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Do exchange rate changes have symmetric or asymmetric effects on the trade balance? Evidence from U.S.–Korea commodity trade☆

Mohsen Bahmani-Oskooee[a,*], Jungho Baek[b]

[a] The Center for Research on International Economics, The Department of Economics, University of Wisconsin-Milwaukee, Milwaukee, WI 53201, United States
[b] Department of Economics, School of Management, University of Alaska Fairbanks, United States

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ABSTRACT

Previous studies of the effects of exchange rate changes on Korea's trade balance have assumed symmetry between currency depreciation and appreciation. In this paper, we distinguish between the two to show that the effects at the industry level are in fact asymmetrical in most industries for Korea's bilateral trade with the U.S. We employ an auto-regressive distributed lag (ARDL) approach using quarterly data for the period 1989–2014 for the 79 3-digit industries in which trade between Korea and the U.S. took place. Overall, our model incorporating differentiated responses for appreciation versus depreciation reveals a more significant impact of the exchange rate on commodity trade between Korea and the U.S. than a more standard model that imposes symmetry.

1. Introduction

Since the advent of error-correction modeling and cointgeration tests, time series relationships of all kinds have been revisited, and the link between the trade balance and the real exchange rate is no exception. A vast literature on this topic exists for most countries, Korea included. The literature on Korean may be classified into three categories, with some studies including Korea as one of a number of countries in a sample. The first category includes studies that have assessed the effects of currency depreciation on the Korean trade balance with the rest of the world. The list includes Bahmani-Oskooee (1985, 1989), Bahmani-Oskooee and Malixi (1992), Hsing and Savvides (1996), Lal and Lowinger (2002), Chang (2005), Hsing (2005), and Buyangerel and Kim (2013). These studies have not found strong support for an effect from depreciation, either in the short run or in the long run.[1]

For studies that examine trade flows between Korea and rest of the world, aggregation bias is a concern. To reduce the bias, a second category of studies has focused on bilateral trade between Korea and specific trade partners. The list includes Wilson (2001), Bahmani-Oskooee and Ratha (2004), Bahmani-Oskooee, Goswami, and Talukdar (2005), Sim and Chang

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* Corresponding author.
E-mail addresses: bahmani@uwm.edu (M. Bahmani-Oskooee), jbaek3@alaska.edu (J. Baek).
[1] For a comprehensive review of the literature see Bahmani-Oskooee and Hegerty (2010).

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(2006), Mustafa and Rahman (2008), Chang (2009), Kim (2009), Bahmani-Oskooee and Harvey (2010), and Wang, Lin, and Yang (2012). For these studies, results on the impact of a currency depreciation have been mixed.

Studies in the second category may also suffer from aggregation bias, however, in that they rely on aggregate exports and imports between Korea and its trade partners. To address this bias, Bahmani-Oskooee and Zhang (2014) disaggregated trade flows by industry for Korea and the rest of the world and found that in the short run the trade balance for 91 of 148 industries was affected favorably by depreciation while in the long run the effect was limited to only 26 industries. This study suffers from yet another form of aggregation bias, however, in that a real effective exchange rate based on aggregate trade is applied. To ameliorate this bias, Bahmani-Oskooee, Xu, and Saha (2016) concentrated on Korea's trade with the U.S. and the won-dollar exchange rate applied to 69 industries.[2] They found that while the trade balance of most industries was affected by currency depreciation in the short run, a far more limited number of industries benefited in the long run.[3]

A common assumption behind all models employed by the studies surveyed above is that the effects of exchange rate changes on the trade balance are symmetric, meaning that to the degree that depreciation improves the trade balance, appreciation must worsen it. How valid is this assumption? Could the effects of exchange rate changes in fact be asymmetric? An asymmetric effect is arguably a possibility since traders could have different reactions and different expectations when a currency depreciates than when it appreciates. Furthermore, when a currency depreciates, producers may react quickly to satisfy the demand for exports. However, they may not respond as fast to appreciation if it means adding to inventories rather than drawing them down or adjusting production. The main purpose of this paper is to test this hypothesis by using industry-specific trade flows between Korea and the U.S. To that end, we introduce our method in Section 2. Section 3 presents empirical results which are largely supportive of asymmetric effects of exchange rate changes. Finally, Section 4 concludes. Variable definitions and data sources are given in an Appendix.

2. Models and methods

To test the hypothesis that exchange rate movements have asymmetrical effects using Korean-U.S. trade flows at industry or commodity level, we adopt the specification of Bahmani-Oskooee et al. (2016) and others given by Eq. (1):

$$\ln\left(\frac{M_i}{X_i}\right)_t = a + b\ln Y_t^{US} + c\ln Y_t^{KOR} + d\ln REX_t + \varepsilon_t. \tag{1}$$

The model is specified from the U.S. perspective, meaning M_i is defined as U.S. imports of commodity i from Korea and X_i as U.S. exports of commodity i to Korea. The commodity trade ratios are unit free allowing us to the model in log-linear form. The determinants of the commodity trade balances are given as real income in the U.S. denoted by Y^{US}, real income in Korea denoted by Y^{KOR}, and the real bilateral exchange rate denoted by REX. We expect the estimate of b to be positive and that of c to be negative. REX is defined such that a decrease signifies depreciation of the U.S. dollar, hence we expect the estimate of d to be positive.[4]

Eq. (1) is a long-run model with the estimated coefficients reflecting the long-run effects of the exogenous variables on industry i's trade balance. In order to infer short-run effects, in particular with regard to the real exchange rate (i.e., the J-curve effect), we specify Eq. (1) in an error-correction format as follows:

$$\begin{aligned}\Delta\ln\left(\frac{M_i}{X_i}\right)_t = \alpha + \sum_{k=1}^{n}\beta_{t-k}\Delta\ln\left(\frac{M_i}{X_i}\right)_{t-k} + \sum_{k=0}^{n}\delta_{t-k}\Delta\ln Y_{t-k}^{US} + \sum_{k=0}^{n}\gamma_{t-k}\Delta\ln Y_{t-k}^{KOR} + \sum_{k=0}^{n}\pi_{t-k}\Delta\ln REX_{t-k} + \lambda_1\ln\left(\frac{M_i}{X_i}\right)_{t-1} \\ + \lambda_2\ln Y_{t-1}^{US} + \lambda_3\ln Y_{t-1}^{KOR} + \lambda_4\ln REX_{t-1} + \mu_t.\end{aligned} \tag{2}$$

Pesaran, Shin, and Smith (2001), who favor such a specification, recommend applying the standard F test to test the null hypothesis $H_0: \lambda_1 = \lambda_2 = \lambda_3 = \lambda_4 = 0$ against the alternative of $H_1: \lambda_1 \neq 0, \lambda_2 \neq 0, \lambda_3 \neq 0, \lambda_4 \neq 0$. If the calculated F statistic is significant, the null is rejected in favor of the alternative hypothesis and the variables are said to be cointegrated. They demonstrate that the F test in this context has new critical values, which they tabulate. These critical values account for integrating properties of the variables ruling out pre-unit root testing.[5] Once cointegration is established, the error-correction component of Eq. (2) is set equal to zero and the long-run effects are derived by normalizing estimates of λ_2–λ_4 on λ_1.[6] The short-run effects are judged by the estimates of coefficients attached to first-differenced variables.

A major assumption behind Eq. (2) is that a change in any of the exogenous variables has symmetric effects on the trade balance of industry i. For the exchange rate, this assumption implies that if depreciation improves the trade balance,

[2] These 69 industries for which continuous time-series data were available engaged in almost 70% of the trade between Korea and the U.S.

[3] Baek (2012) is another study that has investigated the impact of exchange rate changes on the U.S.–Korea trade at industry level. However, rather than estimating a trade balance equation for each industry, he estimates import and export demand models separately and investigates the response of each industry's in-payments (exports) and out-payments (imports) to exchange rate changes.

[4] The real bilateral exchange rate between the U.S. dollar and the Korean won, REX, is defined as $P^{US} \times NEX/P^{KOR}$ where P^{US} is the price level in the U.S., NEX is the nominal exchange rate defined as number of won per dollar, and P^{KOR} is the price level in Korea. Price levels are measured by the consumer price index.

[5] Under this approach, variables could be a combination of $I(0)$ and $I(1)$. We have applied the augmented Dickey-Fuller test to all variables in this paper to ensure we have no I(2) variables.

[6] For more details on the procedure, see Bahmani-Oskooee and Fariditavana (2015).