Contents lists available at SciVerse ScienceDirect

Journal of Monetary Economics

Trade wedges, inventories, and international business cycles

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ARTICLE INFO

ABSTRACT

The large, persistent fluctuations in international trade that cannot be explained in standard models by changes in expenditures and relative prices are often attributed to trade wedges. We show that these trade wedges can reflect the decisions of importers to change their inventory holdings. We find that a two-country model of international business cycles with an inventory management decision can generate trade flows and wedges consistent with the data. Moreover, matching trade flows alters the international transmission of business cycles. Specifically, real net exports become countercyclical and consumption is less correlated across countries than in standard models. We also show that ignoring inventories as a source of trade wedges substantially overstates the role of trade wedges in business cycle fluctuations.

Published by Elsevier B.V.

1. Introduction

The recent global collapse and rebound of international trade has renewed interest in understanding both the determinants of the cyclical fluctuations of international trade and the role of international trade in transmitting business cycles across integrated economies. Our understanding of international business cycles is limited, however, by the failure of standard models to account for the dynamics of international trade. As Levchenko et al. (2010) forcefully document, international trade tends to fluctuate much more than can be explained in standard models by the changes in expenditures on traded goods and relative prices. This is true even once one carefully controls for the different composition of the goods that are traded or consumed.[1] Since nearly all models of international business cycles fail to generate the magnitude of trade fluctuations observed in the data, these models lack a potentially important channel in the international propagation of business cycles.

In this paper, we consider a model of international trade and inventory management that can generate sizable fluctuations in international trade flows, similar to those observed in the data. We then use our model to re-examine the role of trade in propagating business cycles internationally. We find that the model generates countercyclical real net exports and relatively less comovement of consumption across countries. Hence, adding inventory frictions allows us to make progress on two dimensions along which standard models fair poorly: the cyclicality of real net exports and the consumption–output anomaly.

We focus on inventories in a business cycle setting because inventory management decisions have been shown to be an important feature in international trade. Since international trade takes time and is relatively costly, firms that engage in international trade tend to hold much larger stocks of inventories. Our previous work, Alessandria et al. (2010a, 2010b),

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[1] Eaton et al. (2010) also study the recent trade collapse. They focus on the changes in the ratio of trade to GDP and attribute a large fraction of these movements to trade being relatively intensive in durables. Engel and Wang (2011) also focus on the role of durables in the volatility of trade. In our analysis, we focus on the movements of trade that cannot be accounted for by composition.

documents the role of inventories in international trade empirically. We document, using various sources of data, that importers hold much larger inventory stocks than non-importers do and order goods much less frequently. Moreover, we also show that inventories account for a sizable fraction of the import collapses following large devaluations or in the recent global recession. For example, Alessandria et al. (2010a) show that at the height of the trade collapse, US imports of automobiles fell more dramatically than final sales of imported autos in the US. Similarly, during the rebound of US trade, US imports of autos grew much faster than final sales of imported autos. US inventories of imported cars followed suit, falling during the collapse and being restocked during the trade recovery.

Motivated by these observations, we develop a model with domestic and foreign inventories that allows us to quantify the role of inventories in trade movements. In doing so, we introduce a dynamic component into the interpretation of trade wedges garnered from static (within-period) optimality conditions. We take a standard two-country real business cycle model and introduce a retail sector that has a stockout avoidance motive for holding inventories.[2] Our model is quite tractable as it introduces a small number of additional equilibrium conditions with analytical solutions. The analytical solutions shed light on the both the long-run and cyclical determinants of inventory investment. The additional parameters are disciplined by the salient facts on the inventory holdings of imported and domestically produced goods in the data. Since we find that inventories are important, we emphasize that, given its simplicity, our approach can be easily applied to other work on international business cycles.

Our first goal is to see whether a plausibly calibrated model of inventory management and international trade can generate volatile and persistent fluctuations in international trade that are largely attributed to movements in a trade wedge of the type documented by Levchenko et al. (2010). We find that with the inventory mechanism we propose and international business cycles driven by productivity shocks, our model generates sizable fluctuations in inventories. These movements in inventories generate, in turn, large fluctuations in international trade and the trade wedge. Moreover, we find that the sources of these wedges matter a great deal. Our inventory-generated wedges imply fluctuations in consumption and output that are in line with the data. With wedges from "exogenous" taste or trade cost shocks, consumption becomes three times as volatile as in the data and these shocks account for an unreasonably high one-third of all aggregate fluctuations in output.

Our second goal is to explore whether a model with the appropriate fluctuations in international trade can generate international business cycles that match the data along other dimensions. Specifically, we consider two well-known failures of standard international business cycle models. First, as Raffo (2008) points out, standard models do not generate countercyclical real net exports, when the movements in investment in the model are constrained to match the data. With this constraint, exports expand more than imports and real net exports are procyclical. Second, Backus et al. (1994, BKK hereafter) show that standard trade models predict consumption to be more correlated across countries than output, the opposite of what is observed in the data. This anomaly is now referred to as the consumption–output anomaly.[3]

We find that our model with inventories can make substantial progress regarding both of these failures of the standard model. Our model generates net exports that are countercyclical despite the fact that it accounts well for the variability of investment in the data. With inventories, following a good shock, imports expand more strongly and exports are dampened as domestic firms build their inventories of both goods. These dynamics reflect the different dynamics of net inventory investment and investment in equipment. In both the data and the model, net inventory investment movements are sharp but not very persistent, while investment in equipment has smaller and more persistent fluctuations.

In terms of the consumption–output anomaly, we find that inventories reduce the correlation of consumption across countries. The idea is simple. It is cheaper to consume from the stock of goods held locally than from goods that must be shipped internationally. Thus, consumption will depend on both the shocks and the stock of goods available. Since the stocks can move differently across countries, consumption becomes less correlated. For the same reasons, we also find that inventories tend to reduce the synchronization of production across countries, but the effect on consumption is much stronger.

Our paper is related to many papers that study trade dynamics and business cycles empirically and theoretically.[4] In terms of quantitative work, our paper is closely related to the work by Backus et al. (1992, BKK hereafter) and Stockman and Tesar (1995). BKK show that standard trade models imply a very tight link between relative quantities and relative prices and that, given this tight link, it is impossible for equilibrium business cycle models to generate relative prices and quantities that match the data. Stockman and Tesar show that shocks to tastes can break the link between relative quantities and prices and create a trade wedge. They consider the role of these shocks in the propagation of business cycles. Unlike their work, which takes the wedge as exogenous, we focus on understanding the source of the wedge. In our analysis, we show that the transmission of business cycles looks markedly different with endogenous wedges arising from inventories than with exogenous wedges arising from taste shocks or trade costs. Indeed, with only exogenous wedges, these taste shocks become an important driver of aggregate fluctuations. Lastly, this paper is related to our own work on inventories and trade. Similar to Alessandria et al. (2010b), we also develop a general equilibrium model of international

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[2] Our earlier quantitative work on the recent recession (Alessandria et al., 2010b) applied a model without capital investment. It therefore lacked an important element for a quantitative analysis of international business cycle properties. The option of investing in capital and inventories, and their relationship with interest rates, has been shown to be important in analyzing the role of inventories in business cycles (Khan and Thomas, 2007a).

[3] See Baxter and Crucini (1995) who propose one resolution to this puzzle, namely, incomplete markets and adding permanent productivity shocks.

[4] Husted and Kollintzas (1984) study import dynamics in the presence of inventory dynamics in a partial equilibrium model (Khan and Thomas, 2007a, b).