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On the stability of intra-industry trade ☆

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ABSTRACT

This paper presents the novel finding that, in contrast to what the previous literature has shown, two-way intra-industry trade (IIT) in product–country pairs, when looked from a dynamic perspective, is very unstable by using disaggregated trade data of OECD countries. Many products frequently switch among two-way, one-way and zero trade over time. To measure the stability of two-way trade, we propose a measure that we refer to as the "IIT stability index". Our estimation results using the proposed measure show that two-way trade involving markets of different sizes and long distance are likely to be unstable and primary products are more unstable than manufactured products.

1. Introduction

The literature of international trade has shown that two-way trade within a sector, so-called intra-industry trade (IIT), has been increasingly becoming dominant pattern of trade. Welfare gain by IIT through the variety effect is theoretically argued (Krugman, 1980) and empirically shown important (Feenstra and Weinstein, 2016).[1] Many previous studies have proposed various methodologies to measure two-way trade and address the questions of why and how two-way trade occurs. We argue that these measures are all static and once we look at dynamic aspects we observe very unstable feature of IIT. Trade patterns frequently switch from one type to another among the three types, namely zero trade, one-way trade and two-way trade (i.e., IIT). This dynamic aspect in trade patterns is investigated in this paper.

Our investigation yields some empirical evidence. First, trade flows among OECD countries switch between two-way, one-way and zero trade with remarkably high frequency. Two-way trade is much more unstable than expected in the previous literature. Second, the frequent switching can be explained by the GDP and geographical distance between pairs of countries. Two-way trade between large GDP countries with short distance is likely to be sustained, while this trade is more unstable when there are large distances and gaps in GDP. Third, primary products are more unstable than machinery products.

1.1. Literature review

Our empirical investigation follows the recent literature on IIT and can be linked with several current studies.

1.1.1. Trade patterns

Our empirical study is related to three primary strands in the literature for examining the types of trade patterns: (1) heterogeneous firm trade models, (2) stochastic trade models and (3) analysis of sequential exporting and the duration of trade.

The first strand is based on the heterogeneous firm trade model. Helpman et al. (2008) construct a heterogeneous firm trade model and uncover the relationship among the three types of trade patterns. One of their contributions is to show the possibility of switching from two-way trade to one-way and zero trade under a framework of Dixit–Stiglitz monopolistic competition by introducing firm heterogeneity as in Melitz (2003). This approach differs

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[1] It shows that the half of the welfare gains the US enjoyed between 1992 and 2005 comes from the variety effect while the other half from the competition effect.

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from the standard monopolistic competition trade models, such as those of Helpman and Krugman (1985) and Krugman (1980), which always involve two-way trade.[2] A key element of their model is the export beachhead cost, which is a sunk cost for exporting. Since firms are heterogeneous in productivity and profitability, only high productivity firms can be exporters, as they are able to use high operating profits to cover the export cost. By contrast, our focus is a stochastic aspect of trade, that is, how *frequently* or rapidly trade flows for a certain product in a country pair switch across two-way, one-way and zero-trade and what factors explain these switches.

The second strand examines the stochastic aspect in international trade. For example, Eaton and Kortum (2002) add the stochastic aspect to their trade model.[3] They develop a probabilistic formulation by using a Ricardian type of comparative advantage model in a multi-country setting and using a continuum of goods. The model indicates the possibility that a substantial technology difference could result in a case of one-way trade and that some countries might have no exports to some foreign destinations.[4] Much closer to our motivation is Eaton et al. (2011). The model involves idiosyncratic shocks to demand, export costs and productivity.[5] If the temporary shocks are large (e.g., negative demand shock, large positive export costs and/or negative productivity shocks), firms will not be able to export to some destinations in certain sectors, and thus zero-trade and one-way trade could temporarily arise.

The third strand examines sequential exporting and the duration of trade. The duration of exporting products is very short and the hazard rate sharply declines over time (Besedes and Prusa, 2006). Many exporters are likely to give up exporting after a short period due to product- or destination-related shocks, which results in temporary trade (Békés and Muraközy, 2012). A different aspect from this evidence is learning by exporting and sequential exporting. Albornoz et al. (2012), Papageorgiou and Arkolakis (2009) and Buono and Fadinger (2012) find that firms have difficulty in initiating exports due to sunk costs. However, once they start trading, firms learn about foreign markets and thus will face lower demand uncertainty in future periods. In contrast, less productive firms are more likely to stop trading as a result of experiencing demand uncertainty. Although these studies are not directly linked to ours, they can support our empirical finding that IIT at the product-destination level may be less likely to endure over time.

1.1.2. IIT literature

Our empirical strategy is based on the IIT literature. The measure of IIT most commonly used in the literature is the Grubel–Lloyd (GL) index (Grubel and Lloyd, 1975). In the literature, conventional IIT is classified into two types: horizontal IIT (HIIT) and vertical IIT (VIIT). HIIT is defined as IIT *without* a substantial per-unit export and import price gap. In contrast, VIIT is defined as IIT *with* a substantial per-unit export and import price gap. The HIIT and VIIT indices were first proposed by Greenaway et al. (1995) and have subsequently been used by many authors. Using category-level UK trade data from 1988 under the five-digit Standard International Trade Classification system, Greenaway et al. (1995) empirically investigated the determinants of HIIT and VIIT. Subsequently, Aturupane et al. (1999) and Jensen and Lüthje (2009) studied the determinants of HIIT and VIIT using trade data between the EU and Central and Eastern European transition economies from 1990 to 1995 and from 1996 to 2005, respectively.[6] Brülhart (2009) provided a comprehensive description of global IIT and inter-industry trade patterns using worldwide category-level trade data under the six-digit Harmonised System (HS).

Our paper aims to provide some empirical evidence on how and why the three types of trade flows frequently switch over time. For our purposes, “stability” in IIT means no frequent changes in the trade type and sustained IIT. On the other hand, “instability” is defined as the frequent switching among the three types of trade. This paper adds the concept of IIT stability to the literature, starting from the standard IIT methodology.

The rest of the paper is organised as follows. The next section explains the data and the Grubel–Lloyd IIT index and its decomposition. Section 3 proposes an index to measure the stability of IIT and examines the determinants of IIT stability. The final section provides concluding remarks.

2. Data and Grubel–Lloyd IIT index

This section describes the evolution of the conventional IIT index using the GL index. We use OECD country trade data at the 6-digit HS category level for the period of 1994 to 2010. Data are from the UN COMTRADE database. The analyses use the 28 OECD countries, and the choice of the period (1994–2010) is based on the longest possible length of time that allows for balanced panel data in terms of the coverage in each year. A balanced panel is required for our type of analysis because the period of data coverage needs to be identical across countries to compute and compare the IIT stability index, as will be explained below.

The GL index of product category p between country i and j at time t is defined as

$$GL_{ijpt} \equiv 1 - \frac{\left|TRADE_{ijpt} - TRADE_{jipt}\right|}{TRADE_{ijpt} + TRADE_{jipt}},$$

where $Trade_{ijpt}$ refers to exports of product p from country i to country j at time t. The second term represents the index of *inter*-industry trade. The index of *intra*-industry trade is computed as one minus the index of *inter*-industry trade, namely, as the residual.

An aggregate index of total IIT between two countries is conventionally computed by using the share of trade values as weights (e.g., as in Jensen and Lüthje, 2009).

$$IIT_{ijt} \equiv \sum_{p\in\Omega}\left(w_{ijpt} \times GL_{ijpt}\right),$$

where $w_{ijpt} \equiv \frac{TRADE_{ijpt}+TRADE_{jipt}}{\sum_{p\in\Omega}\left(TRADE_{ijpt}+TRADE_{jipt}\right)}$.

Ω indicates a set of all products. Using this, the IIT index is calculated for all the country pairs and the simple average is taken. The evolution of the IIT index is shown in Fig. 1. As has been documented in the IIT literature, the IIT index has been increasing over time. As is well known, the more aggregated the definition of product, the higher the IIT index. Since the variety effect is captured better at disaggregated level such as HS 6-digit, this paper

[2] In the trade models with Dixit–Stiglitz-type monopolistic competition, a monopolistic competition sector always engages in two-way trade, in which goods are always produced and exported to the other country, when trade costs are finite and market sizes are not substantially different. One way to rationalize zero trade is to assume away CES function and allow choke prices, above which all demand is gone (Novy, 2013).

[3] Blum et al. (2013) highlight capital constraints and provide other evidence.

[4] Finicelli et al. (2013), using the Eaton and Kortum (2002) model, provide empirical evidence on the selection mechanism and find how Ricardian comparative advantage affects trade and productivity.

[5] Eaton et al. (2011) use the trade model of Eaton and Kortum (2002) combined with firm heterogeneity as in Melitz (2003) where export-related fixed costs include a fixed-cost shock specific to a product and a destination as well as marketing cost.

[6] Some recent empirical studies find that international production networks substantially increase VIIT and upgrade product quality (e.g. Okubo, 2007; Ito and Okubo, 2012, 2016).