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Exchange rate and transport cost sensitivities of bilateral freight flows between the US and China

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ABSTRACT

This paper explores the long-run impacts of gross domestic product, exchange rate, and transport costs on bilateral air and ocean freight flows between the US and China. The study employs a cointegration framework by using export and import data over the period of 2003:Q1-2014:Q2. Results show that gross domestic product is the key determinant of bilateral freight flows, indicating that real income of a trading partner is a driving force of the bilateral freight flows between the US and China. In examining the sensitivities of the bilateral trade flows, air freight flows are found to be more responsive to a real income change than ocean freight flows. The bilateral exchange rate is a significant factor affecting the freight flows from China to the US, suggesting that a US dollar appreciation against the Chinese yuan increases the inflows of Chinese commodities to the US. The impacts of the bilateral exchange rate and transport cost are found to vary at industry and commodity levels. These findings support the importance of employing disaggregate data in the bilateral freight flow analysis.

1. Introduction

The trade between the United States (US) and China has grown rapidly since a bilateral trade agreement was implemented in 1979. According to US Congressional Research Service (Morrison, 2014), total bilateral trade between the two countries reached $562 billion in 2013. China is the second-largest US trading partner, the third-largest US export market, and the largest source of US imports. The US–China trading volume has risen substantially, with total US export volume to China having reached more than 588 billion kilograms in 2013, up from 332 billion kilograms in 2003 (Census, 2015). Both air and ocean freight flows reached a record high level in 2013.

Although US–China economic ties have substantially expanded over the past decade, there are political and academic debates on the bilateral trade between the two nations (Morrison, 2011). From the US trade perspective, the largest and most important dispute between the US and China is a growing US trade deficit in which US imports well exceeds its exports. More than $342 billion of the US trade deficit with China was reported in 2014 (Census, 2015). Recently, US policymakers argued that Chinese polices have increased the resistance to appreciate the Chinese yuan against the US dollar, which significantly contributed to the US trade deficit (Blecker, 2013; Bayraktar, 2014; Morrison, 2014). However, existing literature provides insufficient evidence that the appreciation of the Chinese yuan improves the US trade deficit.

There are conflicting empirical results concerning the trade and bilateral exchange rate between the US and China. A group of studies found a significant role of the bilateral exchange rate in the US–China trade (Chou, 2000; Bahmani-Oskooee and Wang, 2007 and 2008; Baak, 2008; Bahmani-Oskooee and Xu, 2012). For example, Bahmani-Oskooee and

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Wang (2007) investigated the short- and long-run effects of the bilateral exchange rate on the US–China trade. Using industry-level data, the study found evidence that the yuan-dollar exchange rate has a significant impact on the bilateral trade. Baak (2008) employed a fully-modified ordinary least squares (FMOLS) technique to examine the long-run effects of the yuan-dollar exchange rates. The results showed that a 1% depreciation of the Chinese yuan increases the Chinese exports to the US by 1.7%, while a 1% depreciation of the US dollar increases the US exports to China by 0.4%.

In contrast, another group of studies (Zhang, 1999; Groenewold and He, 2007; Zhang, 2012) found empirical evidence that the bilateral exchange rate has little effect on the trade, suggesting that the revaluation of the Chinese yuan does not correct the trade imbalance. For instance, Zhang (1999) adopted the Johansen maximum-likelihood procedure and found a moderate impact of the real effective exchange rate on the China's trade balance. Groenewold and He (2007) found that the long-run impacts of Chinese currency revaluations on the US–China trade ranged from 10% to 50% and concluded that improvements from a revaluation of the Chinese yuan in the trade balance would be very modest.

From a shipper's perspective, it is important to advance understanding of the main determinants of their commodity flows and determine the extent of their export and import flow sensitivities to a change of these determinants (e.g., Cerra and Dayal-Gulati, 1999; Coto-Millán et al., 2005). For example, a decline in transport and logistics costs in the US can lead to a rise in the competitiveness of US products in Chinese markets, which in turn, increase outflows of US commodities to China. Assessing the long-run impact of transport cost changes on bilateral commodity flows may help shippers determine the needs for freight transport infrastructure and service expansions, and re-shape their operations.

Numerous studies have investigated the relationship between transport costs and international trade (Geraci and Prewo, 1977; Hummels, 2007; Baier and Bergstrand, 2001; Limao and Venables, 2001; Sánchez et al., 2003; Martínez-Zarzoso and Suárez-Burguet, 2005; Martínez-Zarzoso et al., 2008). For example, Baier and Bergstrand (2001) examined the determinants of world trade and found that about 67% and 8% of world trade growth can be explained by income growth and transport-cost reductions, respectively. Martínez-Zarzoso and Suárez-Burguet (2005) used a gravity model for sectoral imports in Latin American countries and found that improving transport infrastructure and port efficiency contributes to transport cost reduction and trade growth. Martínez-Zarzoso et al. (2008) used disaggregate industry data to estimate the elasticity of trade with respect to transport costs. The results showed that transport costs have a significant negative impact on trade flows; high value-added industries (household appliances and vehicle parts) are more sensitive to a transport cost change than low value-added industries (agro-industry and ceramics). Although past research found evidence that transport costs have a significant impact on trade flows and their effects can vary by industry, no study has attempted to explore the effect of transport costs on bilateral US–China trade flows by using disaggregate data. Therefore, the existing literature lacks empirical evidence on the transport cost elasticities of air and ocean freight flows between the US and China.

To tackle these US–China trade core issues, this paper investigates the long-run impacts of real income, exchange rate, and transport costs on bilateral US–China trade flows by air and vessel. The main focus of the paper is to examine the sensitivity of bilateral US–China trade flows with regard to exchange rate and transport cost changes. For this purpose, the paper adopts the autoregressive distributed lag (ARDL) approach to cointegration, proposed by Pesaran et al. (2001). A distinct advantage of the ARDL approach over standard cointegration techniques is that the ARDL can be applied regardless of whether underlying regressors are purely $I(0)$, purely $I(1)$, or fractionally integrated (Pesaran and Pesaran, 1997). Therefore, it does not require a pre-testing procedure (i.e., a unit root test). To provide new insights into the main determinants of the bilateral trade and commodity flows, this paper uses both aggregate and disaggregate industry data. The empirical results are derived from quarterly data for the period of 2003:Q1-2014:Q2 (15-industry and 50-commodity data). To the best of our knowledge, this study is the first that empirically analyzes the long-run effect of transport costs on bilateral US–China trade flows at an industry level. Our findings could be used to help policymakers, exporters, and importers develop a long-term strategic plan for air and ocean freight services.

The remainder of the paper is organized as follows. In Section 2, the study outlines the method and the ARDL procedure used in this study. Section 3 provides the data and empirical results of long-run coefficient estimates of the bilateral freight flows between the US and China. The determinants of the bilateral air and ocean freight flows are examined at aggregate and disaggregate industry levels. The last section concludes with key findings and important policy insights derived from the findings.

2. The method and the models

To investigate the dynamic impacts of economic growth, exchange rate, and transport costs on bilateral trade flows between the US and China, this paper modifies export and import models developed by Bahmani-Oskooee and Goswami (2004) and Bahmani-Oskooee and Ardalani (2006). The general form of export and import models can be represented as follows:

$$EXP = EXP(Y^*, ER, TC) \tag{1}$$

$$IMP = IMP(Y, ER, TC^*) \tag{2}$$

where the export volume or quantity (EXP) is a function of the real income in a trading partner (Y^*), the bilateral exchange rate (ER), and the transportation costs in the home country (TC). Similarly, the import volume (IMP) depends on the real domestic income (Y), the bilateral exchange rate (ER), and the transportation costs in a trading partner (TC^*).