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SEF WORKING PAPER 12/2016

WORKING PAPERS IN ECONOMICS AND FINANCE

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Working Paper 12/2016

ISSN 2230-259X (Print)

ISSN 2230-2603 (Online)

US-China trade and exchange rate dilemma: the role of trade data discrepancy

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Abstract

The US and China report substantially different figures regarding their trade with each other. Empirical studies suggest that neither the US nor China can be solely blamed for this discrepancy. Previous empirical studies investigating the effects of Yuan depreciation on US-China trade largely retrieved the data from one side only without even citing which side it is. This study extends the literature regarding the dynamic effects of exchange rate on trade balance, known as the J-Curve Theory, by employing the trade data reported by the US and China independently in empirical assessment. We tested 38 trade commodities over the period 1987-2012 and found that: (i) discrepancy in trade data affects the accuracy of testing the J-Curve considerably. (ii) the coefficients suggesting that Yuan depreciation increases the US bilateral trade deficit with China seem much less inconsistent compared with the coefficients claiming the opposite. This applies to short and long run. We propose Mutual Confirmation as a robustness check for the empirical assessment of the J-Curve Theory.

Keywords: Exchange rate depreciation, Trade data discrepancy, ARDL, US-China trade, Mutual confirmation

JEL Classification: F31, F14, F32

1. Background and Research Approach

US-China trade has increased substantially since the two nations re-established diplomatic relations in 1979. According to US data, the total US-China trade has risen from nearly $1 billion in 1978, when China was still the 32nd largest nation in the US export market and its 57th largest source of imports, to $536 billion in 2012, where China became America's third largest export market and its greatest source of imports. In terms of total trade, China currently is the second largest US trade partner preceded only by Canada (Morrison 2013). Most importantly for this study, the US-China bilateral trade deficit, according to US data, has surged over the past two decades, skyrocketing from $10 billion in 1990 to $315 billion in 2013. China has been the largest source of trade deficit for the US since 2000 onwards (Flannery 2013).

Some US politicians and economists have criticized the high level of trade deficit with China, stating that it has stolen US jobs and threatened the US economy. They claim that this deficit is mainly due to China's unfair economic policies against the US, which has strained the bilateral political and economic relations (Zhao 2008). In 2010 alone, the US filed three cases against China to the World Trade Organization (WTO). The first was regarding China's subsidies to promote its wind power industries, the second about its use of trade 'remedy laws' to protect domestic industries, and finally, against the restrictions on electronic payment services (Morrison 2011).

Empirical research suggests many possible causes for the US bilateral deficit with China. For instance, China's role in the intra-Asia trade framework and China's inadequate protection of the US intellectual property rights. However, the most important unsettled dispute between the two giants is China's resistance to adopting a market-based currency. The row over China's undervalued Yuan against the USD dates back to 1994 when China pegged the Yuan to the USD at the rate of 8.7 Y/$ (Devadoss, Hilland, Mittelhammer and Foltz 2014). From the following year until 2005, China appreciated the Yuan and pegged it at 8.28 Y/$, which the US claimed to be still highly undervalued (Poleg 2005). After continuous pressure from the US, China adopted a new exchange rate regime in 2005 and moved away from the rigid fixed regime. Instead, China pegged the Yuan to a basket of currencies including the Euro, Japanese Yen, US Dollar, South Korean Won, the British Pound, Thai Baht, and the Russian Ruble (Devadoss, Hilland, Mittelhammer and Foltz 2014).

The Yuan again appreciated nominally against the USD, falling from nearly 8.1 Y/$ in 2005 to 6.83 Y/$ in 2008, which continued at the same rate throughout the global financial crisis (Morrison 2011). In 2010, the Yuan resumed appreciation and reached 6.21 Y/$ in 2012 (Devadoss, Hilland, Mittelhammer and Foltz 2014). As of March 2015, the Y/$ remained unchanged at 6.21. Even with this general trend of nominal Yuan appreciation relative to USD, many studies believe the Yuan is still undervalued and far from its rightful value if determined by the laws of free market under the free floating exchange rate regime.

Subramanian (2010) estimated the Yuan to be undervalued by almost 30% as of April 2010, while Ferguson and Schularick (2011) estimated the undervaluation to be between 30% and 40% for the period of 1980-2008. Overall, estimates of undervaluation in empirical studies range from 15% to 50% depending on the period and the estimation technique (Morrison 2011).

Many researchers argue that the undervalued Yuan has given China an immoral trade advantage over the US. They claim that this policy constitutes a de facto subsidy for China's exports to the US, and acts as a de facto tariff barrier on China's imports from the US (Morrison 2011). The question here is; based on which trade data the researchers are empirically assessing the effects of Y/$ exchange rate movements on the US-China bilateral trade? In fact, previous studies largely retrieved the data from one side only. Most of these studies did not mention which side it is. For examples of these studies, please refer to Magee (1973), Meade (1988), Rose and Yellen (1989), and Dhasmana (2012).

There is substantial difference between what each side claims to have traded with the other, which is known as 'trade data discrepancy'. In 2012, according to the US, bilateral trade deficit with China was $315.1 billion. According to China, however, its trade surplus with the US was $224.1 billion, which accumulates merely 71% of the US claim. The data is obtained from the SITC, WITS, the World Bank (please refer to section 3).

Assessing whether researchers can use the trade data reported by either side for econometric analysis depends on answering a simple query. Do we have enough reason to trust the data of one partner more than the other? The short answer is no. The US-China Joint Commission on Commerce and Trade (JCCT) is an official project working under the auspices of the US and China governments to look into the causes of discrepancy. As JCCT reported in 2013, there are two main sources for the discrepancy. First, the differing US-China valuation policies for their merchandise. These policies mainly differ on whether to include the insurance and freight in the registered value of imports, exports, or both. Second, the misattributions of origin and destination of US imports transhipped through a third location (mainly Hong Kong) before arriving in the US. Since the discrepancy is chiefly caused by the mismatch of trade data compilation methods among the US and China and the role of transhipments, it is unjustified to assume that the data of one side is more accurate than the other, which indicates that both data sources are in error. For more explanations regarding the causes of discrepancy, please refer to the following in-depth studies; JCCT Joint Report (2012) and Ferrantino and Wang (2008).

As widely accepted in econometrics, the quality of results for any analysis is not only dependent on the estimation and modelling methods, but on the quality of inputs of those models, the data. As well stated by the celebrated econometrician Damodar Gujarati (2003), 'the researcher should always keep in mind that the results of research are only as good as the quality of the data'. This study aims to investigate the role of trade data discrepancy among the US and China in assessing the effects of exchange rate movements on bilateral trade. To achieve this objective, the empirical analysis will investigate the impact of exchange rate movements on the US-China bilateral trade in 38 commodities using both the US and China trade data reports, independently. The role of trade data discrepancy will be captured by comparing the two sets of regression results, which used different trade data sources for constructing the dependent variable, the bilateral trade balance, *ceteris paribus*.

After this introduction, Section 2 reviews the theories on this topic and justifies the choice of the J-Curve Theory. Section 3 lists the data sources and research methodology. Section 4 presents and explains the empirical results. The last section concludes the study by a review of the thesis, research approach, a summary of the results, and a recommendation to future studies.

2. Literature Review

There are three widely-defined approaches to explain the effects of exchange rate movements on trade balance. First, the Monetary Approach, which was originally championed by Harry Johnson (1972) and Jacob Frenkel (1975). This approach suggests that depreciation should be assessed in a monetary context (Dunn Jr and Mutti 2000). Second, the Keynesian-based Absorption Approach, which was formally modelled by Meade (1951) and Alexander (1952). The Absorption Approach relates depreciation to macroeconomic variables that usually undermine the favourable effect of exchange rate devaluation on trade balance and suggests that trade balance is a function of real income (output) and absorption (domestic consumption) $TB = f(Y, A)$.

Absorption and Monetary Approaches focus on the macroeconomic connections, claiming that the relationship between trade and exchange rate cannot be understood in isolation from other macroeconomic variables. Thus, the two are considered as full equilibrium models (Kim 2009). There are relatively few empirical studies on these two approaches. This could be attributed to the fact that both did not substantially evolve to cope with dramatic changes in the nature of the current account balance in post Bretton Woods era.

In the third approach, known as the Elasticities, trade balance adjustment path in reaction to currency depreciation is viewed on the basis of elasticities of demand for imports and exports (Howitt, Watson and Adams 1980). In other words, assessing whether a country's trade balance would benefit from currency depreciation depends on the responsiveness of trade, in terms of quantity, to changes in price. The Elasticity Approach is also commonly known as Bickerdike-Robinson-Metzler Condition (Chee-Wooi and Tze-Haw 2008).

Marshall-Lerner Condition (MLC) is a further extension of the Elasticity Approach. Nevertheless, it was named after Alfred Marshall (1842-1924), since he is considered as the father of elasticity as a concept, and Abba Lerner (1944) for his later exposition of it (Brooks 1999). In simplest terms, MLC states that;

the sum of the absolute values of the two elasticities of demand for imports and exports must exceed unity in order for depreciation to have a favourable impact on trade balance (Brown and Hogendorn 2000).

Almost three decades after the generalization of MLC, the J-Curve theory came into existence. As first illustrated by Magee (1973), the J-Curve phenomenon reflects how a devaluation of a country's exchange rate affects its trade balance over time. Thus, it is considered as a dynamic view of MLC (Niehans 1984), or more generally, the Elasticities Approach. The rationale behind the J-Curve theory is that, although nominal exchange rate is changed instantly, it still takes time for trade volumes to adjust to changes in relative prices in foreign and domestic markets. Devaluation of the real exchange rate affects trade flows through volume and price effects. Price effect, initiated by the depreciation of domestic currency, causes exports to become relatively cheaper expressed in foreign currency units. On the other hand, imports become relatively more expensive expressed in domestic currency. The two reasons work in the same direction causing trade balance to deteriorate.

The short-run price effect discussed above takes place quickly after the change in exchange rate. However, it also paves the way for the second phase of the J-Curve by stimulating changes in export and import volumes. The long-run gradual decrease in the volume of imports and the increase in the volume of exports, known as the volume effect, reflect the slow adjustments to changes in relative prices and commonly causes the trade balance to improve to a higher level compared to the initial level before the depreciation occurred. Actually, if the pattern of short-run deterioration and long-run improvement of the trade balance as a result of currency depreciation takes place, that is the J-Curve Phenomenon exists, it can be indicative that MLC is met, too (Clarke and Kulkarni 2010).

Among all the theories and approaches discussed above, this study tests the J-Curve Theory for the following reasons: (a) empirical testing for the J-Curve can indirectly test the approaches of Elasticities and MLC by evaluating the long and short-run coefficients of the real exchange rate in econometric analysis. (b) The J-Curve allows tracing the effects of real exchange rate depreciation on trade balance dynamically.

Bahmani-Oskooee and Ratha (2004) and Bahmani-Oskooee and Hegerty (2010), reviewed the empirical literature on the J-Curve and categorized these studies into three groups. The first group employed aggregate trade data. Therefore, investigated the J-Curve in a country and all of its trade partners in one regression. Magee (1973), Himarios (1985), and Meade (1988) are examples of studies in this group which included the US or China in the analysis.

The first group was criticized for aggregating trade data, which could obscure significant results. Therefore, the second group of studies segregated the data by country and investigated bilateral relations to reduce heterogeneity. In other words, studies in the second group investigated the J-Curve in one country with one partner at a time. Rose and Yellen (1989), Marwah and Klein (1996), Bahmani-Oskooee and Brooks (1999), and Dhasmana (2012) are examples of studies in this group which investigated the US or China.

The third group consists of the studies that further disaggregated trade data, this time by commodity or trade sector. Thus, studies in this group investigated the J-Curve between two countries among a set of different commodities. There is literally enormous body of literature in this category.

As can be seen from the concise literature review provided above, the improvements in J-Curve literature were in shape of reducing aggregation bias. In fact, most of these studies, especially on the third group, were merely about changing the case study, while keeping the estimation methods and research approach untouched. Most importantly, to the best knowledge of the authors, the studies stated above used trade data provided by only one side of a bilateral trade, which this study claims to be oversimplifying the comlexities of the effects of currency depreciation on trade balance.

We were able to identify one study in the literature on the J-Curve for the case of US-China bilateral commodity-level trade (third group of studies). Wang (2005) investigated the J-Curve for 88 commodities. The data extended over the period 1978-2002 annually as reported by the US only. It is retreived from the Standard International Trade Classification (SITC), which is maintained by the United Nations. Where SITC codes trade data on five digits (more digits indicate higher levels of disaggregation), Wang (2005) collected data on two and three digits, thus, average level of aggregation. Wang (2005) will function as a frame of reference for the results of this study.

3. Data and Research Methodology

The data used in this study is retrieved from the World Integrated Trade Solution database, the World Bank. The database compiles international trade data as reported by different countries. Following Wang (2005), the data is collected following the Standard International Trade Classification (SITC). The authors were able to indicate 1366 trade sectors and commodities of identical spans as reported by both the US and China independently for the period 1987-2012. Since estimating the J-Curve for this immense number of commodities is time and space-consuming, we search for the highest possible number of commodities within one trade sector. The priority is given to commodities with higher disaggregation. Following the above-mentioned criteria, we were able to collect 38 commodities coded from 5000 to 6000, all are within the sector of chemicals. This practice is followed to assure more neutrality in choosing the sample. For a full list of the commodities, please refer to Table 1.

As mentioned earlier, this study strictly follows Wang (2005) for two reasons. First, the applied model and estimation techniques in Wang (2005) are the same with the majority of studies in the literature. Second, the two investigated countries are also the US and China. Therefore, the results of this study can be interpreted in a comparative context. The basic trade balance model takes the following form:

$$lnTB_{i,t} = \alpha + \beta\ lnY_{US,t} + \gamma\ lnY_{c,t} + \varphi lnREX_t + \mu_t \qquad (1)$$

where TB_i is a measure of the trade balance of commodity i, defined as the ratio of US nominal imports of commodity i from China over her exports of the same commodity to China (Imp_i/Exp_i). Y_{US} is the real income of the US, measured in real Gross Domestic Product. Since an increase in economic growth of the US is expected to increase US's imports of commodity i from China, thus, improve the trade balance, an estimate of β is expected to be positive. Likewise, an estimate of γ is expected to be negative if an increase in the real income of China denoted by Y_c encourages an increase in US's export of commodity i to China. Finally, REX_t is the real Yuan/Dollar bilateral exchange rate defined as:

$$REX = \frac{P_{US} * \text{NEX}}{P_C} \qquad (2)$$

where NEX is the nominal bilateral exchange rate (period average), defined as the number of China's Yuan per US Dollar. P_c and P_{us} are China's and US's price levels, measured by CPI, respectively. An increase in REX reflects an appreciation for the Dollar and a depreciation for the Yuan. If real depreciation of the Yuan is to increase China's exports of commodity i and/or decrease imports of commodity i, hence improve the trade balance, an estimate of φ is expected to be positive. An improvement in trade balance means either a reduction in deficit or an increase in surplus.

Equation 1 estimates the long-run relationship among variables. In order to infer the J-Curve effect, which is a time-dependent Phenomenon, it is necessary to include the short-run dynamics into Equation 1. Following Pesaran, Shin and Smith (2001) the equation is expressed in an error-correction modelling format:

$$\Delta LnTB_{i,t} = \alpha + \sum_{k=1}^{n_1} \emptyset_k \Delta lnTB_{i,t-k} + \sum_{k=0}^{n_2} \beta_k \Delta lnYus_{t-k} + \sum_{k=0}^{n_3} \gamma_k \Delta lnYc_{t-k} + \sum_{k=0}^{n_4} \varphi_k \Delta lnREX_{t-k} + \delta_1 lnTB_{i,t-1} + \delta_2 lnYus_{t-1} + \delta_3 lnYc_{t-1} + \delta_4 lnREX_{t-1} + \mu_t \qquad (3)$$

The model includes a linear combination of lagged level variables as a proxy for lagged error-correction term ECT_{t-1}; this term reflects the speed of adjustment of the dependent variable (return to equilibrium) after a deviation had occurred in the independent variables. To test cointegration, the null hypothesis of $\delta_1 = \delta_2 = \delta_3 = \delta_4 = 0$ is tested against the alternative: $\delta_1 \neq \delta_2 \neq \delta_3 \neq \delta_4 \neq 0$ using Wald Test of joint significance. If F-Statistic of the test exceeds the upper bound of the critical value provided by Pesaran et al. (2001), the null of no cointegration can be rejected. However, since the time period of this study is relatively short, we use the table of critical values proposed by Narayan (2005) for small samples. The estimated short-run coefficients are acquired by estimating the model in 4:

$$\Delta LnTB_{i,t} = \alpha + \sum_{k=1}^{n_1} \emptyset_k \Delta lnTB_{i,t-k} + \sum_{k=0}^{n_2} \beta_k \Delta lnYus_{t-k} + \sum_{k=0}^{n_3} \gamma_k \Delta lnYc_{t-k} + \sum_{k=0}^{n_4} \varphi_k \Delta lnREX_{t-k} + ECT_{i,t-1} + \mu_t \qquad (4)$$

First lag of the error correction term is included because it can be indicative of cointegration among variables when appears significant and carries a negative sign as argued by Kremers, Ericsson and Dolado (1992). The short-run coefficients are reported once the regression passes all the diagnostic tests of LM autocorrelation residual-based test, White Test of heteroscedasticity, Ramsey misspecification RESET Test, CUSUM and CUSUM of Squares Structural stability tests, and significant and negative ECT_{t-1}. For estimating the long-run coefficients, a special derivation of equation 3 is applied:

$$LnTB_{i,t} = \alpha + \sum_{k=1}^{n=2} \emptyset_k lnTB_{i,t-k} + \sum_{k=1}^{n=2} \beta_k lnYus_{t-k} + \sum_{k=1}^{n=2} \gamma_k lnYc_{t-k} + \sum_{k=1}^{n=2} \varphi_k lnREX_{t-k} + \mu_t \qquad (5)$$

The approach of general to specific is followed in equation 5 as well. However, at least one lag from each level is left in the regression even if insignificant. Following Wang (2005), the highest included lagged level variable for each variable is two. The results of the long-run estimates are normalized by the first lag of the dependent variable through Wald Test.

4. Empirical Results

4.2 Cointegration among variables

Table 1 presents the results of cointegration among variables using the US trade reports. Table 2 lists the results using the data provided by China. The other variables remain unchanged for all regressions in both reports. First, we impose two lags on all variable and check for cointegration, if cointegration is not supported, we follow General to Specific Technique to optimize the optimal lag structure.

Table 1. Cointegration results using US report

code	description [a]	F-Test with 2 lags	optimal lag	F-Test at optimal lags	autocorrelation LM test [b]
5121	Hydrocarbons and their derivatives	4.02	2.2.2.1	4.59	1.07
5122	Alcohols, phenols, phenol alcohols, glycerin	1.95	2.2.2.2	9.27	1.07
5123	Ethers, epoxides, acetals	9.42	2.2.2.2	9.42	3.8
5124	Aldehyde ,ketone ,quinone function compounds	23.72	2.2.2.2	23.72	3.11
5125	Acids and their halogenated derivatives	2.19	1.2.2.1	3.76	1.9
5127	Nitrogen function compounds	4.18	1.1.2.2	5.51	2.39
5128	Organo inorganic & heterocyclic compounds	2.29	2.2.2.1	5.96	1.51
5129	Other organic chemicals	3.32	2.2.2.2	4.87	0.54
5132	Chemical elements n.e.s.	0.85	2.2.2.2	5.07	0.25
5133	Inorganic acids & oxygen comp.of metalloids	18.22	2.2.2.2	18.22	4.33
5135	Metallic oxides used in paints	7.95	2.2.2.2	7.95	1.11
5136	Other inorganic bases and metallic oxides	2.54	2.0.2.2	4.37	0.95
5141	Metallic salts & peroxysalts of inorganic acids	2.04	2.2.2.2	4.54	2.21
5142	Oth.metal.salts & peroxysalts of inorg.acids 1	2.92	2.2.2.1	4.77	1.52
5143	Oth.metal.salts & peroxysalts of inorg.acids 2	1.17	1.1.2.2	4.45	1.93
5149	Inorganic chemical products, n.e.s.	3.2	2.1.2.2	5.65	2.93
5310	Synthetic organic dyestuffs	7.06	2.2.2.2	7.06	3.09
5331	Colouring materials, n.e.s.	12.51	2.2.2.2	12.51	1.16
5333	Prepared paints, enamels, lacquers, etc.	2.42	2.2.2.2	6.09	2.33
5411	Vitamins and provitamins	1.45	2.2.2.1	4.18	1.19
5413	Penicillin streptom. Tyrocidine & oth. Antibiot	1.27	1.1.2.1	5.09	9.2*
5415	Hormon.e.s	1.52	1.2.1.1	4.37	0.73
5416	Glycosides, glands & extracts, sera, vaccin.e.s	2.79	2.2.2.2	4.68	2.17
5417	Medicaments	2.43	1.2.2.2	4.47	2.01
5419	Pharmaceutical goods	2.04	2.1.2.0	4.41	2.36
5511	Essential oils and resinoids	1.78	1.2.1.2	4.35	0.95
5512	Synth. perfume & flavour materials	2.84	2.2.1.2	5.5	0.72
5530	Perfumery & cosmetics, dentifrices	3.37	2.2.2.2	5.54	2.81
5541	Soaps	3.01	2.2.2.1	9.39	1.23
5811	Prods of condensation, polycond. & polyaddition	4.96	2.1.1.2	8.92	6.6*
5812	Products of polymerization and copolymerization	6.72	2.2.2.2	6.72	2.84
5813	Regen. cellulose and vulcanized fibre	2.99	2.2.1.2	6.07	3.8
5819	Other artificial resins and plastic materials	0.99	1.0.2.1	3.48	4.06*

5992	Insecticides, fungicides, disinfectants	1.23	2.2.1.2	5.92	1.26
5995	Starches, inulin, gluten, albumin.substances, glues	3.64	2.2.2.2	4.78	0.79
5996	Wood and resin based chemical products	1.43	2.2.2.1	5.89	0.49
5997	Organic chemical products, n.e.s.	1.73	2.2.2.0	4.15	0.54
5999	Chemical products and preparations, n.e.s	9.1	2.2.2.2	9.1	1.61

[a] n.e.s means Not Elsewhere Specified. [b] * indicates significance at 5% level

Table 2. Cointegration results using China's report

code	Description [a]	F-Test with 2 lags	Optimal lag	F-Test at optimal lags	Autocorrelation LM test [b]
5121	Hydrocarbons and their derivatives	5.31	2.2.2.2	5.31	0.05
5122	Alcohols, phenols, phenol alcohols, glycerine	1.01	2.2.1.0	2.81	2.49
5123	Ethers, epoxides, acetals	6.11	2.2.2.2	6.11	2.22
5124	Aldehyde ,ketone ,quinone function compounds	2.58	2.2.0.2	4.9	0.47
5125	Acids and their halogenated derivatives	2.96	2.2.2.2	5.32	0.22
5127	Nitrogen function compounds	21.79	2.2.2.2	21.79	3.04
5128	Organo inorganic & heterocyclic compounds	1.97	1.2.1.2	2.96	1.41
5129	Other organic chemicals	1.85	1.2.2.2	5.19	0.3
5132	Chemical elements n.e.s.	1.51	2.2.2.1	4.59	0.07
5133	Inorganic acids & oxygen comp.of metalloids	28.32	2.2.2.2	28.32	1.59
5135	Metallic oxides used in paints	1.59	1.0.2.0	2.62	13,7*
5136	Other inorganic bases and metallic oxides	2.21	2.2.2.2	4.35	0.38
5141	Metallic salts & peroxysalts of inorganic acids	7.49	1.2.2.0	24.04	7.4**
5142	Oth.metal.salts & peroxysalts of inorg.acids 1	0.74	2.1.2.2	4.96	2.95
5143	Oth.metal.salts & peroxysalts of inorg.acids 2	3.04	2.2.2.2	4.3	0.55
5149	Inorganic chemical products, n.e.s.	2.03	2.2.1.2	5.46	1.78
5310	Synthetic organic dyestuffs	3.43	1.2.2.2	7.79	11.8*
5331	Colouring materials, n.e.s.	5.47	2.2.2.2	5.47	2.08
5333	Prepared paints, enamels, lacquers, etc.	3.84	2.2.2.2	5.16	4.51
5411	Vitamins and provitamins	1.22	2.1.2.2	4.17	2.53
5413	Penicillin streptom. Tyrocidine & oth. Antibiot	0.58	2.1.1.0	4.17	0.41
5415	Hormon.e.s	2.21	1.2.2.1	6.94	0.25
5416	Glycosides, glands & extracts, sera, vaccin.e.s	5.75	2.0.2.2	8.43	3.36
5417	Medicaments	2.87	2.2.2.2	4.62	4.06
5419	Pharmaceutical goods	1.73	2.2.2.2	4.67	0.82
5511	Essential oils and resinoids	3.35	1.2.2.2	4.4	3.21

5512	Synth. perfume & flavour materials	2.45	2.2.2.2	5.57	3.26
5530	Perfumery & cosmetics, dentifrices	1.72	2.2.2.1	5.24	0.79
5541	Soaps	5.27	2.2.2.1	7.73	2.7
5811	Prods of condensation, polycond. & polyaddition	1.62	2.1.0.0	3.97	0.58
5812	Products of polymerization and copolymerization	14.38	2.2.1.0	19.69	3.37
5813	Regen. cellulose and vulcanized fibre	30.98	2.2.2.2	25.28	1.49
5819	Other artificial resins and plastic materials	1.2	1.0.1.2	2.37	0.23
5992	Insecticides, fungicides, disinfectants	1.03	1.2.1.2	3.31	1.47
5995	Starches, inulin, gluten, albumin.substances, glues	0.61	1.1.1.0	2.23	0.08
5996	Wood and resin based chemical products	2.09	2.0.0.2	3.31	1.34
5997	Organic chemical products, n.e.s.	4.08	2.2.2.2	5.3	0.57
5999	Chemical products and preparations, n.e.s	11.75	2.2.2.2	11.75	2.41

[a] n.e.s means Not Elsewhere Specified. [b] * indicates significance at 5% level

As tabulated by Narayan (2005), the upper bound critical value is 4.15 for 10% level of significance. Cointegration results among variables for two lags on all lagged level variables using the US report seem very different from the results obtained using China's report. However, after applying the optimal lag for each regression, the difference in cointegration results becomes significantly less. By employing the optimal lag structure, testing cointegration using the US reports provides a moderately stronger evidence for cointegration. Out of 38 commodities, three only are not cointegrated, which accumulates 7.9% of all commodities. Using China's report falls short of providing evidence for cointegration in eight commodities, that is 21.4% of all commodities. Overall, cointegration is mutually established in merely 29 commodities, i.e. 76.3% of the total number of commodities.

Wang (2005) also found similar results. Using ARDL by imposing two lags on all variables, she was able to approve cointegration in 17 commodities (nearly 19% of the total number of commodities). After optimizing the lag structure, the number of cointegrated commodities rose to 70 (nearly 80%).

4.2 Short-run coefficient estimates of REX

To save space, this section presents the short-run coefficient estimates for the variable of interest only, the real exchange rate (REX). Table 3 shows the estimated short-run effects of REX movements on trade balance employing the data provided by the US. Whereas, Table 4 reports the results using China's reports. The tables are followed by a summary on the results using both reports.

Table 3. Short-run effects of REX movements on trade balance using US reports

code	REX short-run estimates [a b]				diagnostic tests [c]				
	ΔLn REX_t	ΔLn REX_{t-1}	ΔLn REX_{t-2}	ECT_{t-1}	Adj. R^2	RESET	LM Test	CUSUM /CUSUM Q	White test
5121	4.84 (2.81)*			-2.18*	0.82	(0.01)	(0.91)	S/S	(1.21)
5122	1.37 (0.79)			-1.09*	0.72	(1.17)	(0.45)	S/S	(0.57)
5123	4.45 (2.97)*			-1.56*	0.84	(1.50)	(0.99)	S/S	(0.86)
5124	-0.69 (-0.78)		-1.88 (-2.34)*	-1.23*	0.86	(0.87)	(1.05)	S/S	(0.46)
5125	-0.84 (-1.02)			-0.36	0.3	(0.27)	(0.74)	S/S	(0.55)
5127	0.39 (0.52)			-0.60*	0.62	(0.22)	(1.25)	S/S	(1.50)
5128	-0.86 (-0.96)			-0.72*	0.77	(1.84)	(3.54)	S/S	(0.56)
5129	-3.15 (-1.57)			-1.39*	0.72	(0.73)	(1.44)	S/S	(2.16)
5132	3.70 (2.46)*			-0.76*	0.88	(0.14)	(0.61)	S/S	(0.92)
5133	5.89 (3.20)*	-3.25 (-2.39)*		-0.60*	0.85	(0.87)	(1.00)	S/S	(1.47)
5135	3.95 (2.40)*			-0.65*	0.74	(0.94)	(0.18)	S/S	(1.43)
5136	2.27 (0.95)			-1.15*	0.60	(1.30)	(0.79)	S/S	(0.36)
5141	4.70 (1.55)			-1.99*	0.82	(0.88)	(1.34)	S/S	(2.11)
5142	1.59 (1.17)			-0.73*	0.52	(0.91)	(1.92)	S/S	(0.70)
5143	-1.96 (-2.13)		-2.01 (-2.10)*	-0.73*	0.62	(0.41)	(0.51)	S/S	(071)
5149	-0.59 (-0.27)			-0.48*	0.74	(1.41)	(1.62)	S/S	(0.71)
5310	0.89 (1.04)			-0.76*	0.52	(1.32)	(0.14)	S/S	(0.96)
5331	-1.50 (-1.11)			-1.42*	0.62	(0.18)	(0.18)	U/S	(2.05)
5333	2.86 (2.68)			-1.06*	0.12	(0.90)	(0.89)	S/S	(2.13)
5411	2.78 (1.63)			-0.75*	0.63	(0.70)	(0.61)	S/S	(0.49)

5413	-1.03 (-1.16)		-2.42 (-2.85)*	-0.66*	0.80	(0.53)	(3.51)	S/S	(1.96)
5415	-4.08 (-0.84)			-1.33*	0.82	(1.58)	(1.13)	S/S	(1.09)
5416	-3.50 (-1.99)			-0.81*	0.82	(0.20)	(0.60)	S/S	(0.61)
5417	-3.97 (-2.90)*			-1.45*	0.67	(2.34)	(2.34)	S/S	(2.56)
5419	6.62 (6.21)*			-0.57*	0.94	(0.50)	(1.82)	S/S	(0.58)
5511	-4.07 (-1.90)			-1.42*	0.60	(0.02)	(2.42)	S/S	(0.37)
5512	-3.20 (-2.13)*			-0.36	0.56	(0.61)	(1.68)	S/S	(2.27)
5530	0.49 (0.44)			-0.54*	0.71	(0.82)	(1.22)	S/S	(0.92)
5541	-2.21 (-1.41)		-3.81 (-2.52)*	-1.17*	0.77	(0.85)	(0.85)	S/S	(0.58)
5811	3.31 (1.27)			-1.00*	0.63	(1.05)	(0.01)	S/S	(1.96)
5812	3.03 (4.30)*			-0.77*	0.84	(0.14)	(2.68)	S/S	(1.48)
5813	5.58 (1.12)			-0.62*	0.76	(2.13)	(0.83)	S/S	(0.52)
5819	1.46 (0.64)			-0.61*	0.51	(0.86)	(1.41)	S/S	(1.38)
5992	1.60 (1.26)			-1.19*	0.77	(0.40)	(1.76)	S/S	(0.77)
5995	-1.16 (-0.76)		-3.33 (-2.38)*	-0.83*	0.76	(1.83)	(2.46)	S/S	(1.23)
5996	3.89 (1.77)		-7.19 (-3.15)*	-0.99*	0.90	(0.31)	(0.62)	S/S	(0.85)
5997	3.83 (3.04)*			-0.54*	0.57	(0.24)	(0.43)	S/S	(0.92)
5999	1.62 (2.39)*	-1.98 (-3.22)*		-1.48*	0.93	(0.77)	(0.60)	S/S	(0.73)

a: * indicates significance at 5% level. b: numbers inside parentheses are t-ratios. c: numbers inside parentheses are F-Statistics.

Table 4. Short-run effects of REX movements on trade balance using China's reports

Sect Code	REX short-run estimates [a b]				Diagnostic tests [c]				
	ΔLn REX_t	ΔLn REX_{t-1}	ΔLn REX_{t-2}	EC_{t-1}	Adj. R^2	RESET	LM Test	CUSUM /CUSUM Q	White test
5121	4.66 (3.30)*			-1.48*	0.76	(0.29)	(3.53)	S/S	(0.74)
5122	0.24 (0.21)			-1.13*	0.69	(1.53)	(0.75)	S/S	(0.84)
5123	-1.95 (-2.77)*		-2.01 (-3.53)*	-2.14*	0.89	(0.11)	(3.63)	S/S	(1.56)
5124	-0.86 (-0.86)			-0.47*	0.36	(0.51)	(3.61)	S/S	(1.17)
5125	-0.50 (-0.63)			-0.46	0.36	(1.02)	(1.17)	S/S	(0.84)
5127	0.58 (0.57)	-1.68 (-2.13)*		-0.77*	0.55	(1.26)	(1.37)	S/S	(1.65)
5128	1.43 (1.98)			-0.24	0.53	(1.19)	(0.10)	S/S	(0.88)
5129	4.66 (1.65)			-0.97*	0.53	(1.12)	(2.00)	S/S	(0.64)
5132	1.84 (0.92)		3.80 (2.43)*	-1.06*	0.82	(0.25)	(0.15)	S/S	(0.46)
5133	16.43 (7.35)*	-6.52 (-2.31)*	-5.71 (-2.29)*	-1.23*	0.96	(2.10)	(1.24)	S/S	(0.60)
5135	3.70 (2.86)*			-1.00*	0.76	(0.22)	(0.55)	S/S	(1.19)
5136	2.10 (0.67)			-1.43*	0.60	(0.96)	(1.39)	S/S	(0.58)
5141	-0.93 (-1.10)			-1.93*	0.83	(0.50)	(0.63)	S/S	(0.74)
5142	2.94 (2.16)*	2.69 (2.10)*		-0.87*	0.64	(1.23)	(0.48)	S/S	(0.68)
5143	1.70 (1.13)			-1.04*	0.73	(0.71)	(0.38)	S/S	(1.19)
5149	-2.95 (-2.61)*	3.57 (3.01)*		-0.32	0.69	(2.08)	(0.58)	S/S	(1.43)
5310	0.49 (0.82)			-0.79*	0.63	(2.09)	(3.04)	S/S	(0.66)
5331	1.21 (0.76)			-0.69*	0.55	(0.39)	(1.72)	S/S	(1.25)
5333	1.45 (1.72)			-1.22*	0.86	(0.22)*	(1.76)	S/S	(0.80)
5411	1.36 (0.61)			-0.91*	0.76	(0.70)	(1.06)	S/S	(1.45)
5413	0.59 (0.45)			-0.89*	0.62	(0.14)	(1.06)	S/S	(2.24)
5415	-1.75 (-0.77)			-0.47	0.40	(0.18)	(2.07)	S/S	(0.97)
5416	-2.23 (-1.59)			-0.50*	0.49	(0.06)	(1.21)	S/S	(0.16)
5417	1.21 (0.98)			-0.47*	0.61	(1.53)	(1.81)	S/S	(0.87)
5419	1.95 (2.29)*			-0.66*	0.46	(0.07)	(1.09)	S/S	(1.36)
5511	-0.76 (-0.45)			-1.15*	0.56	(1.82)	(1.36)	S/S	(1.07)

5512	0.37 (0.17)			-1.20*	0.65	(1.12)	(0.47)	S/S	(0.98)
5530	1.42 (1.45)			-0.94*	0.54	(1.19)	(3.54)	S/S	(1.00)
5541	0.75 (0.41)			-0.79*	0.60	(0.62)	(0.87)	S/U	(1.31)
5811	2.29 (1.41)			-0.65*	0.61	(2.08)	(1.22)	S/S	(0.53)
5812	2.35 (2.44)*			-1.69*	0.89	(1.22)	(1.59)	S/S	(1.83)
5813	-1.49 (-0.42)			-0.96*	0.83	(0.67)	(0.13)	S/S	(2.04)
5819	1.38 (0.55)			-1.04*	0.66	(1.82)	(0.49)	S/S	(0.89)
5992	-0.60 (-0.61)		3.70 (4.29)*	-0.40*	0.80	(0.38)	(0.26)	S/S	(0.83)
5995	-0.84 (-1.11)			-0.31	0.25	(0.45)	(1.42)	S/S	(0.64)
5996	-3.97 (-1.33)			-1.17*	0.51	(0.16)	(1.77)	S/S	(2.49)
5997	0.45 (0.34)			0.00	0.65	(1.24)	(1.33)	S/S	(0.53)
5999	2.11 (1.93)			-1.72*	0.71	(1.32)	(0.31)	S/S	(0.69)

a: * indicates significance at 5% level. b: numbers inside parentheses are t-ratios. c: numbers inside parentheses are F-Statistics.

Probing cointegration as argued by Kremers, Ericsson and Dolado (1992), a negative and significant error correction term (EC_{t-1}) can be seen in most of the cases using either of the reports. Nevertheless, for the 38 commodities that use the US reports, there are two not cointegrated commodities, while using the conventional method of ARDL fails to support cointegration in three cases. One commodity only fails to have any support for cointegration applying either of the techniques. Regarding cointegration using China's reports, which had no support for cointegration under ARDL in eight commodities, using the technique of Kremers, Ericsson and Dolado (1992), we find no support in six commodities only.

Concerning the diagnostic tests using either the US or China's reports, little support is found for misspecification, heteroscedasticity, autocorrelation, and regression instability. The average R^2 for all 38 commodities is moderately higher using US reports, with an average of 70%, while R^2 averages 64% using China's reports.

At any lag length of the short-run REX, 10 commodities carry a significant positive sign using the US data, compared to also 10 using China's data. On the other hand, at any lag length of the short-run REX, using the US data, 10 commodities carry a significant negative sign, while six are significant and negative using China's data.

To assess the overall effect of REX on TB in the short-run, the sum of all significant short-run effects of each commodity is calculated. The results reveal that using US reports, estimated REX is positive in nine commodities and negative in other nine with a positive average of 0.32 for all commodities. However, using China's reports, REX is positive in 10 commodities and negative in two only, the average of these effects stands at 2.27. REX in six commodities is mutually approved to be positive, while no commodity is mutually approved in the case of negative short-run REX.

As can be seen above, using different data yields highly mixed estimates of REX. However, for the case of positive REX, after taking the overall short-run effects of REX into account, the inconsistency drops substantially. The fact that positive REX is mutually approved in six cases out of seven commodities where REX carries a significant sum of short-run effects indicates that US trade deficit is affected by the Yuan depreciation, indeed. The same is also supported by the fact that negative REX is not mutually supported in any case.

The traditional definition of the J-Curve suggests quick trade balance worsening followed by an improvement over later periods when REX depreciation takes place (Bahmani-Oskooee and Ratha 2004). This can be captured by looking at the signs of $\Delta LnREX_t$, $\Delta LnREX_{t-1}$, and $\Delta LnREX_{t-2}$. A pattern of negative significant coefficient(s) followed by a positive significant coefficient(s) indicates the existence of the J-Curve Phenomenon. Therefore, the J-Curve exists in one commodity using Chinese data only (5149: Inorganic chemical products, n.e.s.). This commodity constitutes 0.05% of the US total merchandise with China according to US data, and 0.07% according to Chinese data. However, it is not clear why the bilateral trade balance of this commodity in particular followed the J-shaped adjustment path as a reaction to currency depreciation. As claimed by Wang (2005) 'Such lack of support for the traditional version of the J-Curve may due to the limited lags.' Following the same approach, Wang (2005) found support for the J-Curve in three commodities.

4.3 Long run coefficient estimates

This section lists the regression results for all variables in the long run. Where the results in Table 5 are acquired using the US reports, Table 6 uses China's reports.

Table 5. Long-run coefficient estimates using US reports

code	lnY_{US} [a b]	lnY_c [a b]	$lnREX$ [a b]	C [a b]
5121	-4.62 (-1.22)	2.14 (1.93)	1.86 (1.46)	24.46 (0.89)
5122	-3.19 (-1.02)	0.16 (0.17)	-1.96 (-1.72)	31.37 (1.40)
5123	-1.43 (-0.57)	1.83 (2.46)*	2.01 (2.20)*	-4.89 (-0.27)
5124	-6.93 (-1.77)	1.79 (1.58)	2.85 (2.29)*	50.90 (1.78)
5125	-26.54 (-0.82)	8.38 (0.97)	9.19 (1.07)	182.02 (0.76)
5127	-14.56 (-1.24)	4.91 (1.30)	5.89 (1.36)	96.03 (1.18)
5128	-2.37 (-0.64)	0.98 (0.93)	1.46 (1.06)	13.90 (0.52)
5129	-7.21 (-1.22)	4.72 (2.66)	7.64 (3.27)*	23.17 (0.55)
5132	-2.89 (-0.74)	-1.17 (-1.04)	3.71 (2.10)*	37.08 (1.31)
5133	-116.70 (-0.19)	46.33 (0.18)	138.32 (0.18)	621.41 (0.19)
5135	-9.46 (-2.26)*	2.43 (1.98)	3.82 (2.32)*	70.01 (2.33)*
5136	-6.79 (-0.91)	1.70 (0.78)	-0.07 (-0.03)	53.04 (0.97)
5141	1.09 (0.26)	-0.34 (-0.27)	-0.27 (-0.20)	-6.52 (-0.21)
5142	0.14 (0.02)	0.63 (0.31)	1.47 (0.66)	-8.01 (-0.17)
5143	-0.73 (-0.32)	0.04 (0.07)	-1.24 (-1.56)	7.96 (0.47)
5149	-27.89 (-3.86)*	6.24 (3.09)*	8.76 (3.75)*	215.48 (4.05)*
5310	-9.69 (-3.30)*	1.81 (2.22)*	2.62 (2.46)*	79.48 (3.67)*
5331	-20.49 (-1.14)	6.85 (1.27)	6.84 (1.37)	136.55 (1.07)
5333	7.74 (3.79)*	-2.55 (-4.24)*	-0.31 (-0.43)	-54.39 (-3.66)*
5411	15.00 (1.29)	-5.68 (-1.65)	-7.73 (-1.99)	-91.49 (-1.10)
5413	-15.60 (-3.50)*	4.88 (3.69)*	3.83 (2.26)*	108.94 (3.42)*
5415	12.34 (1.65)	-2.88 (-1.35)	-6.09 (-2.36)*	-90.55 (-1.66)
5416	-1.65 (-0.21)	0.96 (0.42)	4.03 (1.13)	5.73 (0.10)
5417	-5.68 (-1.69)	1.20 (1.25)	0.82 (0.67)	44.72 (1.81)
5419	9.48 (1.48)	-3.33 (-1.72)	-4.91 (-1.71)	-59.14 (-1.31)
5511	-13.83 (-3.43)*	2.26 (1.89)	1.86 (1.26)	116.93 (4.07)*
5512	-47.28 (-2.71)*	12.94 (2.73)*	17.06 (2.94)*	340.08 (2.68)*
5530	8.21 (4.52)*	-1.91 (-3.78)*	-2.34 (-3.39)*	-61.97 (-4.61)*
5541	3.56 (0.97)	-0.92 (-0.90)	-3.74 (-2.76)*	-23.12 (-0.85)
5811	0.71 (0.05)	-0.16 (-0.04)	-1.11 (-0.17)	-5.21 (-0.05)
5812	-2.84 (-0.94)	1.34 (1.55)	2.78 (2.74)*	13.26 (0.59)
5813	12.72 (1.12)	-0.75 (-0.23)	-0.84 (-0.19)	-121.02 (-1.45)
5819	10.59 (2.37)*	-3.68 (-2.92)*	1.98 (1.10)	-73.23 (-2.21)*
5992	3.02 (1.10)	0.41 (0.51)	0.05 (0.06)	-34.05 (-1.72)
5995	20.13 (0.56)	-8.58 (-0.63)	-30.05 (-0.69)	-101.11 (-0.48)
5996	-2.61 (-0.56)	0.67 (0.49)	-1.57 (-0.94)	21.91 (0.64)
5997	-12.41 (-2.20)*	3.18 (1.90)	2.45 (1.14)	92.60 (2.27)*
5999	0.76 (0.45)	0.27 (0.56)	1.47 (2.32)*	-11.71 (-0.93)

a: numbers inside parentheses are t-ratios. b: * indicates significance at 5% level

Table 6. Long-run coefficient estimates for China data

code	lnY_{US} [a b]	lnY_c [a b]	$lnREX$ [a b]	C [a b]
5121	-1.14 (-0.21)	1.21 (0.76)	-0.66 (-0.32)	0.37 (1.01)
5122	-4.78 (-1.70)	1.17 (1.44)	1.07 (1.03)	35.49 (1.73)
5123	-5.37 (-2.22)*	2.19 (3.04)*	0.57 (0.79)	32.63 (1.87)
5124	-13.81 (-2.47)*	4.27 (2.64)*	4.27 (2.64)*	94.96 (2.35)*
5125	-20.64 (-0.95)	7.12 (1.20)	7.70 (1.24)	135.48 (0.84)
5127	-15.50 (-1.56)	5.80 (1.72)	5.56 (1.59)	96.72 (1.45)
5128	1.24 (0.14)	0.28 (0.10)	-2.64 (-0.72)	-13.81 (-0.22)
5129	10.02 (2.30)*	-1.69 (-1.32)	-0.05 (-0.03)	-84.36 (-2.66)*
5132	-8.21 (-2.36)*	0.08 (0.08)	5.32 (3.47)*	77.30 (3.08)*
5133	-21.06 (-2.32)*	6.72 (2.57)*	12.56 (3.57)*	140.48 (2.13)*
5135	-6.14 (-2.04)*	2.23 (2.57)*	3.37 (3.23)*	38.79 (1.77)
5136	-9.23 (-1.41)	2.38 (1.29)	-0.90 (-0.37)	0.72 (0.01)
5141	-3.15 (-1.75)	1.62 (3.01)*	-0.51 (-0.87)	18.35 (1.41)
5142	-5.56 (-1.17)	3.41 (2.42)*	-0.06 (-0.03)	24.77 (0.72)
5143	3.30 (1.58)	-1.21 (-2.05)*	-1.61 (-2.11)*	-20.72 (-1.35)
5149	-18.96 (-3.98)*	3.60 (2.59)*	5.21 (3.58)*	153.47 (4.45)*
5310	-1.63 (-1.23)	0.31 (0.83)	0.33 (0.69)	13.99 (1.43)
5331	-4.41 (-0.95)	2.12 (1.49)	2.66 (1.61)	22.69 (0.69)
5333	-7.34 (-2.38)*	3.39 (3.34)*	3.49 (2.81)*	38.06 (1.78)
5411	8.66 (1.96)	-2.65 (-2.10)*	-1.88 (-1.14)	-59.28 (-1.85)
5413	-2.27 (-0.70)	1.42 (1.48)	3.99 (3.67)*	6.81 (0.29)
5415	-24.32 (-4.06)*	9.20 (5.24)*	14.37 (5.52)*	149.51 (3.50)*
5416	5.61 (0.47)	-2.69 (-0.88)	3.80 (0.90)	-34.49 (-0.38)
5417	-7.16 (-0.88)	0.16 (0.07)	-3.97 (-0.92)	71.95 (1.24)
5419	-1.59 (-0.52)	-0.49 (-0.53)	3.12 (2.80)*	18.92 (0.86)
5511	-9.57 (-3.22)*	-9.57 (-3.22)*	1.60 (1.82)	80.20 (3.75)*
5512	-15.83 (-2.79)*	3.76 (2.40)*	4.47 (2.24)*	120.05 (2.86)*
5530	7.74 (3.57)*	-1.54 (-2.50)*	-1.71 (-2.09)*	-61.58 (-3.87)*
5541	-18.62 (-4.62)*	5.57 (4.90)*	-0.04 (-0.03)	136.22 (4.56)*
5811	-15.55 (-1.44)	6.98 (1.72)	11.37 (1.82)	19.88 (1.17)
5812	3.27 (1.48)	0.82 (1.29)	2.54 (2.55)*	-43.79 (-2.50)*
5813	26.13 (2.07)	-4.65 (-1.37)	-15.40 (-2.39)*	-210.83 (-2.29)*
5819	12.22 (1.76)	-3.76 (-1.93)	-0.20 (-0.08)	-87.14 (-1.69)
5992	10.73 (2.89)*	-1.16 (-1.11)	3.00 (1.96)	-99.86 (-3.65)*
5995	3.20 (0.52)	-0.81 (-0.45)	-0.46 (-0.22)	-24.72 (-0.55)
5996	-2.97 (-0.76)	0.63 (0.55)	-0.47 (-0.34)	24.92 (0.87)
5997	-14.82 (-3.97)*	4.38 (4.16)*	7.09 (5.57)*	101.25 (3.69)*
5999	-2.15 (-0.84)	1.11 (1.51)	1.90 (2.17)*	8.94 (0.48)

a: numbers inside parentheses are t-ratios. b: * indicates significance at 5% level

Similarly, the long-run coefficient estimates seem highly mixed if different trade data sources are used. Employing China's data, REX is significant and negative three commodities and positive in 13. However, using US data yields 3 negative coefficients and 11 positive. The long-run positive effect of REX on TB is supported mutually in eight commodities, compared with one for inverse coefficients. Clearly, the inconsistency in the long-run coefficient estimates using different reports seems much lower in the case of positive REX compared to negative. Additionally, the average size of the long-run significant REX coefficients is 3.17 using US reports, compared to 3.31 using China's reports, which is positive and very close in both cases. These findings are in line with the short-run results provided in section 4.2, which also suggested that changing the data source has much less effect on positive estimates of REX compared to negative. All this adds more evidence that Yuan depreciation does actually hurt the US bilateral trade balance.

As argued by Rose and Yellen (1989), the J-Curve can also be defined as the long-run improvement of the trade balance after a depreciation in the real exchange rate (Bahmani-Oskooee and Brooks 1999). Thus, regardless the sign of the short-run coefficients of REX, a significant and positive estimate in the long-run can place enough evidence for the J-Curve, which also means that Marshall-Lerner Condition is satisfied (please refer to section 2). Following the modern definition of the J-Curve, the reports of the US suggest its existence in 11 commodities, which represents 29% of the total number of commodities. On the other hand, using China's reports reflects the Phenomenon in 13 commodities (34.2%). In reference to Wang (2005), 34 commodities out 88 had long run positive estimate, which constitutes nearly 40%.

5. Conclusion

Following the literature on US-China bilateral trade data discrepancy, both the US and Chinese trade data are highly inaccurate. Based on this notion, this study investigated the dynamic effects of real exchange rate movements on bilateral trade balance using both trade data sets independently. Most interestingly, the coefficients suggesting that Yuan depreciation increases the US bilateral trade deficit with China seemed much more consistent compared with the coefficients claiming the opposite in the short and long run. Moreover, although cointegration among variables can be generally established through using the data reported by either partner, the discrepancy can substantially deteriorate the accuracy of assessing the US-China trade and exchange rate dilemma.

The high inconsistency in regression results when using the data provided by each partner suggests the estimation problem is more complicated than the way presented in the literature. For the time being, since no studies on trade data reconciliation have yet produced usable data on long spans, we recommend future empirical studies to follow the concept of Mutual Confirmation as a robustness check for the results. Researchers are invited to consider the results reliable if the estimated coefficients are statistically significant and carry equal or similar magnitudes using either trade data source.

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