and Xu (2012). However, as shown in Table 14, three from the five largest importing industries are affected by the real bilateral exchange rate in the long run. More specifically, 841- *Clothing except fur clothing* (with 6.79% trade share), and 897- *Jewellery, goldsmiths' and silversmiths' wares* (with 4.27% trade share) are positively affected, while 231- *Crude rubber including synthetic and reclaimed* (with 2.75% trade share) is negatively affected by the real bilateral exchange rate.

Finally, the Dummy variable, which accounts for the impact of the 1997 Asian financial crisis on the imports equation, carries a significant coefficient in 18 out of 43

^{18/} Besides these 30 positively influenced industries, there is one U.S. importing industry, coded 941- *Animal, n.e.s. including zoo animals, dogs* (with negligible 0.0003% of total trade share), that the long-run coefficient estimate shows negatively significant result.

industries. While this 1997 crisis affects 17 importing industries negatively, only one industry is positively affected. The size of an industry in imports does not seem to matter, since the largest importing industry, coded 841- *Clothing except fur clothing* (with 6.79% trade share), the third largest importing industry, coded 897- *Jewellery, goldsmiths' and silversmiths' wares* (with 4.27% trade share), and the fourth largest importing industry, coded 031- *Fish, fresh and simply preserved* (with 3.14% trade share) are adversely affected by the Dummy, while the second largest importing industry, coded 032- *Fish, in airtight containers* (with 4.77% trade share), and the fifth largest importing industry, coded 231- *Crude rubber including synthetic and reclaimed* (with 2.75% trade share) appear to be unaffected.

4.6 Diagnostic Statistics:

To receive the empirical verification, several diagnostic tests were performed to check whether the data are adequately represented by the models. The diagnostic results for each exporting and importing industry are reported in Tables 12 and 16 respectively.

Table 12 lists the diagnostic statistics for U.S. export demand. The Lagrange Multiplier (LM) provides a way of checking serial correlation among the residuals from the estimate under the null hypothesis^{19/}. The LM statistics are significant in only 6 export models, showing that most export models do not have autocorrelation problems of the residuals. Proposed by Ramsey (1969), Regression Specification Error Test (RESET)

^{19/} Lagrange Multiplier statistic (LM) has a Chi-squared distribution with one degree of freedom. At five percent confidence level, the critical value is 3.84.

is used for testing the functional mis-specification of the models^{20/}. It turns out that for only 18 export models the calculated RESET is greater than the critical value, indicating appropriate functional form or correct specification of most export models. The Jarque-Bera test for residual normality^{21/} (assigned as *Normality* in Table 12) shows only 19 statistically significant cases, implying that the residuals are normally distributed in most of the export models^{22/}. Moreover, the Cumulative Sum (CUSUM), and the Cumulative Sum of Squares (CUSUMSQ), are applied to test the stability of the short-run and long-run coefficients^{23/}. In Table 12, the results of stable coefficients are reported by an "S", while unstable coefficients are reported as "U". In almost all exporting industries, the CUSUM and CUSUMSQ values stay inside the critical bound at five percent significance level, indicating that the export equations are stable. Finally, the adjusted R^2 , as a measure of the goodness of fit, shows reasonable size in the majority of exporting industries.

The diagnostic statistics for U.S. import demand are reported in Table 16. The Lagrange Multiplier (LM) statistics are significant only in 6 importing industries, suggesting a lack of serial correlation among the residuals for the most estimated models. The Ramsey's RESET statistics are significant in 12 cases, in which the calculated RESET statistic is greater than its critical value of 3.84 at the 5% significance level. This signifies that the majority of error-correction models are not mis-specified. The Jarque-

^{20/} Ramsey's RESET also has a Chi-squared distribution with one degree of freedom. At five percent confidence level, the critical value is 3.84.

^{21/} See Jarque, C. and Bera, A. (1987).

^{22/} The Jarque-Bera statistic has an asymptotic Chi-squared distribution with two degrees of freedom. At five percent confidence level, the critical value is 5.99.

^{23/} The CUSUM test is based on a plot of the sum of the recursive residuals. The CUSUMSQ test is similar to the CUSUM test, but plots the cumulative sum of squared recursive residuals. Also see Brown, Durbin, and Evans (1975).

Bera test for normality indicates only 10 industries reject the null hypothesis that the residuals are normally distributed. The CUSUM and CUSUMSQ show that the coefficients of almost all import models are stable. Finally, similar to export models, most import models exhibit a good fit suggested by adjusted R^2 .

5. Conclusion

Exchange rate volatility has been more prominent under flexible exchange rate regimes since 1970s. It has been gaining a great deal of attention on economic analysis, such as its impact on international trade flows. Previous empirical literature studied this relationship mostly employs aggregate trade data, either bilateral trade data between the country pairs or aggregate trade data between the focusing country and the rest of the world. These studies using such aggregate data may have a problem so called aggregation bias.

To suitably minimize the aggregation bias, this paper thus emphasizes on utilizing the annual disaggregated bilateral trade data between the U.S. and Thailand at commodity level from 1971 to 2012. This paper analyzes the effect of exchange rate volatility on 119 U.S. exporting industries to Thailand and 43 U.S. importing industries from Thailand individually to reveal the distinctive responses from each commodity. An autoregressive distributed lag (ARDL) approach to cointegration within an error-correction modeling framework has been performed to distinguish the short run effects from the long run effects for each commodity.

The findings indicate that the volatility of the real bilateral exchange rate has a short-run significant effect on 87 U.S. exports and 27 U.S. imports. However, the effects of exchange rate volatility are less pronounced in the long run, since only 29 exporting industries and 10 importing industries are significantly affected by the volatility. Furthermore, 22 out of 29 exports and 8 out of 10 imports are adversely affected by the volatility. This mixed results point out that a specific commodity responds to the volatility differently, supporting the underlined aggregation bias issue.

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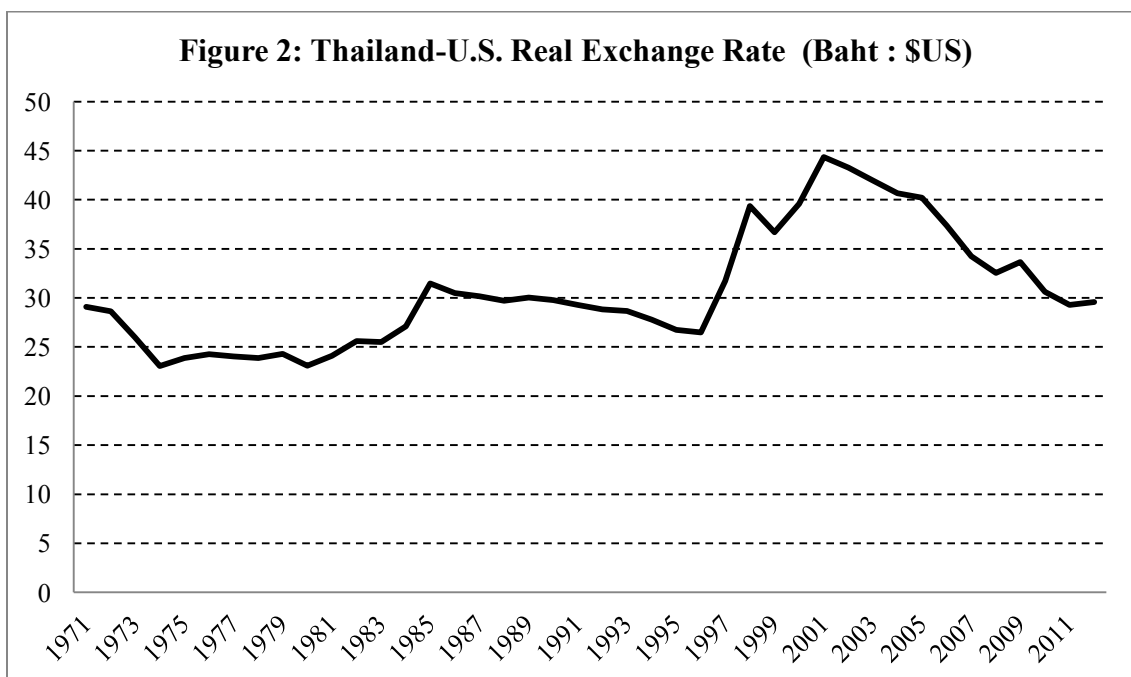
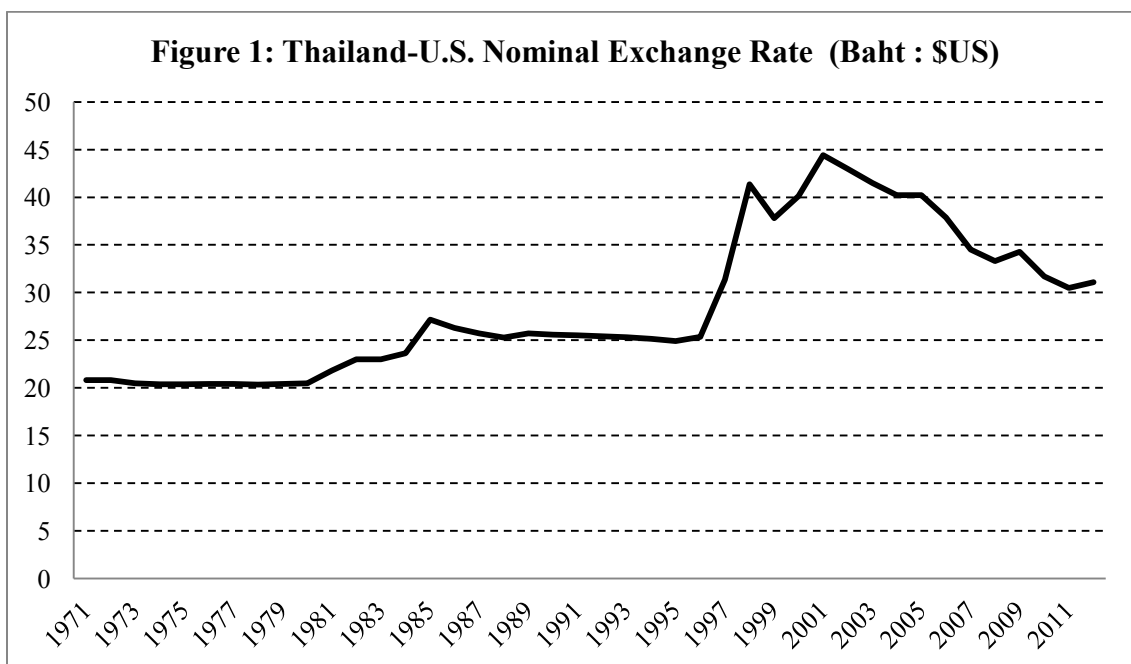
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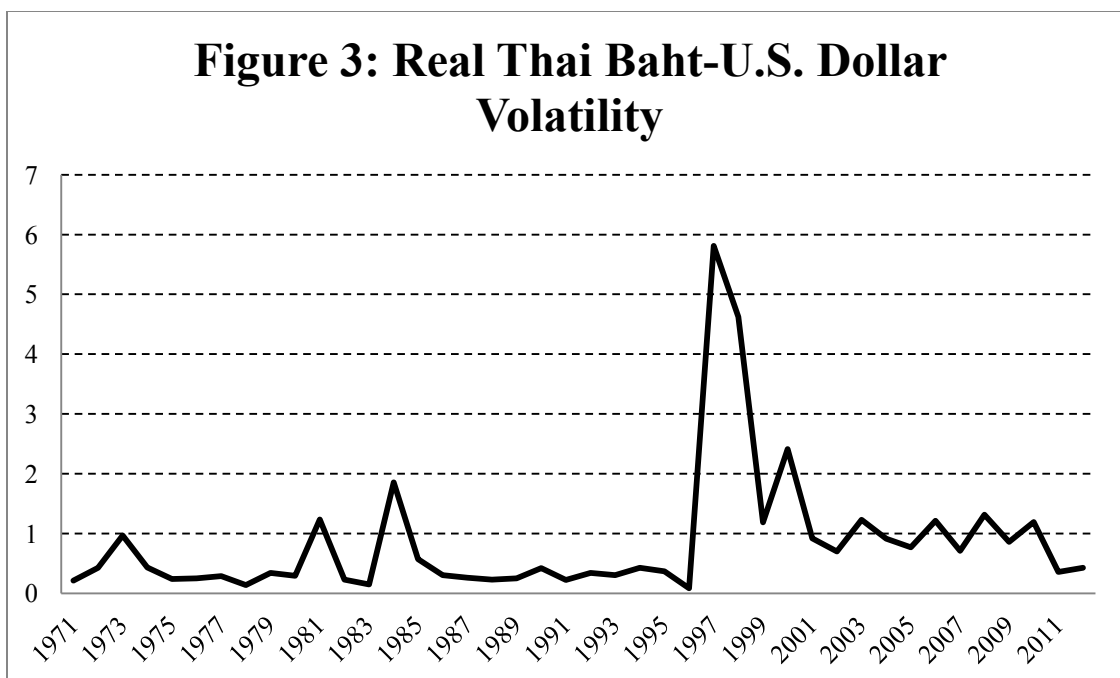
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Appendix A: Figures





Appendix B: Tables

Table 1: List of Industries under Study (U.S. Exports to Thailand)

Code	Industry Name	Trade Share	Share Rank
	Total Export	100	-
001	Live animals	0.10	72
011	Meat, fresh, chilled or frozen	0.03	93
022	Milk and cream and milk products other than butter or cheese	0.36	43
041	Wheat (including spelt) and meslin, unmilled	1.90	11
044	Maize (not including sweet corn), unmilled	0.03	94
048	Cereal preparations and preparations of flour or starch of fruits or vegetables	0.21	53
051	Fruit, fresh, and nuts - excluding oil	0.78	24
052	Dried fruit	0.09	75
053	Fruit, preserved and preparation	0.19	56
054	Vegetables, roots & tubers, fresh	0.18	58
055	Vegetables, roots & tubers, preserved or prepared	0.06	83
061	Sugar and honey	0.32	46
062	Sugar confectionery, sugar preps. - excluding chocolate	0.01	109
071	Coffee	0.02	100
073	Chocolate & preparations	0.06	86
075	Spices	0.02	103
081	Feeds for animals excluding unmilled	1.80	13
091	Margarine lard & shortening	0.01	110
099	Food preparations, n.e.s.	1.36	20
112	Alcoholic beverages	0.11	71
121	Tobacco, unmanufactured; Tobacco refuse	0.12	70
122	Tobacco manufactures	0.001	119
231	Crude rubber including synthetic and reclaimed	1.51	19
251	Pulp & waste paper	0.93	23
263	Cotton	1.87	12
266	Synthetic and regenerated fibers	0.07	82
273	Stone, sand and gravel	0.01	106
275	Natural abrasives-incl.industrial diamonds	0.02	97
276	Other crude minerals	0.24	52
282	Iron and steel scrap	1.51	18
284	Non-ferrous metal scrap	0.14	67
292	Crude vegetable materials, n.e.s.	0.08	78
332	Petroleum products	0.53	37
411	Animal oils and fats	0.003	118
431	Animal/Vegetable oils and fats, processed	0.03	95
512	Organic chemicals	3.67	6
513	Inorganic chemicals elements, oxides	0.24	51
514	Other inorganic chemicals	1.12	21
515	Radioactive and associated materials	0.05	90
531	Synthetic organic dyestuffs, natural	0.08	77

Code	Industry Name	Trade Share	Share Rank
533	Pigments, paints, varnishes & related materials	0.96	22
541	Medicinal & pharmaceutical products	1.52	17
551	Essential oils, perfume and flavour materials	0.65	27
553	Perfumery, cosmetics, dentifrices	0.57	32
554	Soaps, cleansing and polishing preparations	0.42	42
571	Explosives and pyrotechnic products	0.35	45
581	Plastic materials, regenerated cellulose	4.11	5
599	Chemical materials and products, n.e.s.	2.77	7
612	Manufacturer of leather or of artificial leather	0.01	114
621	Materials of rubber (e.g., Pastes, Plates, Sheets, Rods, Thread, Tubes)	0.12	69
629	Articles of rubber, n.e.s.	0.29	48
632	Wood manufactures, n.e.s.	0.10	73
641	Paper and paperboard	0.62	29
642	Articles of paper, pulp, or paperboard	0.07	80
651	Textile yarn and thread	0.26	49
652	Cotton fabrics, woven excluding narrow or special fabrics	0.02	101
653	Textile fabrics, woven excluding narrow or special fabrics	0.16	63
654	Tulle, lace, embroidery, ribbons	0.01	111
655	Special textile fabrics and related products	0.54	36
656	Made-up articles, wholly or chiefly of textile materials	0.01	105
657	Floor coverings, tapestries, etc.	0.01	116
661	Lime, cement and fabricated building materials	0.01	104
662	Clay and refractory construction materials	0.03	92
663	Mineral manufactures, n.e.s.	0.20	54
664	Glass	0.17	59
665	Glassware	0.02	102
667	Pearls and precious or semi-precious stones, unworked or worked	0.59	31
673	Iron and steel bars, rods, angles, shapes and sections	0.05	88
674	Universals, plates and sheets of iron	0.16	64
677	Iron and steel wire	0.01	108
678	Tubes, pipes and fittings of iron or steel	0.20	55
681	Silver and platinum group metals	0.14	66
682	Copper	0.15	65
683	Nickel	0.05	89
684	Aluminium	0.17	62
689	Miscellaneous non-ferrous base metals employed in metallurgy, cermets	0.07	81
691	Finished structural parts of iron, steel or aluminium	0.06	85
692	Metal containers for storage and transport	0.08	79
693	Wire products (excluding insulated electrical wiring) and fencing grills	0.02	99
694	Nails, screws, nuts, bolts, rivets of iron, steel, copper or aluminium	0.13	68
695	Tools for use in the hand or in machines	0.31	47
696	Cutlery	0.01	107

Code	Industry Name	Trade Share	Share Rank
697	Household equipment of base metals	0.01	115
698	Manufactures of base metal, n.e.s.	0.49	38
711	Power-generating machinery and parts thereof	1.94	10
712	Agricultural machinery and parts thereof	0.62	30
714	Office machines	2.49	8
715	Metalworking machinery	0.68	26
717	Textile and leather machinery	0.08	76
718	Machines for special industries	1.65	14
719	Machinery and appliances, non-electrical	7.17	3
722	Electric power machinery and switch	1.64	15
723	Equipment for distributing electricity	0.46	40
724	Telecommunications apparatus	1.60	16
725	Domestic electrical equipment	0.10	74
726	Electrical apparatus for medical purposes and radiological apparatus	0.63	28
729	Other electrical machinery and apparatus	12.90	1
731	Railway vehicles	0.06	84
732	Road motor vehicles	2.17	9
733	Road vehicles other than motor vehicles	0.25	50
734	Aircraft	0.78	25
735	Ships and boats	0.17	61
812	Sanitary, plumbing, heating and lighting fixtures and fittings	0.05	91
821	Furniture	0.19	57
831	Travel goods, handbags and similar containers	0.02	98
841	Clothing except fur clothing	0.05	87
861	Scientific, medical, optical, means/controlling instruments and apparatus	4.12	4
862	Photographic and cinematographic supplies	0.17	60
863	Developed cinematographic film	0.005	117
864	Watches and clocks	0.01	113
891	Musical instruments, sound recorders	0.45	41
892	Printed matter	0.49	39
893	Articles of artificial plastics	0.54	34
894	Perambulators, toys, games and sporting goods	0.55	33
895	Office and stationery supplies, n.e.s.	0.02	96
896	Works of art, collectors' pieces and antiques	0.01	112
897	Jewellery, goldsmiths' and silversmiths' wares	0.54	35
899	Miscellaneous manufactured articles, n.e.s.	0.35	44
931	Special transactions not classified according to kind	9.20	2

Notes: Trade share for each industry is defined as the ratio of each industry's exports as a percent of total U.S. exports to Thailand in 2012. For example, the trade share of industry 001-Live animals is 0.10; this means this industry accounts for 0.1% of the total U.S. exports to Thailand in 2012. The same description applies for imports in Table 2.

Table 2: List of Industries under Study (U.S. Imports from Thailand)

Code	Industry Name	Trade Share	Share Rank
	Total Import	100	-
031	Fish, fresh and simply preserved	3.14	4
032	Fish, in airtight containers, n.e.s.	4.77	2
053	Fruit, preserved and fruit preparations	1.59	8
054	Vegetables, roots and tubers, fresh or dried	0.09	28
055	Vegetables, roots and tubers, prepared or preserved	0.10	27
075	Spices	0.02	40
099	Food preparations, n.e.s.	0.98	10
121	Tobacco, unmanufactured; Tobacco refuse	0.02	38
211	Hides and skins, (except furskins), raw	0.002	42
231	Crude rubber including synthetic and reclaimed	2.75	5
243	Wood, shaped or simply worked	0.02	39
291	Crude animal materials, n.e.s.	0.02	37
292	Crude vegetable materials, n.e.s.	0.20	24
599	Chemical materials and products, n.e.s.	0.35	17
611	Leather	0.05	32
631	Veneers, plywood, particle boards and other wood, worked	0.03	35
632	Wood manufactures, n.e.s.	0.26	20
642	Articles of paper, pulp, or paperboard	0.11	25
651	Textile yarn and thread	0.07	30
652	Cotton fabrics, woven excluding narrow or special fabrics	0.06	31
653	Textile fabrics, woven excluding narrow or special fabrics	0.10	26
656	Made-up articles, wholly or chiefly of textile materials	0.23	21
657	Floor coverings, tapestries, etc.	0.09	29
666	Pottery	0.22	22
667	Pearls and precious or semi-precious stones, unworked or worked	0.83	14
696	Cutlery	0.03	36
697	Household equipment of base metals	1.07	9
698	Manufactures of base metal, n.e.s.	0.55	15
735	Ships and boats	0.04	34
812	Sanitary, plumbing, heating and lighting fixtures and fittings	0.22	23
821	Furniture	0.93	13
831	Travel goods, handbags and similar containers	0.32	19
841	Clothing except fur clothing	6.79	1
851	Footwear	0.41	16
891	Musical instruments, sound recorders	2.64	6
892	Printed matter	0.05	33
893	Articles of artificial plastics	0.96	11
894	Perambulators, toys, games and sporting goods	0.93	12
896	Works of art, collectors' pieces and antiques	0.01	41
897	Jewellery, goldsmiths' and silversmiths' wares	4.27	3

Code	Industry Name	Trade Share	Share Rank
899	Miscellaneous manufactured articles, n.e.s.	0.35	18
931	Special transactions not classified according to kind	1.59	7
941	Animals, n.e.s. including zoo animals, dogs	0.0003	43

Note: Trade share for each industry is defined as the ratio of each industry's imports as a percent of aggregate U.S. imports from Thailand in 2012.

For example, the trade share of industry 031-Fish, fresh and simply preserved is 3.14; this means this industry accounts for 3.14% of the total U.S. imports from Thailand in 2012.

Table 3: Dickey-Fuller Unit Root Tests on First-Differences (U.S. Export Commodities)

Code	Industry Name	DF without Trend	DF with Trend
	Y_{TH}	-4.61	-4.55
	Y_{US}	-4.87	-4.83
	REX	-4.87	-4.85
	V	-9.22	-9.09
	Total Export	-6.06	-6.04
001	Live animals	-8.89	-8.80
011	Meat, fresh, chilled or frozen	-8.68	-8.61
022	Milk and cream and milk products other than butter or cheese	-7.84	-7.71
041	Wheat (including spelt) and meslin, unmilled	-8.57	-8.48
044	Maize (not including sweet corn), unmilled	-8.58	-8.48
048	Cereal preparations; preparations of flour or starch of fruits or veg.	-7.40	-7.40
051	Fruit, fresh, and nuts - excluding oil	-5.58	-5.51
052	Dried fruit	-10.63	-10.63
053	Fruit, preserved and preparation	-7.95	-7.83
054	Vegetables, roots & tubers, fresh	-7.20	-7.11
055	Vegetables, roots & tubers, preserved or prepared	-6.07	-5.97
061	Sugar and honey	-9.23	-9.26
062	Sugar confectionery, sugar preps. - excluding chocolate	-6.65	-6.65
071	Coffee	-9.30	-9.23
073	Chocolate & preparations	-8.62	-8.50
075	Spices	-6.72	-6.64
081	Feeds for animals excluding unmilled	-10.69	-10.65
091	Margarine lard & shortening	-7.04	-6.96
099	Food preparations, n.e.s.	-8.49	-8.58
112	Alcoholic beverages	-8.82	-8.80
121	Tobacco, unmanufactured; Tobacco refuse	-10.06	-10.08
122	Tobacco manufactures	-7.87	-7.79
231	Crude rubber including synthetic and reclaimed	-9.00	-9.18
251	Pulp & waste paper	-7.51	-7.42
263	Cotton	-6.97	-6.90
266	Synthetic and regenerated fibers	-6.99	-6.92
273	Stone, sand and gravel	-7.41	-7.55
275	Natural abrasives-incl.industrial diamonds	-8.97	-9.04
276	Other crude minerals	-10.32	-10.19
282	Iron and steel scrap	-8.08	-8.08
284	Non-ferrous metal scrap	-8.02	-7.89
292	Crude vegetable materials, n.e.s.	-7.79	-7.68
332	Petroleum products	-7.49	-7.38
411	Animal oils and fats	-7.59	-7.55
431	Animal/Vegetable oils and fats, processed	-8.09	-8.04
512	Organic chemicals	-6.89	-6.79
513	Inorganic chemicals elements, oxides	-7.72	-7.56
514	Other inorganic chemicals	-10.03	-9.89
515	Radioactive and associated materials	-11.66	-11.50

Code	Industry Name	DF without Trend	DF with Trend
531	Synthetic organic dyestuffs, natural	-7.54	-7.76
533	Pigments, paints, varnishes & related materials	-6.43	-6.48
541	Medicinal & pharmaceutical products	-8.30	-8.36
551	Essential oils, perfume and flavour materials	-8.19	-8.38
553	Perfumery, cosmetics, dentifrices	-7.28	-7.19
554	Soaps, cleansing and polishing preparations	-8.64	-8.53
571	Explosives and pyrotechnic products	-9.35	-9.26
581	Plastic materials, regenerated cellulose	-7.59	-7.54
599	Chemical materials and products, n.e.s.	-7.12	-7.00
612	Manufacturer of leather or of artificial leather	-8.57	-8.59
621	Materials of rubber (e.g., Pastes, Plates, Sheets, Rods, Thread, Tubes)	-7.35	-7.46
629	Articles of rubber, n.e.s.	-9.08	-9.15
632	Wood manufactures, n.e.s.	-8.48	-8.37
641	Paper and paperboard	-5.94	-5.86
642	Articles of paper, pulp, or paperboard	-9.41	-9.28
651	Textile yarn and thread	-9.06	-8.94
652	Cotton fabrics, woven excluding narrow or special fabrics	-5.84	-5.82
653	Textile fabrics, woven excluding narrow or special fabrics	-7.52	-7.42
654	Tulle, lace, embroidery, ribbons	-9.93	-10.17
655	Special textile fabrics and related products	-5.47	-5.45
656	Made-up articles, wholly or chiefly of textile materials	-9.55	-9.40
657	Floor coverings, tapestries, etc.	-8.26	-8.14
661	Lime, cement and fabricated building materials	-7.17	-7.10
662	Clay and refractory construction materials	-6.94	-6.84
663	Mineral manufactures, n.e.s.	-7.13	-7.05
664	Glass	-6.21	-6.23
665	Glassware	-9.37	-9.38
667	Pearls and precious or semi-precious stones, unworked or worked	-5.87	-5.72
673	Iron and steel bars, rods, angles, shapes and sections	-8.73	-8.66
674	Universals, plates and sheets of iron	-10.20	-10.17
677	Iron and steel wire	-12.99	-12.87
678	Tubes, pipes and fittings of iron or steel	-8.88	-8.76
681	Silver and platinum group metals	-7.65	-7.55
682	Copper	-7.70	-7.58
683	Nickel	-11.24	-11.09
684	Aluminium	-6.21	-6.12
689	Miscellaneous non-ferrous base metals in metallurgy, and cermets	-9.05	-9.00
691	Finished structural parts of iron, steel or aluminium	-8.26	-8.16
692	Metal containers for storage and transport	-7.90	-8.27
693	Wire products (excluding insulated electrical wiring) and fencing grills	-10.94	-10.84
694	Nails, screws, nuts, bolts, rivets of iron, steel, copper or aluminium	-5.71	-5.63
695	Tools for use in the hand or in machines	-7.97	-7.87
696	Cutlery	-8.18	-8.07
697	Household equipment of base metals	-7.49	-8.01
698	Manufactures of base metal, n.e.s.	-4.98	-4.90
711	Power-generating machinery and parts thereof	-7.35	-7.24
712	Agricultural machinery and parts thereof	-6.89	-6.85

Code	Industry Name	DF without Trend	DF with Trend
714	Office machines	-7.86	-8.62
715	Metalworking machinery	-7.59	-7.49
717	Textile and leather machinery	-6.67	-6.55
718	Machines for special industries	-5.59	-5.57
719	Machinery and appliances, non-electrical	-4.39	-4.28
722	Electric power machinery and switch	-6.97	-7.01
723	Equipment for distributing electricity	-6.57	-6.56
724	Telecommunications apparatus	-6.05	-6.04
725	Domestic electrical equipment	-5.21	-5.08
726	Electrical apparatus for medical purposes and radiological apparatus	-8.02	-7.92
729	Other electrical machinery and apparatus	-5.10	-5.73
731	Railway vehicles	-6.38	-6.31
732	Road motor vehicles	-6.39	-6.34
733	Road vehicles other than motor vehicles	-10.74	-10.60
734	Aircraft	-8.28	-8.41
735	Ships and boats	-9.57	-9.44
812	Sanitary, plumbing, heating and lighting fixtures and fittings	-8.08	-7.97
821	Furniture	-8.70	-8.76
831	Travel goods, handbags and similar containers	-10.98	-10.83
841	Clothing except fur clothing	-10.79	-10.64
861	Scientific, medical, optical, means/controlling instruments	-6.19	-6.11
862	Photographic and cinematographic supplies	-7.59	-7.52
863	Developed cinematographic film	-11.93	-11.85
864	Watches and clocks	-7.12	-7.06
891	Musical instruments, sound recorders	-6.99	-6.92
892	Printed matter	-6.56	-6.50
893	Articles of artificial plastics	-7.27	-7.21
894	Perambulators, toys, games and sporting goods	-9.12	-9.01
895	Office and stationery supplies, n.e.s.	-8.60	-8.44
896	Works of art, collectors' pieces and antiques	-10.12	-9.98
897	Jewellery, goldsmiths' and silversmiths' wares	-5.00	-5.01
899	Miscellaneous manufactured articles, n.e.s.	-9.07	-9.18
931	Special transactions not classified according to kind	-6.47	-6.45

Notes: 95% critical value for DF statistics: -2.94 without time trend;
-3.53 with time trend

The same critical value applies for imports in Table 4.

Table 4: Dickey-Fuller Unit Root Tests on First-Differences (U.S. Import Commodities)

Code	Industry Name	DF without Trend	DF with Trend
	Total Import	-3.56	-4.10
031	Fish, fresh and simply preserved	-5.39	-5.45
032	Fish, in airtight containers, n.e.s.	-5.03	-6.19
053	Fruit, preserved and fruit preparations	-4.66	-5.80
054	Vegetables, roots and tubers, fresh or dried	-8.66	-8.56
055	Vegetables, roots and tubers, prepared or preserved	-5.09	-5.03
075	Spices	-7.07	-7.64
099	Food preparations, n.e.s.	-9.48	-10.99
121	Tobacco, unmanufactured; Tobacco refuse	-8.75	-9.00
211	Hides and skins, (except furskins), raw	-7.36	-7.27
231	Crude rubber including synthetic and reclaimed	-8.24	-8.13
243	Wood, shaped or simply worked	-6.64	-6.55
291	Crude animal materials, n.e.s.	-6.20	-6.29
292	Crude vegetable materials, n.e.s.	-6.32	-6.50
599	Chemical materials and products, n.e.s.	-8.41	-8.30
611	Leather	-6.47	-6.35
631	Veneers, plywood, particle boards and other wood, worked	-7.88	-7.75
632	Wood manufactures, n.e.s.	-5.38	-6.07
642	Articles of paper, pulp, or paperboard	-5.34	-5.32
651	Textile yarn and thread	-7.61	-11.52
652	Cotton fabrics, woven excluding narrow or special fabrics	-7.73	-8.25
653	Textile fabrics, woven excluding narrow or special fabrics	-9.06	-9.63
656	Made-up articles, wholly or chiefly of textile materials	-5.16	-5.67
657	Floor coverings, tapestries, etc.	-7.03	-7.30
666	Pottery	-6.04	-7.33
667	Pearls and precious or semi-precious stones, unworked or worked	-7.79	-7.95
696	Cutlery	-9.21	-9.31
697	Household equipment of base metals	-4.84	-5.03
698	Manufactures of base metal, n.e.s.	-6.45	-6.28
735	Ships and boats	-10.14	-10.00
812	Sanitary, plumbing, heating and lighting fixtures and fittings	-5.73	-5.95
821	Furniture	-3.88	-6.31
831	Travel goods, handbags and similar containers	-3.54	-3.75
841	Clothing except fur clothing	-8.58	-8.96
851	Footwear	-7.43	-9.11
891	Musical instruments, sound recorders	-4.89	-5.22
892	Printed matter	-8.27	-8.69
893	Articles of artificial plastics	-8.18	-8.73
894	Perambulators, toys, games and sporting goods	-6.31	-7.20
896	Works of art, collectors' pieces and antiques	-7.69	-7.58
897	Jewellery, goldsmiths' and silversmiths' wares	-3.51	-3.79
899	Miscellaneous manufactured articles, n.e.s.	-5.19	-6.27
931	Special transactions not classified according to kind	-6.81	-6.69
941	Animals, n.e.s. including zoo animals, dogs	-10.13	-9.99

Table 5: Cointegration Test Results (U.S. Exports)

Code	Industry Name	F-test	ECM _{t-1}	Cointegrated?
	Total Export	2.36	-0.28 (3.57)	Yes
001	Live animals	5.81	-0.86 (4.96)	Yes
011	Meat, fresh, chilled or frozen	8.01	-0.90 (5.73)	Yes
022	Milk and cream, milk products other than butter or cheese	4.08	-0.56 (3.88)	Yes
041	Wheat (including spelt) and meslin, unmilled	5.81	-0.90 (6.48)	Yes
044	Maize (not including sweet corn), unmilled	1.26	0.20 (2.83)	No
048	Cereal preps.; preparations of flour /starch of fruits or veg.	2.22	-0.30 (2.78)	Yes
051	Fruit, fresh, and nuts - excluding oil	4.41	-0.91 (6.97)	Yes
052	Dried fruit	6.25	-0.21 (5.53)	Yes
053	Fruit, preserved and preparation	1.60	-0.40 (3.67)	Yes
054	Vegetables, roots & tubers, fresh	2.78	-0.49 (3.51)	Yes
055	Vegetables, roots & tubers, preserved or prepared	3.54	-0.36 (7.35)	Yes
061	Sugar and honey	1.48	-0.49 (3.16)	Yes
062	Sugar confectionery, sugar preps. - excluding chocolate	4.35	-0.26 (4.46)	Yes
071	Coffee	7.46	-0.91 (5.64)	Yes
073	Chocolate & preparations	5.08	-0.51 (4.69)	Yes
075	Spices	4.56	-0.81 (4.37)	Yes
081	Feeds for animals excluding unmilled	4.80	-0.42 (4.42)	Yes
091	Margarine lard & shortening	3.39	-0.71 (4.36)	Yes
099	Food preparations, n.e.s.	1.66	-0.29 (4.07)	Yes
112	Alcoholic beverages	4.59	-0.57 (4.71)	Yes
121	Tobacco, unmanufactured; Tobacco refuse	2.86	-0.16 (3.50)	Yes
122	Tobacco manufactures	0.69	-0.30 (2.26)	Yes
231	Crude rubber including synthetic and reclaimed	0.91	-0.32 (3.60)	Yes
251	Pulp & waste paper	3.31	-0.37 (3.61)	Yes
263	Cotton	7.01	-0.81 (6.04)	Yes
266	Synthetic and regenerated fibers	7.39	-0.87 (5.85)	Yes
273	Stone, sand and gravel	1.63	-0.43 (3.64)	Yes
275	Natural abrasives-incl.industrial diamonds	2.95	-0.49 (3.47)	Yes
276	Other crude minerals	9.40	-1.08 (6.41)	Yes
282	Iron and steel scrap	3.27	-1.03 (6.75)	Yes
284	Non-ferrous metal scrap	5.12	-0.44 (4.73)	Yes
292	Crude vegetable materials, n.e.s.	3.39	-0.67 (4.65)	Yes
332	Petroleum products	4.09	-0.49 (3.58)	Yes
411	Animal oils and fats	3.08	-1.18 (4.28)	Yes
431	Animal/Vegetable oils and fats, processed	2.99	-0.31 (3.14)	Yes
512	Organic chemicals	8.57	-0.70 (6.52)	Yes
513	Inorganic chemicals elements, oxides	4.74	-0.79 (4.67)	Yes
514	Other inorganic chemicals	10.56	-0.97 (6.48)	Yes
515	Radioactive and associated materials	6.49	-1.09 (6.95)	Yes
531	Synthetic organic dyestuffs, natural	1.96	-0.37 (2.78)	Yes
533	Pigments, paints, varnishes & related materials	1.95	-0.96 (5.11)	Yes
541	Medicinal & pharmaceutical products	4.23	-0.67 (5.03)	Yes

Code	Industry Name	F-test	ECM _{t-1}	Cointegrated?
551	Essential oils, perfume and flavour materials	1.82	-0.53 (3.62)	Yes
553	Perfumery, cosmetics, dentifrices	2.95	-0.23 (3.22)	Yes
554	Soaps, cleansing and polishing preparations	6.15	-0.20 (5.12)	Yes
571	Explosives and pyrotechnic products	6.11	-0.73 (5.21)	Yes
581	Plastic materials, regenerated cellulose	3.38	-0.51 (5.56)	Yes
599	Chemical materials and products, n.e.s.	8.15	-0.79 (6.15)	Yes
612	Manufacturer of leather or of artificial leather	5.36	-0.17 (4.84)	Yes
621	Materials of rubber (e.g., Pastes, Plates, Sheets, Rods, Thread, Tubes)	5.49	-0.92 (5.44)	Yes
629	Articles of rubber, n.e.s.	2.35	-0.87 (4.72)	Yes
632	Wood manufactures, n.e.s.	6.38	-0.49 (5.41)	Yes
641	Paper and paperboard	1.87	-0.16 (2.86)	Yes
642	Articles of paper, pulp, or paperboard	3.44	-0.25 (4.94)	Yes
651	Textile yarn and thread	2.26	-0.16 (3.15)	Yes
652	Cotton fabrics, woven excluding narrow or special fabrics	5.47	-0.20 (5.54)	Yes
653	Textile fabrics, woven excluding narrow or special fabrics	5.04	-0.58 (4.32)	Yes
654	Tulle, lace, embroidery, ribbons	2.65	-0.11 (3.60)	Yes
655	Special textile fabrics and related products	4.93	-0.25 (4.78)	Yes
656	Made-up articles, wholly or chiefly of textile materials	2.07	-0.58 (2.87)	Yes
657	Floor coverings, tapestries, etc.	1.80	-0.30 (3.07)	Yes
661	Lime, cement and fabricated building materials	6.94	-0.73 (5.90)	Yes
662	Clay and refractory construction materials	3.41	-0.49 (3.70)	Yes
663	Mineral manufactures, n.e.s.	5.52	-0.93 (4.94)	Yes
664	Glass	10.05	-0.74 (6.93)	Yes
665	Glassware	0.10	0.07 (2.40)	No
667	Pearls and precious or semi-precious stones, unworked or worked	2.62	0.09 (3.69)	No
673	Iron and steel bars, rods, angles, shapes and sections	5.26	-1.03 (6.15)	Yes
674	Universals, plates and sheets of iron	3.94	-0.83 (5.89)	Yes
677	Iron and steel wire	2.23	-0.90 (4.90)	Yes
678	Tubes, pipes and fittings of iron or steel	7.36	-0.90 (5.72)	Yes
681	Silver and platinum group metals	5.42	-0.68 (4.09)	Yes
682	Copper	6.65	-0.22 (5.33)	Yes
683	Nickel	20.77	-3.61 (10.52)	Yes
684	Aluminium	2.46	-0.58 (3.36)	Yes
689	Miscellaneous non-ferrous base metals in metallurgy, and cermets	6.60	-0.42 (5.77)	Yes
691	Finished structural parts of iron, steel or aluminium	2.30	-0.48 (4.64)	Yes
692	Metal containers for storage and transport	8.92	-0.83 (7.23)	Yes
693	Wire products (excluding insulated electrical wiring) and fencing grills	8.91	-0.62 (6.26)	Yes
694	Nails, screws, nuts, bolts, rivets of iron, steel, copper or aluminium	3.28	-0.29 (3.71)	Yes
695	Tools for use in the hand or in machines	2.49	-0.74 (4.20)	Yes
696	Cutlery	3.43	-0.58 (3.98)	Yes
697	Household equipment of base metals	3.86	-0.42 (4.09)	Yes
698	Manufactures of base metal, n.e.s.	4.33	-0.16 (4.21)	Yes
711	Power-generating machinery and parts thereof	4.16	-0.66 (4.79)	Yes
712	Agricultural machinery and parts thereof	2.97	-0.34 (4.07)	Yes

Code	Industry Name	F-test	ECM _{t-1}	Cointegrated?
714	Office machines	1.39	-0.19 (3.99)	Yes
715	Metalworking machinery	5.79	-0.38 (5.26)	Yes
717	Textile and leather machinery	1.55	-0.33 (2.82)	Yes
718	Machines for special industries	4.11	-0.41 (4.65)	Yes
719	Machinery and appliances, non-electrical	4.67	-0.02 (5.03)	Yes
722	Electric power machinery and switch	2.01	-0.23 (2.85)	Yes
723	Equipment for distributing electricity	3.26	-0.34 (4.02)	Yes
724	Telecommunications apparatus	3.13	-0.31 (4.06)	Yes
725	Domestic electrical equipment	1.31	-0.13 (2.58)	Yes
726	Electrical apparatus for medical purposes and radiological apparatus	1.62	-0.44 (3.26)	Yes
729	Other electrical machinery and apparatus	9.12	-0.38 (6.04)	Yes
731	Railway vehicles	7.45	-1.43 (6.02)	Yes
732	Road motor vehicles	3.62	-0.38 (4.57)	Yes
733	Road vehicles other than motor vehicles	1.22	-0.78 (3.37)	Yes
734	Aircraft	8.45	-0.68 (6.55)	Yes
735	Ships and boats	10.39	-2.02 (6.63)	Yes
812	Sanitary, plumbing, heating and lighting fixtures and fittings	7.71	-0.74 (5.66)	Yes
821	Furniture	2.88	0.15 (3.50)	No
831	Travel goods, handbags and similar containers	8.40	-0.57 (6.53)	Yes
841	Clothing except fur clothing	0.93	-0.32 (4.36)	Yes
861	Scientific, medical, optical, means/controlling instruments	3.10	0.16 (3.75)	No
862	Photographic and cinematographic supplies	0.73	-0.29 (2.60)	Yes
863	Developed cinematographic film	12.59	-2.08 (7.56)	Yes
864	Watches and clocks	3.48	-0.84 (4.35)	Yes
891	Musical instruments, sound recorders	4.92	-0.15 (4.67)	Yes
892	Printed matter	2.31	-0.20 (2.72)	Yes
893	Articles of artificial plastics	4.03	-0.43 (5.34)	Yes
894	Perambulators, toys, games and sporting goods	1.03	-0.32 (2.03)	Yes
895	Office and stationery supplies, n.e.s.	0.93	-0.28 (2.28)	Yes
896	Works of art, collectors' pieces and antiques	2.87	-2.47 (5.16)	Yes
897	Jewellery, goldsmiths' and silversmiths' wares	3.82	-0.65 (3.67)	Yes
899	Miscellaneous manufactured articles, n.e.s.	2.14	-0.55 (3.82)	Yes
931	Special transactions not classified according to kind	2.63	-0.26 (3.12)	Yes

Notes: 1. The number inside the parenthesis next to estimated ECM_{t-1} coefficient is the absolute value of the t-ratio. In this paper, the critical values at 5% and 10% significance level are 1.96 and 1.64, respectively.

2. The upper bound critical value of the F-statistics, used for testing cointegration in each model, comes from Pesaran *et al.* (2001); Table CI(iii), Case III, p. 300.

In this paper, at the 10% level of significance, with the numbers of explanatory variables (K) = 3, the upper bound critical value is 3.77.

The same description applies for imports in Table 6.

Table 6: Cointegration Test Results (U.S. Imports)

Code	Industry Name	F-test	ECM _{t-1}	Cointegrated?
	Total Import	2.40	-0.07 (3.51)	Yes
031	Fish, fresh and simply preserved	1.42	-0.18 (2.67)	Yes
032	Fish, in airtight containers, n.e.s.	4.94	-0.15 (4.52)	Yes
053	Fruit, preserved and fruit preparations	20.69	-0.61 (9.66)	Yes
054	Vegetables, roots and tubers, fresh or dried	6.68	-0.95 (5.70)	Yes
055	Vegetables, roots and tubers, prepared or preserved	1.41	-0.22 (3.09)	Yes
075	Spices	2.41	-0.53 (3.78)	Yes
099	Food preparations, n.e.s.	8.41	-0.35 (6.49)	Yes
121	Tobacco, unmanufactured; Tobacco refuse	7.71	-0.54 (5.38)	Yes
211	Hides and skins, (except furskins), raw	2.08	-0.48 (3.59)	Yes
231	Crude rubber including synthetic and reclaimed	9.05	-0.89 (6.26)	Yes
243	Wood, shaped or simply worked	2.15	-0.51 (3.01)	Yes
291	Crude animal materials, n.e.s.	4.43	-0.80 (5.09)	Yes
292	Crude vegetable materials, n.e.s.	6.47	-0.44 (5.91)	Yes
599	Chemical materials and products, n.e.s.	5.26	-0.67 (4.93)	Yes
611	Leather	1.94	-0.33 (2.81)	Yes
631	Veneers, plywood, particle boards and other wood	3.73	-0.17 (4.38)	Yes
632	Wood manufactures, n.e.s.	10.34	0.03 (6.66)	Yes
642	Articles of paper, pulp, or paperboard	5.85	-0.44 (5.04)	Yes
651	Textile yarn and thread	6.23	-0.06 (5.22)	Yes
652	Cotton fabrics, woven excluding narrow, special fabrics	4.09	-0.31 (4.35)	Yes
653	Textile fabrics, woven excluding narrow, special fabrics	2.54	-0.45 (4.24)	Yes
656	Made-up articles, wholly or chiefly of textile materials	4.85	-0.16 (5.88)	Yes
657	Floor coverings, tapestries, etc.	15.44	-0.30 (8.67)	Yes
666	Pottery	4.03	-0.15 (3.72)	Yes
667	Pearls and precious or semi-precious stones	5.06	-0.23 (4.79)	Yes
696	Cutlery	5.70	-0.27 (6.21)	Yes
697	Household equipment of base metals	6.57	-0.23 (5.80)	Yes
698	Manufactures of base metal, n.e.s.	2.88	-0.23 (2.43)	Yes
735	Ships and boats	8.25	-1.07 (5.99)	Yes
812	Sanitary, plumbing, heating and lighting fixtures and fittings	5.00	-0.45 (4.47)	Yes
821	Furniture	10.47	-0.33 (7.16)	Yes
831	Travel goods, handbags and similar containers	1.66	-0.14 (3.82)	Yes
841	Clothing except fur clothing	1.33	-0.17 (2.71)	Yes
851	Footwear	21.65	-0.16 (10.95)	Yes
891	Musical instruments, sound recorders	2.97	-0.19 (3.92)	Yes
892	Printed matter	2.90	-0.07 (4.22)	Yes
893	Articles of artificial plastics	7.80	-0.63 (6.43)	Yes
894	Perambulators, toys, games and sporting goods	1.90	-0.38 (3.94)	Yes
896	Works of art, collectors' pieces and antiques	3.55	-1.07 (5.29)	Yes
897	Jewellery, goldsmiths' and silversmiths' wares	0.73	-0.25 (3.95)	Yes
899	Miscellaneous manufactured articles, n.e.s.	5.40	-0.43 (5.21)	Yes
931	Special transactions not classified according to kind	1.33	-0.54 (4.88)	Yes
941	Animals, n.e.s. including zoo animals, dogs	3.92	-1.61 (4.31)	Yes

Table 7: Estimation Results of Aggregate U.S. Exports to Thailand

Panel A: Short-Run Coefficient Estimates

$\Delta \text{Ln } V_t$	$\Delta \text{Ln } V_{t-1}$	$\Delta \text{Ln } V_{t-2}$	$\Delta \text{Ln } V_{t-3}$
-0.03 (0.63)	0.29 (3.39)	0.17 (3.13)	0.13 (3.67)

Panel B: Long-Run Coefficient Estimates

Constant	Dummy	$\text{Ln } Y_{TH}$	$\text{Ln } \text{REX}$	$\text{Ln } V$
-9.29 (1.59)	0.77 (1.09)	1.37 (4.62)	3.51 (2.07)	-1.76 (2.02)

Panel C: Diagnostic Statistics

F	ECM_{t-1}	LM	RESET	Normality	CUSUM	CUSUMSQ	Adj. R^2
2.36	-0.28 (3.57)	0.22	0.87	2.36	S	S	0.63

- Notes:* 1. The number inside the parenthesis next to an estimated coefficient is the absolute value of the t-ratio. In this paper, the critical values at 5% and 10% significance level are 1.96 and 1.64, respectively.
2. The upper bound critical value of the F-statistics, used for testing cointegration, comes from Pesaran et al. (2001); Table CI(iii), Case III, p. 300. In this paper, at the 10% level of significance, with the numbers of explanatory variables (K) = 3, the upper bound critical value is 3.77.
3. LM is the Lagrange multiplier test of residual serial correlation, distributed as a Chi-squared distribution with one degree of freedom.
4. RESET is Ramsey's test for functional form, distributed as a Chi-squared distribution with one degree of freedom.
5. Normality is the Jarque-Bera test for residual normality, and has an asymptotic Chi-squared distribution with two degrees of freedom.
6. CUSUM and CUSUMSQ are stability tests of the short-run and long-run coefficients. Stable coefficients are indicated by an "S", whereas unstable coefficients are indicated by a "U".

Table 8: Estimation Results of Aggregate U.S. Imports from Thailand

Panel A: Short-Run Coefficient Estimates

$\Delta \text{Ln } V_t$	$\Delta \text{Ln } V_{t-1}$	$\Delta \text{Ln } V_{t-2}$	$\Delta \text{Ln } V_{t-3}$
0.02 (2.24)	-	-	-

Panel B: Long-Run Coefficient Estimates

Constant	Dummy	$\text{Ln } Y_{\text{TH}}$	Ln REX	$\text{Ln } V$
-25.12 (2.89)	-1.17 (1.35)	3.22 (2.87)	2.21 (1.49)	0.09 (0.32)

Panel C: Diagnostic Statistics

F	ECM_{t-1}	LM	RESET	Normality	CUSUM	CUSUMSQ	Adj. R^2
2.40	-0.07 (3.51)	5.41	0.19	0.59	S	S	0.78

Notes: 1. The number inside the parenthesis next to an estimated coefficient is the absolute value of the t-ratio. In this paper, the critical values at 5% and 10% significance level are 1.96 and 1.64, respectively.

2. The upper bound critical value of the F-statistics, used for testing cointegration, comes from Pesaran et al. (2001); Table CI(iii), Case III, p. 300. In this paper, at the 10% level of significance, with the numbers of explanatory variables (K) = 3, the upper bound critical value is 3.77.

3. LM is the Lagrange multiplier test of residual serial correlation, distributed as a Chi-squared distribution with one degree of freedom.

4. RESET is Ramsey's test for functional form, distributed as a Chi-squared distribution with one degree of freedom.

5. Normality is the Jarque-Bera test for residual normality, and has an asymptotic Chi-squared distribution with two degrees of freedom.

6. CUSUM and CUSUMSQ are stability tests of the short-run and long-run coefficients. Stable coefficients are indicated by an "S", whereas unstable coefficients are indicated by a "U".

Table 9 : Short-Run Coefficient Estimates of Exchange Rate Volatility, U.S. Exports

Code	Industry Name	$\Delta \text{Ln } V_t$	$\Delta \text{Ln } V_{t-1}$	$\Delta \text{Ln } V_{t-2}$	$\Delta \text{Ln } V_{t-3}$
001	Live animals	-0.01 (0.18)			
011	Meat, fresh, chilled or frozen	0.03 (0.28)			
022	Milk and cream and milk products other than butter or cheese	-0.20 (1.47)			
041	Wheat (including spelt) and meslin, unmilled	0.06 (1.48)			
044	Maize (not including sweet corn), unmilled	-0.35 (2.19)			
048	Cereal preparations; preparations of flour or starch of fruits or veg.	-0.03 (0.23)			
051	Fruit, fresh, and nuts - excluding oil	-0.14 (1.81)			
052	Dried fruit	-0.28 (2.47)	1.06 (4.28)	0.52 (3.08)	0.26 (2.37)
053	Fruit, preserved and preparation	0.05 (1.06)			
054	Vegetables, roots & tubers, fresh	0.19 (1.40)			
055	Vegetables, roots & tubers, preserved or prepared	-0.52 (5.18)	1.74 (6.75)	0.90 (4.98)	0.57 (5.26)
061	Sugar and honey	-0.16 (0.98)	0.63 (2.77)	0.85 (4.09)	
062	Sugar confectionery, sugar preps. - excluding chocolate	0.09 (0.51)	1.29 (4.33)	0.88 (3.89)	0.36 (1.99)
071	Coffee	-0.26 (3.13)			
073	Chocolate & preparations	-0.20 (2.25)	-0.38 (3.44)		
075	Spices	0.04 (0.49)			
081	Feeds for animals excluding unmilled	-0.37 (3.33)	-0.31 (2.54)		
091	Margarine lard & shortening	0.24 (1.78)			
099	Food preparations, n.e.s.	-0.14 (2.54)			
112	Alcoholic beverages	0.00 (0.03)	0.05 (0.98)	0.12 (2.59)	
121	Tobacco, unmanufactured; Tobacco refuse	-0.07 (1.00)	0.35 (4.40)	0.18 (2.58)	
122	Tobacco manufactures	-0.55 (2.50)			
231	Crude rubber including synthetic and reclaimed	0.19 (4.04)			
251	Pulp & waste paper	0.09 (2.64)			
263	Cotton	0.21(3.40)			
266	Synthetic and regenerated fibers	-0.11 (1.56)			
273	Stone, sand and gravel	0.01 (0.13)			
275	Natural abrasives-incl.industrial diamonds	0.15 (2.18)			
276	Other crude minerals	0.10 (1.76)	-0.59 (5.66)	-0.36 (3.85)	-0.19 (2.81)

Code	Industry Name	$\Delta \text{Ln } V_t$	$\Delta \text{Ln } V_{t-1}$	$\Delta \text{Ln } V_{t-2}$	$\Delta \text{Ln } V_{t-3}$
282	Iron and steel scrap	0.26 (3.53)			
284	Non-ferrous metal scrap	-0.31 (2.36)			
292	Crude vegetable materials, n.e.s.	0.00 (0.04)			
332	Petroleum products	0.11 (1.58)			
411	Animal oils and fats	0.35 (1.88)	0.26 (1.30)		
431	Animal/Vegetable oils and fats, processed	0.07 (1.24)			
512	Organic chemicals	0.10 (3.24)	0.31 (6.25)	0.17 (4.73)	
513	Inorganic chemicals elements, oxides	0.01 (0.23)			
514	Other inorganic chemicals	-0.12 (2.39)			
515	Radioactive and associated materials	-0.29 (3.23)			
531	Synthetic organic dyestuffs, natural	-0.11 (2.21)			
533	Pigments, paints, varnishes & related materials	-0.02 (0.61)	-0.09 (2.20)	-0.08 (2.31)	
541	Medicinal & pharmaceutical products	0.00 (0.10)	-0.13 (3.20)	-0.08 (2.70)	
551	Essential oils, perfume and flavour materials	0.07 (1.31)	-0.29 (4.64)	-0.17 (3.30)	
553	Perfumery, cosmetics, dentifrices	0.00 (0.05)			
554	Soaps, cleansing and polishing preparations	-0.06 (1.43)	0.20 (3.39)	0.18 (3.91)	0.08 (2.29)
571	Explosives and pyrotechnic products	-0.01 (0.10)			
581	Plastic materials, regenerated cellulose	0.01 (0.27)	-0.10 (2.59)		
599	Chemical materials and products, n.e.s.	0.05 (1.29)	-0.29 (5.35)	-0.25 (5.35)	-0.17 (4.08)
612	Manufacturer of leather or of artificial leather	-0.35 (2.69)	1.30 (5.10)	0.99 (5.82)	0.43 (3.53)
621	Materials of rubber (e.g., Pastes, Plates, Sheets, Rods, Thread, Tubes)	-0.23 (2.43)	0.66 (3.26)	0.23 (1.92)	
629	Articles of rubber, n.e.s.	-0.11 (2.07)			
632	Wood manufactures, n.e.s.	-0.39 (3.73)			
641	Paper and paperboard	-0.23 (4.78)			
642	Articles of paper, pulp, or paperboard	-0.29 (3.34)			
651	Textile yarn and thread	0.05 (0.78)			
652	Cotton fabrics, woven excluding narrow or special fabrics	-0.25 (1.67)	1.50 (5.12)	0.73 (3.32)	-0.28 (1.73)
653	Textile fabrics, woven excluding narrow or special fabrics	0.09 (1.92)			
654	Tulle, lace, embroidery, ribbons	-0.06 (0.48)	0.86 (4.01)	0.39 (2.48)	0.15 (1.39)
655	Special textile fabrics and related products	-0.14 (2.27)	0.25 (4.09)		
656	Made-up articles, wholly or chiefly of textile materials	-0.12 (1.62)			

Code	Industry Name	$\Delta \text{Ln } V_t$	$\Delta \text{Ln } V_{t-1}$	$\Delta \text{Ln } V_{t-2}$	$\Delta \text{Ln } V_{t-3}$
657	Floor coverings, tapestries, etc.	0.15 (1.24)			
661	Lime, cement and fabricated building materials	0.17 (1.80)	-0.46 (4.64)		
662	Clay and refractory construction materials	0.24 (2.32)			
663	Mineral manufactures, n.e.s.	0.13 (1.94)	-0.34 (3.99)	-0.17 (2.41)	-0.21 (3.75)
664	Glass	0.11 (1.22)	0.31 (2.49)	0.42 (3.28)	0.48 (4.49)
665	Glassware	0.06 (1.23)			
667	Pearls and precious or semi-precious stones, unworked or worked	-0.07 (0.68)	0.38 (2.36)	0.52 (3.33)	0.18 (1.49)
673	Iron and steel bars, rods, angles, shapes and sections	-0.23 (1.61)			
674	Universals, plates and sheets of iron	0.01 (0.13)			
677	Iron and steel wire	-0.03 (0.20)	0.56 (3.91)		
678	Tubes, pipes and fittings of iron or steel	0.07 (0.65)			
681	Silver and platinum group metals	-0.51 (2.44)	-0.04 (0.15)	0.51 (2.57)	
682	Copper	-0.32 (2.49)	0.69 (4.27)	0.25 (1.83)	
683	Nickel	1.54 (10.67)	-2.34 (8.12)	-1.45 (6.81)	-0.69 (4.43)
684	Aluminium	0.14 (1.15)	0.71 (3.55)	0.47 (2.76)	0.46 (3.58)
689	Miscellaneous non-ferrous base metals in metallurgy, and cermets	-0.25 (1.92)	1.10 (5.16)	0.28 (1.71)	
691	Finished structural parts of iron, steel or aluminium	-0.24 (2.04)			
692	Metal containers for storage and transport	0.05 (0.78)	0.24 (2.42)	0.13 (1.55)	-0.14 (1.98)
693	Wire products (excluding insulated electrical wiring) and fencing grills	-0.57 (3.49)	2.47 (6.17)	1.33 (5.01)	0.55 (3.49)
694	Nails, screws, nuts, bolts, rivets of iron, steel, copper or aluminium	0.03 (0.41)	-0.33 (3.27)	-0.29 (3.12)	
695	Tools for use in the hand or in machines	0.14 (3.26)			
696	Cutlery	0.04 (0.38)	0.04 (0.32)	0.21 (2.24)	
697	Household equipment of base metals	-0.25 (2.56)			
698	Manufactures of base metal, n.e.s.	-0.01 (0.22)			
711	Power-generating machinery and parts thereof	-0.08 (1.08)	0.59 (4.38)	0.37 (3.15)	0.11 (1.44)
712	Agricultural machinery and parts thereof	-0.33 (3.83)			
714	Office machines	0.05 (1.09)			
715	Metalworking machinery	-0.52 (4.07)	0.96 (4.12)	0.40 (2.81)	
717	Textile and leather machinery	0.01 (0.11)			
718	Machines for special industries	-0.18 (2.95)	0.09 (1.45)		
719	Machinery and appliances, non-electrical	-0.06 (1.94)	0.20 (4.39)	0.09 (2.53)	0.06 (2.42)

Code	Industry Name	$\Delta \text{Ln } V_t$	$\Delta \text{Ln } V_{t-1}$	$\Delta \text{Ln } V_{t-2}$	$\Delta \text{Ln } V_{t-3}$
722	Electric power machinery and switch	-0.03 (0.63)			
723	Equipment for distributing electricity	-0.24 (2.39)	0.06 (0.31)	-0.23 (1.57)	-0.37 (3.27)
724	Telecommunications apparatus	0.04 (1.02)			
725	Domestic electrical equipment	-0.27 (4.15)	0.00 (0.01)	-0.12 (1.68)	
726	Electrical apparatus for medical purposes and radiological apparatus	0.08 (0.90)	0.51 (3.28)	0.44 (3.62)	0.17 (1.98)
729	Other electrical machinery and apparatus	0.15 (3.32)	0.23 (3.58)	0.19 (2.93)	0.22 (4.38)
731	Railway vehicles	-0.33 (1.72)	-0.66 (3.15)		
732	Road motor vehicles	0.07 (0.81)	0.41 (3.17)	0.28 (2.48)	0.18 (1.99)
733	Road vehicles other than motor vehicles	-0.20 (1.65)			
734	Aircraft	-0.12 (0.73)	0.65 (3.21)		
735	Ships and boats	0.23 (2.38)			
812	Sanitary, plumbing, heating and lighting fixtures and fittings	-0.01 (0.30)			
821	Furniture	-0.12 (1.02)	1.07 (3.67)	0.53 (2.90)	0.26 (2.39)
831	Travel goods, handbags and similar containers	-0.23 (1.50)	1.93 (5.72)	1.00 (3.94)	0.28 (1.63)
841	Clothing except fur clothing	0.11 (1.74)	-0.13 (1.83)		
861	Scientific, medical, optical, means/controlling instruments	-0.06 (1.34)	0.33 (4.55)	0.22 (3.79)	0.06 (1.76)
862	Photographic and cinematographic supplies	-0.02 (0.33)	-0.20 (3.44)		
863	Developed cinematographic film	-0.03 (0.16)	-1.69 (5.88)	-1.31 (5.07)	-0.57 (2.62)
864	Watches and clocks	0.57 (3.94)			
891	Musical instruments, sound recorders	-0.39 (2.98)	0.46 (2.58)	0.38 (2.74)	
892	Printed matter	-0.01 (0.34)			
893	Articles of artificial plastics	-0.19 (2.67)	0.06 (1.07)		
894	Perambulators, toys, games and sporting goods	-0.10 (1.59)			
895	Office and stationery supplies, n.e.s.	-0.07 (0.91)	-0.09 (0.86)	-0.09 (0.84)	-0.24 (2.68)
896	Works of art, collectors' pieces and antiques	0.22 (1.00)	1.16 (3.46)	1.00 (3.77)	
897	Jewellery, goldsmiths' and silversmiths' wares	-0.16 (1.71)	0.17 (1.14)	0.15 (1.13)	0.36 (3.61)
899	Miscellaneous manufactured articles, n.e.s.	-0.07 (1.55)			
931	Special transactions not classified according to kind	0.08 (2.05)			

Table 10: Long-Run Coefficient Estimates, U.S. Export Models

Code	Industry Name	Constant	Dummy	Ln Y _{TH}	Ln REX	Ln V
001	Live animals	-3.46 (1.37)	-0.58 (1.77)	0.97 (4.36)	0.81 (1.19)	0.05 (0.45)
011	Meat, fresh, chilled or frozen	-3.92 (0.93)	-0.36 (0.63)	1.37 (3.39)	-0.14 (0.11)	-0.04 (0.17)
022	Milk and cream and milk products other than butter or cheese	-20.71 (3.69)	2.04 (2.81)	2.30 (4.71)	3.37 (2.20)	-0.58 (2.10)
041	Wheat (including spelt) and meslin, unmilled	3.09 (2.08)	0.73 (3.69)	0.77 (5.39)	-0.32 (0.73)	0.03 (0.34)
044	Maize (not including sweet corn), unmilled	42.51 (0.55)	12.39 (0.72)	-3.57 (0.50)	-9.61 (0.55)	0.36 (0.33)
048	Cereal preparations; preparations of flour or starch of fruits or veg	-12.44 (0.91)	0.86 (0.50)	2.35 (2.04)	0.97 (0.27)	-0.49 (0.76)
051	Fruit, fresh, and nuts - excluding oil	-30.50 (7.14)	-2.11 (3.31)	3.14 (11.10)	6.16 (4.37)	-0.27 (0.95)
052	Dried fruit	-55.37 (0.64)	5.66 (1.07)	-2.74 (0.63)	19.78 (0.65)	-9.52 (0.74)
053	Fruit, preserved and preparation	-0.09 (0.03)	1.51 (4.06)	0.03 (0.10)	0.86 (1.01)	-0.04 (0.26)
054	Vegetables, roots & tubers, fresh	-6.56 (0.65)	1.66 (1.25)	2.70 (2.89)	-1.33 (0.49)	0.19 (0.41)
055	Vegetables, roots & tubers, preserved or prepared	-63.59 (3.46)	5.24 (2.23)	1.59 (2.03)	15.14 (2.88)	-7.71 (2.83)
061	Sugar and honey	20.46 (2.54)	7.12 (4.98)	-1.92 (2.81)	-3.61 (1.54)	-1.98 (1.69)
062	Sugar confectionery, sugar preps. - excluding chocolate	-79.09 (2.23)	-3.88 (1.05)	2.30 (1.51)	20.96 (2.01)	-6.26 (1.81)
071	Coffee	2.62 (0.90)	-0.27 (0.66)	0.74 (2.54)	-1.29 (1.41)	-0.20 (1.29)
073	Chocolate & preparations	-25.31 (4.03)	-0.10 (0.11)	1.23 (2.01)	6.31 (3.00)	-0.69 (1.17)
075	Spices	-13.52 (3.49)	0.12 (0.23)	2.12 (6.29)	1.23 (1.16)	0.07 (0.38)
081	Feeds for animals excluding unmilled	-18.92 (1.54)	-0.74 (0.40)	2.27 (2.44)	4.28 (1.23)	-0.68 (0.69)
091	Margarine lard & shortening	5.48 (0.85)	2.65 (2.91)	0.07 (0.12)	-2.13 (1.00)	0.08 (0.26)
099	Food preparations, n.e.s.	1.97 (0.30)	2.70 (2.18)	0.63 (1.23)	-0.46 (0.25)	-1.28 (1.36)
112	Alcoholic beverages	-8.20 (3.17)	0.43 (0.98)	2.50 (11.29)	-0.49 (0.58)	-0.06 (0.22)
121	Tobacco, unmanufactured; Tobacco refuse	2.44 (0.22)	0.91 (0.33)	0.88 (0.53)	-1.35 (0.30)	-2.48 (0.95)
122	Tobacco manufactures	-35.75 (1.92)	-5.49 (2.45)	4.25 (2.81)	5.24 (1.13)	-0.99 (0.95)
231	Crude rubber including synthetic and reclaimed	2.36 (0.31)	2.28 (2.16)	1.91 (3.34)	-2.43 (0.91)	0.43 (0.98)
251	Pulp & waste paper	-0.96 (0.31)	-0.19 (0.34)	1.40 (3.83)	0.09 (0.12)	0.30 (1.24)
263	Cotton	9.67 (5.12)	0.52 (1.99)	0.06 (0.28)	-0.92 (1.64)	0.18 (1.65)
266	Synthetic and regenerated fibers	-2.67 (0.91)	-0.54 (1.19)	0.87 (3.69)	0.69 (0.75)	-0.06 (0.50)
273	Stone, sand and gravel	-24.10 (4.72)	-2.17 (3.22)	2.01 (4.39)	5.10 (3.71)	0.28 (1.16)
275	Natural abrasives-incl. industrial diamonds	-15.41 (4.59)	-0.90 (1.92)	1.16 (3.31)	3.78 (3.52)	0.30 (1.60)
276	Other crude minerals	0.23 (0.09)	-0.18 (0.62)	1.67 (12.32)	-1.21 (1.59)	0.68 (2.27)

Code	Industry Name	Constant	Dummy	Ln Y _{TH}	Ln REX	Ln V
282	Iron and steel scrap	11.90 (4.61)	2.16 (6.02)	0.09 (0.33)	-2.29 (2.90)	0.11 (0.76)
284	Non-ferrous metal scrap	-30.73 (1.66)	0.38 (0.27)	-0.11 (0.10)	10.01 (1.55)	-1.68 (1.34)
292	Crude vegetable materials, n.e.s.	-6.79 (2.57)	0.84 (2.43)	0.50 (2.15)	2.14 (2.95)	-0.09 (0.72)
332	Petroleum products	6.29 (1.31)	-0.13 (0.24)	0.74 (1.99)	-1.19 (0.83)	0.51 (1.44)
411	Animal oils and fats	12.51 (3.79)	2.57 (5.55)	-0.47 (1.67)	-3.31 (3.80)	0.03 (0.10)
431	Animal/Vegetable oils and fats, processed	-15.81 (3.43)	-0.72 (0.93)	2.17 (4.80)	2.24 (1.68)	0.15 (0.61)
512	Organic chemicals	-3.62 (1.86)	0.31 (1.42)	1.40 (12.61)	1.01 (1.64)	-0.42 (1.72)
513	Inorganic chemicals elements, oxides	-4.83 (2.47)	0.44 (1.53)	1.45 (8.36)	0.47 (0.69)	-0.03 (0.32)
514	Other inorganic chemicals	-7.51 (4.42)	-0.17 (0.72)	1.85 (11.77)	1.21 (2.28)	-0.10 (1.24)
515	Radioactive and associated materials	-5.92 (1.85)	1.47 (3.24)	1.86 (5.81)	-0.75 (0.74)	-0.38 (2.25)
531	Synthetic organic dyestuffs, natural	-5.42 (1.74)	0.22 (0.54)	1.08 (3.96)	0.97 (1.15)	-0.21 (1.22)
533	Pigments, paints, varnishes & related materials	0.29 (0.21)	0.87 (4.52)	1.32 (12.86)	-0.69 (1.78)	-0.03 (0.19)
541	Medicinal & pharmaceutical products	1.31 (1.00)	0.53 (2.59)	0.94 (8.00)	-0.06 (0.17)	0.18 (1.22)
551	Essential oils, perfume and flavour materials	5.19 (1.96)	1.54 (4.87)	1.13 (6.55)	-2.09 (2.40)	0.63 (2.13)
553	Perfumery, cosmetics, dentifrices	-26.21 (3.65)	0.35 (0.60)	2.41 (7.10)	5.37 (2.71)	-0.80 (1.98)
554	Soaps, cleansing and polishing preparations	-25.23 (1.68)	0.97 (1.10)	1.75 (3.28)	5.79 (1.52)	-2.05 (1.41)
571	Explosives and pyrotechnic products	6.07 (1.29)	0.71 (1.12)	1.36 (3.31)	-2.62 (2.03)	0.04 (0.17)
581	Plastic materials, regenerated cellulose	5.80 (1.66)	1.06 (2.15)	0.84 (3.20)	-1.01 (0.99)	-0.14 (0.45)
599	Chemical materials and products, n.e.s.	4.17 (2.67)	0.20 (0.70)	1.26 (8.91)	-1.05 (2.07)	0.30 (1.39)
612	Manufacturer of leather or of artificial leather	-120.37 (2.59)	0.63 (0.17)	5.09 (2.57)	26.29 (2.36)	-11.67 (1.80)
621	Materials of rubber (e.g., Pastes, Plates, Sheets, Rods, Thread, Tubes)	-13.04 (3.14)	0.93 (2.09)	0.37 (1.60)	3.98 (3.07)	-1.59 (3.41)
629	Articles of rubber, n.e.s.	3.35 (2.17)	1.51 (7.51)	0.77 (5.65)	-1.23 (2.94)	-0.26 (3.63)
632	Wood manufactures, n.e.s.	-21.78 (2.41)	1.58 (0.84)	2.71 (4.73)	2.75 (0.93)	-1.92 (1.90)
641	Paper and paperboard	-23.31 (2.81)	-0.54 (0.66)	2.54 (4.30)	4.59 (2.22)	-0.90 (1.94)
642	Articles of paper, pulp, or paperboard	-37.86 (1.64)	-4.09 (1.42)	1.01 (1.09)	11.85 (1.73)	-2.45 (1.60)
651	Textile yarn and thread	1.36 (0.04)	4.45 (0.58)	3.85 (0.99)	-6.47 (0.37)	0.85 (0.43)
652	Cotton fabrics, woven excluding narrow or special fabrics	-79.80 (1.89)	5.18 (1.18)	3.79 (1.27)	16.23 (1.51)	-11.19 (2.05)
653	Textile fabrics, woven excluding narrow or special fabrics	-7.97 (4.45)	-0.40 (1.62)	1.65 (9.55)	1.22 (2.56)	0.13 (1.33)
654	Tulle, lace, embroidery, ribbons	-74.95 (0.52)	2.87 (0.27)	-0.40 (0.06)	20.75 (0.47)	-10.47 (0.40)
655	Special textile fabrics and related products	-24.57 (2.11)	2.16 (2.22)	1.84 (3.78)	5.22 (1.68)	-2.28 (1.54)
656	Made-up articles, wholly or chiefly of textile materials	-0.50 (0.09)	1.20 (2.12)	0.07 (0.19)	0.48 (0.34)	-0.35 (1.51)

Code	Industry Name	Constant	Dummy	Ln Y _{TH}	Ln REX	Ln V
657	Floor coverings, tapestries, etc.	-36.09 (2.27)	-3.25 (1.76)	3.83 (3.01)	5.80 (1.46)	-0.43 (0.39)
661	Lime, cement and fabricated building materials	-7.72 (2.71)	-1.33 (1.72)	1.14 (4.29)	1.37 (1.50)	1.29 (2.28)
662	Clay and refractory construction materials	-4.51 (0.51)	0.10 (0.08)	1.68 (2.06)	-0.40 (0.14)	0.36 (0.81)
663	Mineral manufactures, n.e.s.	-1.75 (0.81)	-0.18 (0.48)	1.56 (8.11)	-0.50 (0.81)	0.46 (1.48)
664	Glass	-15.23 (4.50)	-0.52 (0.76)	1.02 (3.24)	4.35 (4.43)	-0.34 (0.60)
665	Glassware	40.77 (0.38)	8.68 (0.41)	-1.97 (0.29)	-9.20 (0.38)	-1.46 (0.35)
667	Pearls and precious or semi-precious stones, unworked or worked	-59.87 (1.24)	-11.13(1.00)	14.47 (1.18)	-0.67 (0.07)	5.09 (0.75)
673	Iron and steel bars, rods, angles, shapes and sections	-25.96 (5.07)	-2.69 (4.01)	3.30 (7.67)	3.92 (2.43)	0.09 (0.37)
674	Universals, plates and sheets of iron	18.97 (6.29)	1.78 (4.46)	-0.90 (2.88)	-3.34 (3.86)	-0.11 (0.65)
677	Iron and steel wire	1.15 (0.15)	2.80 (3.27)	0.06 (0.14)	-0.62 (0.25)	-0.83 (1.00)
678	Tubes, pipes and fittings of iron or steel	-0.83 (0.21)	0.25 (0.46)	1.46 (4.00)	-0.65 (0.59)	0.08 (0.39)
681	Silver and platinum group metals	-36.22 (4.55)	1.28 (1.09)	3.84 (5.83)	5.18 (2.34)	-1.04 (1.21)
682	Copper	-75.87 (1.65)	-1.51 (0.59)	2.02 (1.24)	19.91 (1.39)	-5.22 (1.43)
683	Nickel	-0.17 (0.12)	0.16 (0.75)	2.47 (25.99)	-2.85 (6.49)	1.45 (8.36)
684	Aluminium	-14.29 (1.59)	-0.09 (0.07)	0.72 (1.34)	4.57 (1.63)	-1.26 (1.00)
689	Miscellaneous non-ferrous base metals in metallurgy, and cermets	-30.30 (1.82)	1.32 (0.52)	0.45 (0.26)	8.74 (1.34)	-4.47 (0.93)
691	Finished structural parts of iron, steel or aluminium	-29.82 (2.54)	-3.19 (2.30)	2.07 (3.63)	7.36 (2.05)	-1.22 (1.68)
692	Metal containers for storage and transport	-16.45 (6.97)	-1.27 (3.62)	2.63 (13.23)	2.16 (2.85)	-0.44 (1.54)
693	Wire products (excluding insulated electrical wiring) and fencing grills	-40.49 (2.98)	2.27 (2.14)	-0.40 (0.83)	12.39 (3.05)	-6.28 (3.63)
694	Nails, screws, nuts, bolts, rivets of iron, steel, copper or aluminium	-16.76 (2.20)	-1.39 (0.83)	2.26 (3.24)	2.93 (1.35)	0.84 (0.71)
695	Tools for use in the hand or in machines	2.15 (1.04)	0.59 (2.20)	1.00 (5.18)	-0.85 (1.49)	0.11 (1.10)
696	Cutlery	-10.09 (1.80)	-0.44 (0.51)	1.62 (3.36)	1.10 (0.70)	-0.18 (0.28)
697	Household equipment of base metals	-12.53 (1.56)	0.04 (0.04)	-0.46 (0.62)	4.84 (1.96)	-1.43 (1.48)
698	Manufactures of base metal, n.e.s.	-21.62 (1.15)	-1.59 (0.84)	4.20 (2.24)	1.79 (0.45)	-1.22 (0.88)
711	Power-generating machinery and parts thereof	-5.88 (1.97)	1.28 (2.14)	1.13 (4.16)	1.56 (1.79)	-1.19 (2.66)
712	Agricultural machinery and parts thereof	2.52 (0.40)	2.57 (3.13)	0.75 (1.56)	-1.07 (0.65)	-1.81 (2.80)
714	Office machines	-21.67 (1.77)	-3.77 (0.83)	2.18 (1.73)	6.09 (1.57)	0.66 (0.73)
715	Metalworking machinery	-49.92 (2.07)	0.48 (0.35)	1.65 (2.28)	13.36 (1.95)	-5.83 (1.97)
717	Textile and leather machinery	-7.18 (0.93)	-0.86 (0.73)	1.14 (1.51)	1.78 (0.71)	0.05 (0.13)
718	Machines for special industries	-3.28 (0.70)	0.77 (1.05)	1.26 (3.33)	0.74 (0.57)	-1.04 (1.63)
719	Machinery and appliances, non-electrical	-113.97 (0.22)	9.98 (0.23)	9.97 (0.26)	16.20 (0.23)	-18.68 (0.22)

Code	Industry Name	Constant	Dummy	Ln Y _{TH}	Ln REX	Ln V
722	Electric power machinery and switch	-17.49 (2.29)	-0.23 (0.30)	1.81 (3.81)	4.33 (2.10)	-0.58 (1.14)
723	Equipment for distributing electricity	-30.57 (1.76)	-0.70 (0.42)	3.98 (3.31)	4.69 (0.76)	-1.95 (1.07)
724	Telecommunications apparatus	-13.22 (3.05)	-1.27 (2.48)	1.89 (5.54)	3.24 (2.76)	-0.32 (0.85)
725	Domestic electrical equipment	-27.27 (1.18)	1.29 (0.49)	2.21 (1.37)	5.11 (0.87)	-4.30 (1.13)
726	Electrical apparatus for medical purposes and radiological apparatus	-7.50 (0.58)	1.51 (0.87)	1.19 (1.82)	1.53 (0.38)	-1.58 (0.63)
729	Other electrical machinery and apparatus	-3.99 (0.83)	0.53 (0.70)	1.63 (4.47)	1.18 (0.86)	-0.47 (0.89)
731	Railway vehicles	2.64 (0.74)	1.38 (2.16)	0.74 (2.21)	-1.30 (1.24)	0.45 (0.99)
732	Road motor vehicles	5.24 (0.89)	2.14 (1.61)	1.11 (1.86)	-1.78 (0.97)	-1.84 (1.47)
733	Road vehicles other than motor vehicles	1.53 (0.33)	2.26 (3.61)	1.12 (2.64)	-1.65 (1.32)	-0.41 (1.50)
734	Aircraft	-27.62 (3.61)	-1.82 (1.58)	1.03 (1.55)	9.13 (4.00)	-2.40 (2.28)
735	Ships and boats	0.36 (0.18)	-0.07 (0.20)	2.01 (12.43)	-2.26 (3.43)	0.14 (1.47)
812	Sanitary, plumbing, heating and lighting fixtures and fittings	0.01 (0.01)	0.04 (0.16)	0.74 (3.88)	-0.07 (0.14)	-0.05 (0.49)
821	Furniture	52.96 (0.49)	-2.79 (0.50)	2.24 (1.62)	-16.12 (0.54)	10.54 (0.59)
831	Travel goods, handbags and similar containers	-61.12 (3.37)	2.14 (1.57)	1.93 (3.11)	14.60 (2.82)	-4.87 (2.64)
841	Clothing except fur clothing	-19.06 (2.73)	-3.01 (2.03)	2.32 (3.44)	3.73 (2.13)	0.98 (1.41)
861	Scientific, medical, optical, means/controlling instruments	18.23 (0.70)	0.12 (0.08)	0.00 (0.00)	-2.96 (0.62)	2.33 (0.89)
862	Photographic and cinematographic supplies	17.50 (2.94)	1.68 (1.78)	-0.41 (0.78)	-3.54 (2.14)	0.17 (0.22)
863	Developed cinematographic film	25.33 (10.36)	0.06 (0.13)	-0.23 (0.96)	-6.61 (9.27)	0.93 (2.18)
864	Watches and clocks	-9.34 (1.78)	-1.48 (2.20)	2.10 (4.41)	0.39 (0.27)	0.70 (1.87)
891	Musical instruments, sound recorders	-72.47 (1.68)	-2.20 (0.59)	8.95 (1.67)	8.82 (1.38)	-7.06 (1.22)
892	Printed matter	-11.90 (1.74)	-0.93 (0.66)	2.48 (3.32)	1.54 (0.92)	0.07 (0.24)
893	Articles of artificial plastics	-13.14 (2.56)	1.88 (2.16)	1.90 (4.94)	2.02 (1.44)	-1.45 (1.73)
894	Perambulators, toys, games and sporting goods	1.70 (0.27)	1.30 (1.70)	1.07 (1.80)	-0.88 (0.51)	-0.35 (1.04)
895	Office and stationery supplies, n.e.s.	-2.83 (0.34)	-1.08 (0.57)	1.44 (1.30)	-0.08 (0.03)	0.18 (0.13)
896	Works of art, collectors' pieces and antiques	-21.88 (4.91)	-0.81 (1.65)	2.40 (9.69)	3.27 (2.34)	-0.41 (0.76)
897	Jewellery, goldsmiths' and silversmiths' wares	-33.40 (8.17)	-0.83 (1.30)	3.05 (7.75)	6.66 (4.86)	-0.51 (0.93)
899	Miscellaneous manufactured articles, n.e.s.	0.40 (0.17)	1.48 (5.10)	0.92 (4.70)	-0.46 (0.73)	-0.27 (2.43)
931	Special transactions not classified according to kind	-15.47 (2.85)	-0.85 (0.92)	3.26 (5.23)	2.02 (1.12)	0.28 (0.93)

Note: The number inside the parenthesis next to an estimated coefficient is the absolute value of the t-ratio. In this paper, the critical values at 5% and 10% significance level are 1.96 and 1.64, respectively.

Table 11: Long-Run Coefficient Estimates, Significant U.S. Exports

Panel A: Negatively affected by Exchange Rate Volatility

Code	Industry Name	Trade Share	Share Rank	Durability	Capital	Intermediate	Consumption
512	Organic chemicals	3.67	6	Non-durable		<input type="checkbox"/>	
711	Power-generating machinery and parts thereof	1.94	10	Durable	<input type="checkbox"/>	<input type="checkbox"/>	
734	Aircraft	0.78	25	Durable	<input type="checkbox"/>		
715	Metalworking machinery	0.68	26	Durable	<input type="checkbox"/>		
641	Paper and paperboard	0.62	29	Durable		<input type="checkbox"/>	
712	Agricultural machinery and parts thereof	0.62	30	Durable	<input type="checkbox"/>	<input type="checkbox"/>	
553	Perfumery, cosmetics, dentifrices	0.57	32	Non-durable			<input type="checkbox"/>
893	Articles of artificial plastics	0.54	34	Durable		<input type="checkbox"/>	<input type="checkbox"/>
022	Milk and cream and milk products other than butter or cheese	0.36	43	Non-durable		<input type="checkbox"/>	<input type="checkbox"/>
899	Miscellaneous manufactured articles, n.e.s.	0.35	44	Durable		<input type="checkbox"/>	<input type="checkbox"/>
061	Sugar and honey	0.32	46	Non-durable		<input type="checkbox"/>	<input type="checkbox"/>
629	Articles of rubber, n.e.s.	0.29	48	Durable		<input type="checkbox"/>	<input type="checkbox"/>
621	Materials of rubber (e.g., Pastes, Plates, Sheets, Rods, Thread, Tubes)	0.12	69	Durable		<input type="checkbox"/>	
632	Wood manufactures, n.e.s.	0.10	73	Durable		<input type="checkbox"/>	<input type="checkbox"/>
055	Vegetables, roots & tubers, preserved or prepared	0.06	83	Non-durable		<input type="checkbox"/>	
691	Finished structural parts of iron, steel or aluminium	0.06	85	Durable		<input type="checkbox"/>	
515	Radioactive and associated materials	0.05	90	Non-durable		<input type="checkbox"/>	
831	Travel goods, handbags and similar containers	0.02	98	Durable			<input type="checkbox"/>
693	Wire products (excluding insulated electrical wiring) and fencing grills	0.02	99	Durable		<input type="checkbox"/>	
652	Cotton fabrics, woven excluding narrow or special fabrics	0.02	101	Durable		<input type="checkbox"/>	
062	Sugar confectionery, sugar preps. - excluding chocolate	0.01	109	Non-durable			<input type="checkbox"/>
612	Manufacturer of leather or of artificial leather	0.01	114	Durable		<input type="checkbox"/>	<input type="checkbox"/>

Panel B: Positively affected by Exchange Rate Volatility

Code	Industry Name	Trade Share	Share Rank	Durability	Capital	Intermediate	Consumption
263	Cotton	1.87	12	Non-durable		<input type="checkbox"/>	
551	Essential oils, perfume and flavour materials	0.65	27	Non-durable		<input type="checkbox"/>	
276	Other crude minerals	0.24	52	Non-durable		<input type="checkbox"/>	
683	Nickel	0.05	89	Durable		<input type="checkbox"/>	
661	Lime, cement and fabricated building materials	0.01	104	Durable		<input type="checkbox"/>	
864	Watches and clocks	0.01	113	Durable			<input type="checkbox"/>
863	Developed cinematographic film	0.005	117	Durable		<input type="checkbox"/>	<input type="checkbox"/>

Notes: 1. Categorization of goods/industries is based on SITC, Rev.3 basic headings in terms of BEC, "*Classification By Broad Economic Categories*", Statistics Division, Department of Economic and Social Affairs, United Nations.

2. When investigating into finer sub-groups of SITC, i.e. 4-digit SITC or 5-digit SITC, it is possible that some basic headings from the same 3-digit group can be in different BEC categories. For example, *022.1-Milk and cream, not concentrated or sweetened*, when traded internationally, are mainly for household consumption. However, *022.4-Whey; products consisting of natural milk constituents*, when traded internationally, are mainly used by industry (intermediate goods).

Table 12: Diagnostic Statistics for U.S. Export Demand

Code	Industry Name	LM	RESET	Normality	CUSUM	CUSUMSQ	Adj. R ²
001	Live animals	0.19	0.01	253.75	S	U	0.34
011	Meat, fresh, chilled or frozen	0.70	2.52	281.93	S	U	0.42
022	Milk and cream and milk products other than butter or cheese	0.83	1.63	1.34	S	S	0.27
041	Wheat (including spelt) and meslin, unmilled	2.35	4.16	0.46	S	S	0.53
044	Maize (not including sweet corn), unmilled	3.45	1.41	0.80	S	S	0.41
048	Cereal preparations and preparations of flour or starch of fruits or vegetables	0.57	5.04	2.33	S	S	0.09
051	Fruit, fresh, and nuts - excluding oil	0.65	1.38	1.46	S	S	0.59
052	Dried fruit	0.09	10.06	14.17	S	S	0.73
053	Fruit, preserved and preparation	0.03	2.38	8.57	S	S	0.25
054	Vegetables, roots & tubers, fresh	0.27	0.68	0.02	S	S	0.26
055	Vegetables, roots & tubers, preserved or prepared	1.53	0.89	8.87	S	S	0.70
061	Sugar and honey	0.01	0.32	3.48	S	S	0.41
062	Sugar confectionery, sugar preps. - excluding chocolate	0.00	3.41	1.83	S	S	0.54
071	Coffee	0.12	1.75	3.46	S	S	0.49
073	Chocolate & preparations	1.28	5.24	0.75	S	S	0.61
075	Spices	1.09	0.35	23.70	S	S	0.28
081	Feeds for animals excluding unmilled	0.47	0.08	2.60	S	S	0.65
091	Margarine lard & shortening	1.85	0.29	7.63	S	S	0.33
099	Food preparations, n.e.s.	0.57	0.74	63.75	S	S	0.37
112	Alcoholic beverages	0.37	0.33	0.08	S	S	0.71
121	Tobacco, unmanufactured; Tobacco refuse	3.44	0.19	0.50	S	S	0.57
122	Tobacco manufactures	0.12	1.84	0.40	S	S	0.40
231	Crude rubber including synthetic and reclaimed	0.10	0.11	1.83	S	S	0.65
251	Pulp & waste paper	0.21	0.37	1.72	S	S	0.42
263	Cotton	0.03	1.32	2.75	S	S	0.57
266	Synthetic and regenerated fibers	0.51	0.07	0.01	S	S	0.60
273	Stone, sand and gravel	0.65	9.54	29.62	S	S	0.30
275	Natural abrasives-incl.industrial diamonds	0.54	3.36	1.58	S	S	0.33

Code	Industry Name	LM	RESET	Normality	CUSUM	CUSUMSQ	Adj. R ²
276	Other crude minerals	2.01	8.64	0.15	S	S	0.73
282	Iron and steel scrap	1.23	0.52	0.37	S	S	0.71
284	Non-ferrous metal scrap	1.64	0.03	1.22	S	S	0.53
292	Crude vegetable materials, n.e.s.	0.08	8.19	2.59	S	S	0.34
332	Petroleum products	0.34	0.00	0.87	S	S	0.34
411	Animal oils and fats	0.03	0.57	0.10	S	S	0.37
431	Animal/Vegetable oils and fats, processed	0.13	0.14	10.63	S	S	0.34
512	Organic chemicals	6.11	0.61	0.99	S	S	0.80
513	Inorganic chemicals elements, oxides	1.45	0.68	17.91	S	S	0.55
514	Other inorganic chemicals	1.42	2.82	0.28	S	S	0.49
515	Radioactive and associated materials	0.25	4.38	21.16	S	S	0.63
531	Synthetic organic dyestuffs, natural	1.36	2.78	1.16	S	S	0.27
533	Pigments, paints, varnishes & related materials	3.57	2.27	0.66	S	S	0.56
541	Medicinal & pharmaceutical products	4.50	0.01	0.49	S	S	0.37
551	Essential oils, perfume and flavour materials	4.60	3.33	0.81	S	S	0.48
553	Perfumery, cosmetics, dentifrices	1.89	0.37	0.40	S	S	0.38
554	Soaps, cleansing and polishing preparations	0.32	0.00	2.48	S	S	0.54
571	Explosives and pyrotechnic products	0.85	0.01	6.86	S	S	0.38
581	Plastic materials, regenerated cellulose	4.93	0.84	3.71	S	S	0.69
599	Chemical materials and products, n.e.s.	0.20	7.17	1.55	S	S	0.66
612	Manufacturer of leather or of artificial leather	0.00	0.00	0.69	S	S	0.82
621	Materials of rubber (e.g., Pastes, Plates, Sheets, Rods, Thread, Tubes)	0.65	1.87	1.26	S	S	0.57
629	Articles of rubber, n.e.s.	0.26	0.10	1.46	S	S	0.37
632	Wood manufactures, n.e.s.	0.14	5.90	0.13	S	S	0.68
641	Paper and paperboard	0.15	0.52	3.09	S	S	0.41
642	Articles of paper, pulp, or paperboard	0.04	1.33	0.94	S	S	0.48
651	Textile yarn and thread	0.06	0.27	0.36	S	S	0.70
652	Cotton fabrics, woven excluding narrow or special fabrics	3.11	1.23	3.19	S	S	0.71
653	Textile fabrics, woven excluding narrow or special fabrics	0.64	0.96	11.27	S	S	0.33
654	Tulle, lace, embroidery, ribbons	1.21	0.00	1.83	S	S	0.47

Code	Industry Name	LM	RESET	Normality	CUSUM	CUSUMSQ	Adj. R ²
655	Special textile fabrics and related products	0.04	0.44	1.77	S	S	0.53
656	Made-up articles, wholly or chiefly of textile materials	0.31	0.15	0.07	S	S	0.33
657	Floor coverings, tapestries, etc.	0.13	2.79	3.27	S	S	0.38
661	Lime, cement and fabricated building materials, except glass, clay materials	4.29	2.06	0.10	S	S	0.68
662	Clay and refractory construction materials	0.93	1.82	0.89	S	S	0.48
663	Mineral manufactures, n.e.s.	0.16	1.84	14.59	S	S	0.57
664	Glass	0.88	3.12	0.55	S	S	0.76
665	Glassware	0.73	1.56	14.22	S	S	0.42
667	Pearls and precious or semi-precious stones, unworked or worked	0.18	0.06	3.36	S	S	0.49
673	Iron and steel bars, rods, angles, shapes and sections (including sheet piling)	5.56	3.68	0.70	S	S	0.51
674	Universals, plates and sheets of iron	0.30	0.24	1.70	S	S	0.51
677	Iron and steel wire	0.27	1.66	1.10	S	S	0.72
678	Tubes, pipes and fittings of iron or steel	0.03	0.26	112.88	S	S	0.42
681	Silver and platinum group metals	0.67	2.72	2.25	S	S	0.50
682	Copper	2.94	0.42	0.40	S	S	0.58
683	Nickel	0.22	0.36	1.59	S	S	0.87
684	Aluminium	3.62	0.26	0.34	S	S	0.50
689	Miscellaneous non-ferrous base metals employed in metallurgy, and cermets	0.33	0.95	0.53	S	S	0.64
691	Finished structural parts of iron, steel or aluminium	1.61	4.44	4.61	S	S	0.59
692	Metal containers for storage and transport	0.14	2.00	0.32	S	S	0.75
693	Wire products (excluding insulated electrical wiring) and fencing grills	0.80	1.06	0.53	S	S	0.68
694	Nails, screws, nuts, bolts, rivets and the like, of iron, steel, copper, aluminium	0.13	0.71	1.51	S	S	0.36
695	Tools for use in the hand or in machines	2.12	0.74	1.72	S	S	0.42
696	Cutlery	0.05	1.17	0.34	S	S	0.37
697	Household equipment of base metals	2.67	1.99	23.79	S	S	0.44
698	Manufactures of base metal, n.e.s.	0.40	0.02	42.50	S	S	0.37
711	Power-generating machinery and parts thereof	0.00	0.32	0.35	S	S	0.49
712	Agricultural machinery and parts thereof	1.11	0.89	2.80	S	S	0.49
714	Office machines	1.12	4.91	1.69	S	S	0.44
715	Metalworking machinery	0.18	2.73	1.28	S	S	0.66

Code	Industry Name	LM	RESET	Normality	CUSUM	CUSUMSQ	Adj. R ²
717	Textile and leather machinery	0.07	6.18	1.13	S	S	0.48
718	Machines for special industries	0.56	1.04	1.64	S	S	0.40
719	Machinery and appliances, non-electrical	0.00	0.83	1.53	S	S	0.75
722	Electric power machinery and switch	1.17	0.01	3.28	S	S	0.18
723	Equipment for distributing electricity	1.41	4.68	1.81	S	S	0.59
724	Telecommunications apparatus	0.10	0.35	0.73	S	S	0.50
725	Domestic electrical equipment	0.83	2.73	0.38	S	S	0.67
726	Electrical apparatus for medical purposes and radiological apparatus	1.26	5.14	0.31	S	S	0.61
729	Other electrical machinery and apparatus	1.29	0.09	0.40	S	S	0.66
731	Railway vehicles	0.56	0.02	0.83	S	S	0.62
732	Road motor vehicles	1.49	0.31	0.93	S	S	0.64
733	Road vehicles other than motor vehicles	1.04	1.76	1.02	S	S	0.51
734	Aircraft	0.74	0.17	1.29	S	S	0.57
735	Ships and boats	1.48	0.01	0.08	S	S	0.75
812	Sanitary, plumbing, heating and lighting fixtures and fittings	0.36	1.11	1.44	S	S	0.42
821	Furniture	3.31	7.04	0.13	S	S	0.54
831	Travel goods, handbags and similar containers	3.17	0.34	1.10	S	S	0.74
841	Clothing except fur clothing	0.03	0.00	1.25	S	S	0.49
861	Scientific, medical, optical, means/controlling instruments and apparatus	1.20	1.08	0.46	S	S	0.55
862	Photographic and cinematographic supplies	0.24	0.79	0.29	S	S	0.53
863	Developed cinematographic film	1.53	0.66	1.04	S	S	0.80
864	Watches and clocks	1.51	0.08	3.21	S	U	0.49
891	Musical instruments, sound recorders	0.33	10.97	2.81	S	S	0.57
892	Printed matter	0.00	0.74	1.34	S	S	0.35
893	Articles of artificial plastics	0.05	0.28	0.96	S	S	0.47
894	Perambulators, toys, games and sporting goods	0.01	4.52	0.91	S	S	0.32
895	Office and stationery supplies, n.e.s.	0.01	2.39	1.42	S	S	0.49
896	Works of art, collectors' pieces and antiques	2.67	2.38	1.18	S	S	0.79
897	Jewellery, goldsmiths' and silversmiths' wares	0.33	1.89	0.34	S	S	0.57
899	Miscellaneous manufactured articles, n.e.s.	2.98	0.14	0.92	S	S	0.23
931	Special transactions not classified according to kind	1.09	0.25	1.91	S	S	0.49

Notes: 1. LM is the Lagrange multiplier test of residual serial correlation, distributed as a Chi-squared distribution with one degree of freedom.
2. RESET is Ramsey's test for functional form, distributed as a Chi-squared distribution with one degree of freedom.
3. Normality is the Jarque-Bera test for residual normality, and has an asymptotic Chi-squared distribution with two degrees of freedom.
4. CUSUM and CUSUMSQ are stability tests of the short-run and long-run coefficients. Stable coefficients are indicated by an "S", whereas unstable coefficients are indicated by a "U".

Table 13: Short-Run Coefficient Estimates of Exchange Rate Volatility, U.S. Imports

Code	Industry Name	$\Delta \text{Ln } V_t$	$\Delta \text{Ln } V_{t-1}$	$\Delta \text{Ln } V_{t-2}$	$\Delta \text{Ln } V_{t-3}$
031	Fish, fresh and simply preserved	-0.03 (0.62)			
032	Fish, in airtight containers, n.e.s.	-0.01 (0.21)			
053	Fruit, preserved and fruit preparations	-0.04 (1.92)	0.19 (5.65)	0.16 (6.08)	
054	Vegetables, roots and tubers, fresh or dried	0.39 (2.78)	-0.84 (3.94)	-0.62 (3.48)	-0.44 (2.90)
055	Vegetables, roots and tubers, prepared or preserved	0.09 (0.74)	-0.23 (1.66)		
075	Spices	-0.01 (0.29)	0.11 (1.98)	0.07 (1.55)	
099	Food preparations, n.e.s.	-0.03 (1.08)			
121	Tobacco, unmanufactured; Tobacco refuse	-0.04 (0.36)			
211	Hides and skins, (except furskins), raw	0.08 (1.13)			
231	Crude rubber including synthetic and reclaimed	-0.07 (1.41)	0.13 (2.71)		
243	Wood, shaped or simply worked	-0.26 (2.05)			
291	Crude animal materials, n.e.s.	-0.11 (1.04)			
292	Crude vegetable materials, n.e.s.	-0.08 (2.71)			
599	Chemical materials and products, n.e.s.	-0.04 (0.19)	0.99 (3.40)	0.47 (1.81)	
611	Leather	0.26 (3.07)			
631	Veneers, plywood, particle boards and other wood, worked	-0.04 (0.62)	-0.19 (2.62)	-0.11 (1.64)	
632	Wood manufactures, n.e.s.	-0.09 (3.87)			
642	Articles of paper, pulp, or paperboard	-0.10 (1.53)			
651	Textile yarn and thread	0.12 (2.59)			
652	Cotton fabrics, woven excluding narrow or special fabrics	-0.03 (0.66)			
653	Textile fabrics, woven excluding narrow or special fabrics	-0.15 (2.05)	0.14 (1.90)	0.16 (2.44)	
656	Made-up articles, wholly or chiefly of textile materials	0.02 (0.41)	-0.04 (0.70)	0.04 (0.65)	0.17 (3.23)
657	Floor coverings, tapestries, etc.	0.03 (0.62)			
666	Pottery	-0.24 (2.50)	0.31 (3.04)		
667	Pearls and precious or semi-precious stones, unworked or worked	0.02 (0.54)	0.14 (3.38)		
696	Cutlery	0.02 (0.28)	0.34 (4.39)	0.22 (2.92)	0.19 (3.62)

Code	Industry Name	$\Delta \text{Ln } V_t$	$\Delta \text{Ln } V_{t-1}$	$\Delta \text{Ln } V_{t-2}$	$\Delta \text{Ln } V_{t-3}$
697	Household equipment of base metals	-0.11 (1.88)	0.34 (4.06)	0.13 (1.92)	
698	Manufactures of base metal, n.e.s.	0.00 (0.13)			
735	Ships and boats	-0.34 (1.49)			
812	Sanitary, plumbing, heating and lighting fixtures and fittings	-0.05 (0.67)	0.20 (2.15)		
821	Furniture	-0.14 (3.76)	0.29 (4.57)	0.10 (2.08)	
831	Travel goods, handbags and similar containers	-0.05 (0.78)			
841	Clothing except fur clothing	-0.02 (0.52)			
851	Footwear	0.08 (1.11)	0.71 (7.27)	0.36 (4.55)	
891	Musical instruments, sound recorders	-0.21 (1.66)	0.26 (1.68)	0.33 (2.71)	
892	Printed matter	-0.06 (0.88)			
893	Articles of artificial plastics	-0.16 (2.97)	0.74 (5.61)	0.45 (4.59)	0.19 (2.80)
894	Perambulators, toys, games and sporting goods	-0.32 (3.26)	0.23 (1.54)	0.20 (1.73)	0.19 (1.82)
896	Works of art, collectors' pieces and antiques	0.06 (0.86)	0.30 (3.38)	0.22 (2.99)	
897	Jewellery, goldsmiths' and silversmiths' wares	-0.02 (0.76)	-0.05 (1.67)		
899	Miscellaneous manufactured articles, n.e.s.	0.11 (1.90)	-0.05 (0.72)		
931	Special transactions not classified according to kind	-0.02 (0.55)			
941	Animals, n.e.s. including zoo animals, dogs	-0.15 (1.62)			

Note: The number inside the parenthesis next to an estimated coefficient is the absolute value of the t-ratio. In this paper, the critical values at 5% and 10% significance level are 1.96 and 1.64, respectively.

Table 14: Long-Run Coefficient Estimates, U.S. Import Models

Code	Industry Name	Constant	Dummy	Ln Y _{US}	Ln REX	Ln V
031	Fish, fresh and simply preserved	-51.26 (3.29)	-3.03 (1.88)	5.55 (3.14)	2.91 (1.07)	0.18 (0.43)
032	Fish, in airtight containers, n.e.s.	-32.22 (1.52)	-1.13 (0.85)	4.37 (2.02)	0.40 (0.18)	-0.34 (0.58)
053	Fruit, preserved and fruit preparations	-16.83 (7.20)	-0.34 (1.61)	2.32 (6.62)	0.94 (2.04)	-0.44 (3.33)
054	Vegetables, roots and tubers, fresh or dried	-16.73 (2.83)	-2.28 (3.29)	3.12 (3.90)	-1.62 (1.18)	1.69 (3.44)
055	Vegetables, roots and tubers, prepared or preserved	-78.81 (2.68)	-7.97 (2.27)	8.21 (2.65)	4.24 (0.89)	2.19 (1.53)
075	Spices	-36.70 (9.19)	-1.29 (3.28)	4.02 (7.28)	1.11 (1.32)	-0.21 (0.79)
099	Food preparations, n.e.s.	-38.93 (3.61)	-1.83 (4.19)	3.65 (2.39)	4.12 (2.90)	0.10 (0.72)
121	Tobacco, unmanufactured; Tobacco refuse	0.48 (0.06)	-0.71 (0.91)	-0.29 (0.28)	2.21 (1.60)	-0.004 (0.02)
211	Hides and skins, (except furskins), raw	-9.13 (0.97)	-2.22 (2.56)	0.63 (0.57)	2.00 (1.28)	0.36 (1.35)
231	Crude rubber including synthetic and reclaimed	-15.77 (6.79)	0.35 (1.43)	2.95 (10.45)	-1.21 (2.84)	-0.29 (2.19)
243	Wood, shaped or simply worked	3.47 (0.27)	1.28 (1.17)	-0.89 (0.63)	2.04 (0.92)	-0.56 (1.52)
291	Crude animal materials, n.e.s.	-22.25 (2.54)	-0.78 (1.03)	2.90 (2.57)	0.17 (0.09)	-0.12 (0.43)
292	Crude vegetable materials, n.e.s.	-11.37 (2.86)	-0.40 (1.10)	1.29 (2.84)	1.58 (1.87)	-0.13 (1.15)
599	Chemical materials and products, n.e.s.	-36.26 (1.91)	1.43 (0.61)	6.74 (2.75)	-6.34 (1.51)	-1.79 (1.21)
611	Leather	-38.89 (3.74)	-2.68 (2.72)	3.75 (3.07)	2.97 (1.60)	0.04 (0.09)
631	Veneers, plywood, particle boards and other wood, worked	19.74 (0.89)	2.98 (1.35)	-3.69 (1.15)	4.22 (0.96)	1.29 (0.80)
632	Wood manufactures, n.e.s.	-17.07 (0.33)	4.56 (0.33)	5.20 (0.76)	-6.90 (0.30)	5.24 (0.41)
642	Articles of paper, pulp, or paperboard	-48.40 (5.28)	-0.03 (0.03)	4.97 (4.00)	2.00 (1.30)	-0.82 (1.54)
651	Textile yarn and thread	162.89 (0.41)	-0.40 (0.05)	-19.59 (0.43)	7.12 (0.86)	2.19 (0.69)
652	Cotton fabrics, woven excluding narrow or special fabrics	-17.65 (2.46)	-1.90 (3.23)	2.78 (2.95)	-0.59 (0.30)	0.16 (0.73)
653	Textile fabrics, woven excluding narrow or special fabrics	-58.37 (11.37)	-3.10 (5.85)	5.78 (8.57)	3.45 (3.27)	-0.26 (0.78)
656	Made-up articles, wholly or chiefly of textile materials	-28.07 (0.66)	-3.60 (1.01)	-0.56 (0.08)	12.01 (1.34)	1.41 (0.48)
657	Floor coverings, tapestries, etc.	-6.47 (0.53)	1.08 (1.15)	1.47 (1.01)	-1.05 (0.71)	0.00 (0.02)
666	Pottery	-92.90 (3.92)	-0.57 (0.20)	8.69 (2.72)	5.00 (1.07)	-4.47 (1.80)
667	Pearls and precious or semi-precious stones	1.71 (0.09)	1.18 (0.56)	0.98 (0.61)	-1.44 (0.59)	-1.05 (0.99)

Code	Industry Name	Constant	Dummy	Ln Y _{US}	Ln REX	Ln V
696	Cutlery	-71.27 (4.25)	-3.59 (2.02)	6.85 (4.63)	4.40 (1.48)	-1.15 (1.31)
697	Household equipment of base metals	-82.37 (6.57)	1.43 (0.79)	9.77 (5.72)	-1.00 (0.37)	-3.21 (1.63)
698	Manufactures of base metal, n.e.s.	-37.28 (9.21)	-0.31 (0.88)	4.65 (9.37)	0.14 (0.20)	0.04 (0.35)
735	Ships and boats	-34.98 (2.81)	-0.25 (0.22)	5.34 (3.65)	-3.46 (1.72)	-0.22 (0.66)
812	Sanitary, plumbing, heating and lighting fixtures and fittings	-62.71 (7.25)	-1.20 (1.37)	6.90 (5.88)	1.44 (0.95)	-0.90 (1.70)
821	Furniture	-61.90 (7.75)	-0.72 (0.94)	6.55 (6.80)	2.41 (1.77)	-1.62 (3.34)
831	Travel goods, handbags and similar containers	-127.84 (5.54)	-7.36 (3.36)	15.56 (4.78)	-1.40 (0.30)	0.21 (0.31)
841	Clothing except fur clothing	-47.46 (3.47)	-2.84 (1.75)	5.07 (3.57)	3.32 (1.70)	0.08 (0.27)
851	Footwear	76.73 (0.54)	5.15 (0.68)	-9.78 (0.60)	4.78 (0.94)	-6.19 (1.42)
891	Musical instruments, sound recorders	-155.60 (4.80)	-4.27 (1.27)	12.95 (3.00)	13.26 (1.63)	-3.77 (1.38)
892	Printed matter	-108.35 (1.43)	-9.87 (0.71)	5.09 (0.58)	20.94 (0.65)	-2.06 (0.49)
893	Articles of artificial plastics	-38.12 (6.68)	0.97 (1.35)	3.75 (3.99)	2.61 (2.12)	-1.97 (3.41)
894	Perambulators, toys, games and sporting goods	-123.67 (12.75)	-5.50 (4.96)	11.73 (8.39)	7.42 (3.08)	-1.32 (1.65)
896	Works of art, collectors' pieces and antiques	4.47 (1.46)	1.53 (4.90)	-0.61 (1.51)	0.82 (1.28)	-0.44 (2.17)
897	Jewellery, goldsmiths' and silversmiths' wares	-63.92 (7.05)	-3.33 (2.96)	6.65 (5.65)	3.77 (2.00)	0.51 (0.74)
899	Miscellaneous manufactured articles, n.e.s.	-52.40 (7.57)	-4.62 (6.02)	5.59 (6.24)	3.16 (2.48)	0.82 (1.93)
931	Special transactions not classified according to kind	-49.73 (7.87)	-1.58 (2.75)	6.06 (7.72)	0.51 (0.50)	0.18 (1.14)
941	Animals, n.e.s. including zoo animals, dogs	14.36 (6.36)	-0.79 (3.93)	-1.37 (5.14)	-0.26 (0.71)	-0.02 (0.26)

Note: The number inside the parenthesis next to an estimated coefficient is the absolute value of the t-ratio. In this paper, the critical values at 5% and 10% significance level are 1.96 and 1.64, respectively.

Table 15: Long-Run Coefficient Estimates, Significant U.S. Imports

Panel A: Negatively affected by Exchange Rate Volatility

Code	Industry Name	Trade Share	Share Rank	Durability	Capital	Intermediate	Consumption
231	Crude rubber including synthetic and reclaimed	2.75	5	Non-durable		<input type="checkbox"/>	
053	Fruit, preserved and fruit preparations	1.59	8	Non-durable		<input type="checkbox"/>	
893	Articles of artificial plastics	0.96	11	Durable		<input type="checkbox"/>	<input type="checkbox"/>
894	Perambulators, toys, games and sporting goods	0.93	12	Durable	<input type="checkbox"/>		<input type="checkbox"/>
821	Furniture	0.93	13	Durable	<input type="checkbox"/>		<input type="checkbox"/>
666	Pottery	0.22	22	Durable			<input type="checkbox"/>
812	Sanitary, plumbing, heating and lighting fixtures and fittings	0.22	23	Durable	<input type="checkbox"/>	<input type="checkbox"/>	
896	Works of art, collectors' pieces and antiques	0.01	41	Durable			<input type="checkbox"/>

Panel B: Positively affected by Exchange Rate Volatility

Code	Industry Name	Trade Share	Share Rank	Durability	Capital	Intermediate	Consumption
899	Miscellaneous manufactured articles, n.e.s.	0.35	18	Durable		<input type="checkbox"/>	<input type="checkbox"/>
054	Vegetables, roots and tubers, fresh or dried	0.09	28	Non-durable		<input type="checkbox"/>	<input type="checkbox"/>

Note: Categorization of goods/industries is based on SITC, Rev.3 basic headings in terms of BEC, "Classification By Broad Economic Categories", Statistics Division, Department of Economic and Social Affairs, United Nations.

Table 16: Diagnostic Statistics for U.S. Import Demand

Code	Industry Name	LM	RESET	Normality	CUSUM	CUSUMSQ	Adj. R ²
031	Fish, fresh and simply preserved	0.00	1.94	0.94	S	S	0.17
032	Fish, in airtight containers, n.e.s.	0.02	0.64	1.77	S	S	0.40
053	Fruit, preserved and fruit preparations	2.07	0.06	1.50	S	S	0.76
054	Vegetables, roots and tubers, fresh or dried	0.06	8.46	0.08	S	S	0.47
055	Vegetables, roots and tubers, prepared or preserved	9.52	18.38	33.84	S	S	0.34
075	Spices	1.00	0.26	4.43	S	S	0.46
099	Food preparations, n.e.s.	1.64	9.07	2.75	S	S	0.61
121	Tobacco, unmanufactured; Tobacco refuse	2.17	0.47	0.30	S	S	0.42
211	Hides and skins, (except furskins), raw	0.26	0.00	19.70	S	S	0.23
231	Crude rubber including synthetic and reclaimed	0.27	0.03	0.86	S	S	0.57
243	Wood, shaped or simply worked	1.68	2.80	48.90	S	S	0.34
291	Crude animal materials, n.e.s.	1.55	0.39	12.94	S	S	0.36
292	Crude vegetable materials, n.e.s.	0.31	0.28	0.38	S	S	0.59
599	Chemical materials and products, n.e.s.	1.32	31.46	19.04	S	S	0.43
611	Leather	0.01	2.00	0.70	S	S	0.44
631	Veneers, plywood, particle boards and other wood, worked	4.62	0.94	1.64	S	S	0.55
632	Wood manufactures, n.e.s.	1.48	0.00	1.67	S	S	0.67
642	Articles of paper, pulp, or paperboard	0.09	0.62	4.39	S	S	0.61
651	Textile yarn and thread	6.85	0.57	2.11	S	S	0.50
652	Cotton fabrics, woven excluding narrow or special fabrics	0.48	0.00	1.04	S	S	0.70
653	Textile fabrics, woven excluding narrow or special fabrics	0.16	3.91	0.00	S	S	0.54
656	Made-up articles, wholly or chiefly of textile materials	2.26	11.83	2.24	S	S	0.63
657	Floor coverings, tapestries, etc.	14.42	0.72	0.46	S	S	0.78
666	Pottery	1.23	2.84	5.20	S	S	0.23
667	Pearls and precious or semi-precious stones, unworked or worked	1.26	0.26	0.30	S	S	0.60
696	Cutlery	0.87	1.25	0.87	S	S	0.73
697	Household equipment of base metals	0.03	0.67	0.58	S	S	0.56
698	Manufactures of base metal, n.e.s.	2.76	1.44	27.77	S	U	0.58

Code	Industry Name	LM	RESET	Normality	CUSUM	CUSUMSQ	Adj. R ²
735	Ships and boats	0.01	0.21	33.79	S	S	0.45
812	Sanitary, plumbing, heating and lighting fixtures and fittings	1.22	3.70	4.10	S	S	0.64
821	Furniture	0.01	12.43	0.74	S	S	0.72
831	Travel goods, handbags and similar containers	7.21	3.63	44.01	S	S	0.47
841	Clothing except fur clothing	11.18	0.27	14.99	U	U	0.38
851	Footwear	1.00	0.57	0.98	S	S	0.81
891	Musical instruments, sound recorders	0.33	2.77	32.01	S	S	0.32
892	Printed matter	1.50	8.45	0.36	S	S	0.41
893	Articles of artificial plastics	1.39	15.84	0.07	S	S	0.59
894	Perambulators, toys, games and sporting goods	0.37	8.46	0.40	S	S	0.35
896	Works of art, collectors' pieces and antiques	1.35	0.10	1.67	S	S	0.53
897	Jewellery, goldsmiths' and silversmiths' wares	3.58	4.14	0.39	S	S	0.68
899	Miscellaneous manufactured articles, n.e.s.	0.04	8.34	5.96	S	S	0.39
931	Special transactions not classified according to kind	0.65	0.56	0.42	S	S	0.52
941	Animals, n.e.s. including zoo animals, dogs	0.28	0.39	1.22	S	S	0.46

- Notes:* 1. LM is the Lagrange multiplier test of residual serial correlation, distributed as a Chi-squared distribution with one degree of freedom.
2. RESET is Ramsey's test for functional form, distributed as a Chi-squared distribution with one degree of freedom.
3. Normality is the Jarque-Bera test for residual normality, and has an asymptotic Chi-squared distribution with two degrees of freedom.
4. CUSUM and CUSUMSQ are stability tests of the short-run and long-run coefficients. Stable coefficients are indicated by an "S", whereas unstable coefficients are indicated by a "U".

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