

A NOTE ON INTRA-FIRM TRADE & OFFSHORING IN MANUFACTURING AND SERVICES

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1. Introduction

Increasingly, the recent era of globalization has created key roles for both intra-firm trade and trade in intermediate products. Usually, these are topics that have been dealt with separately (see Feenstra and Hanson [1996] and Brainard [1997]). In this review, we take a brief look at their interaction and possible intersection viz. transnational intra-firm trade in intermediate inputs, both manufacturing and services. In the case of the US, a key phenomenon of interest has been intra-firm imports of intermediate products and services, also known as captive offshoring.

Low-cost offshoring has long attracted many firms in developed countries. Increasingly, however, cost issues, strategic, organizational and other considerations have motivated firms in developed countries to specialize in using imported inputs and intermediate services primarily from their majority owned affiliate

es abroad, instead of from arms' length suppliers. This process of unifying offshoring with intra-firm trade seems to be particularly intense in the case of high tech sectors. Indeed, one of the signal attributes of a manufactured high-tech product today is its extensive and elaborate value-chain, the proliferating number of its component intermediate products and services, and the global, fragmented, nature of the entire production process culminating in the final output, whether a good or a service. Progress in transportation, communications and standardization, as well as global institutional changes have significantly increased the geographically dispersed nature of production. The high-tech value-chain, in particular, is now a multilateral, multinational production mosaic, involving many countries but often just one firm or a group of affiliated firms.

The phenomenon of foreign outsourcing or offshoring is no longer restricted to the manufacturing sectors. Business services offshoring has now been going on for a decade, and jobs and occupations ranging from medical transcription, through payroll to stock market research are being offshored from developed to emerging economies, with a view to importing back the "intermediate services products". As with manufacturing, this kind of offshoring also encompasses both imports from third party firms, as well as from subsidiaries and affiliates in foreign countries. Increasingly, Research & Development and innovative activity is being offshored to captive R&D centers in India, China and East Europe.

The issue of intra-firm trade is inextricably linked to the study of multinationals and of foreign direct investment (FDI). For example, Wilamoski and Tinkler [1999] show that there was a rise in intra-firm trade between the US and Mexico as a result of US FDI in Mexico. Konan's (2000) theoretical model, in particular, shows that intra-firm trade in intermediate goods implies that vertical investment complements rather than substitutes for trade. Another branch of the intra-firm trade literature deals with its determinants. For example, Helpman [1984] develops a model that generates shares of intra-firm trade as a function of relative nation size and variations in relative factor endowments. A large literature also exists on transfer-pricing and taxation issues and their relationship with intra-firm trade (Taylor [2002]), Madan [2000]). Turning to outsourcing, Grossman and Helpman [2002] study the determinants of outsourcing locations in a global economy using a general equilibrium trade model. Bardhan (2009), and Bardhan and Jaffee (2009) deal specifically with captive offshoring in services and in R&D. The choice between captive offshoring and offshoring to third parties abroad is a complex one for both manufacturing and services firms. In an age of efficient inventory control, diversified sources of supply call for immense logistical precision and reliability. Large economies of scale and scope in modern component manufacturing mean that for some firms an affiliate operation is out of the question. Strategic considerations, quality monitoring imperatives and technology transfer constraints often imply that the more routinized, commoditized components, with low-value added get sourced from a foreign contract manufacturer. On the other hand, offshoring of high-end component manufacturing, or high-skill, customized services, such as financial and legal research, for reasons similar to those listed above, is usually carried out at an affiliated facility, and the product or service then shipped back to the home country in an intra-firm transaction.

2. Intra-firm Imports of Intermediate Manufactured Goods

Figure 1 can be helpful in clarifying the relationship between imported intermediate inputs and intra-firm imports (this section is based on Bardhan and Jaffee (2005), which quantifies the relationship between the two). The full 360-degree circle represents the total amount of goods imported by the home country. The right hemisphere (quadrants 1 and 2) show intra-firm imports, either from a foreign affiliate to a home country multinational or from a foreign one to its home country based affiliate. Intra-firm trade can occur in either intermediate inputs or final goods, represented by quadrants (1) and

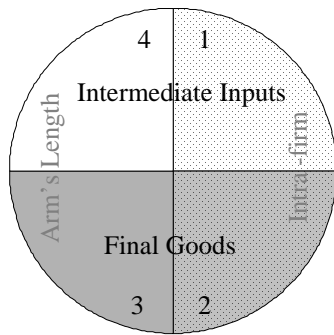
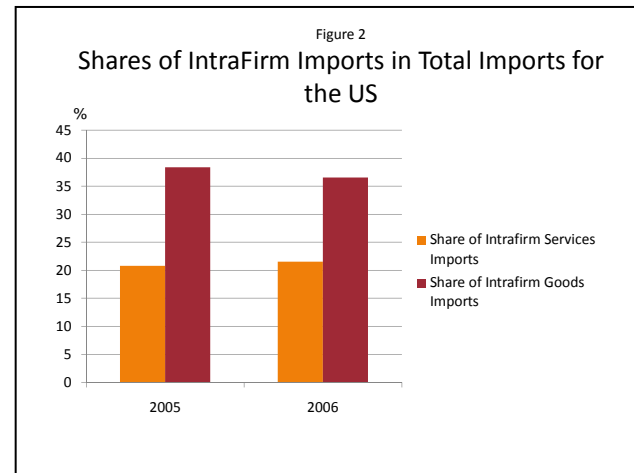


Figure 1. Total Imports into Home country, Classified as Intermediate Inputs or Final Goods and As Intra-Firm or Arm's Length Trade

(2) of the circle respectively. The left hemisphere (quadrants 3 and 4) represents imports from arms' length trading partners. Arms' length trade can also occur in either intermediate inputs or final goods (in quadrants 4 and 3 respectively).

However, the actual magnitude of the intersection of the two, i.e. the amount of imports of intermediates through intrafirm trade is not given by any dataset. The present authors in their 2005 piece mentioned above adopt a simple three step methodology under the premise that since aggregate data do not provide this information directly, data disaggregated by country of origin may be used to develop estimates. First, we compute imported intermediate inputs for the US by combining an input-output matrix based on the 1992 and 1997 US Census of Manufactures with industry import data. Import data by industry and country of origin are then used to estimate imported intermediate inputs by country of origin. Finally, we include intra-firm trade ratios for the US and its trading partner countries from the US Department of Commerce survey data supply and employ a gravity model to develop estimates for the US intra-firm imports of intermediate input products. The survey data shows that in 1997, 52 percent of all US imports were intra-firm imports and 48 percent were arms-length. Also, about 3/5 of all intra-firm imports were carried out by US multinationals, the remainder being imports by the US affiliates of foreign multinationals. More than 70% of the exports to the US from countries such as Japan are carried out through intra-firm trade, while at the other end of the spectrum, imports from Taiwan are primarily of an arms length nature.

Using our first two steps, we estimate that in 1997, 38 percent of all US imports were intermediate goods and 62 percent were final goods. We then modify the standard gravity trade model, where the dependent variable is imported intermediate inputs, by including intra-firm and arms' length goods imports by country as additional explanatory variables. Our key results are: 1) Intra-firm imports were a relatively unimportant source of intermediate inputs as of 1992. Most US intermediate goods imports at that time were the result of arms' length trades.

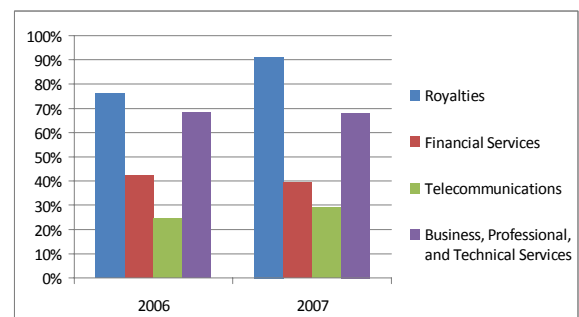


2) By 1997, intra-firm trade, by both US and foreign MNEs had become very important as a source of imported intermediate inputs. However, arms' length trade also remained a significant determinant of US intermediate input imports. 3) Intra-firm trade (not arms' length transactions), and especially imports by US multinationals, were the key constituent of high-tech intermediate input imports, consistent with the view that offshoring has become especially important for high-tech US firms. Indeed, US firms were responsible for more than two-thirds of all imports of high-tech intermediate inputs into the US.

3. Captive Offshoring (Intra-Firm Imports) of Services

Technological advances have made possible the offshoring of jobs which do not require on-location customer service and a local presence in the high-cost developed country. Segments of the services value-chain, as well as white collar, service-oriented tasks in the manufacturing sector, such as accounting and payroll have migrated abroad, mostly to the English-speaking emerging economies, primarily India. Figure 2 shows the share of intrafirm imports in services versus goods for the US. Unlike for manufacturing we cannot carry out a similar exercise to estimate the proportion of intrafirm trade in intermediate services as opposed to final services. However, due to the distinctive nature of services listed below, there is reason to believe

Figure 3 Shares of Intrafirm Imports to the U.S., by Type of Service



that most of the intrafirm services trade is in intermediate categories.

Simple coding, testing for bugs, routinized software development, medical transcription, and similar, relatively low value-added activities were among the first activities to be offshored, and were often farmed off to arms length, third parties in India. In those cases, the possibility of complete contracting and writing-in of most contingencies, given the exhaustively known nature of the activity, its repetitive aspect and commoditization, meant that the parent firm could be secure in the knowledge of complete contractual fulfillment from the third party. The higher the activity is on the value-chain the greater the need for monitoring and control and a corresponding organizational and management solution, whether strategic alliances or joint ventures in the case of turn-key projects, systems integration for large corporate clients or captive R&D centers in the case of critical, proprietary research with potentially fragile

IP assets. Trade in increasingly complex activity dictated increasing internalization and vertical integration, and hence intrafirm trade.

As Figure 2 shows, the share of intrafirm trade in services is less than that in goods/manufacturing. A significant difference in the number and variety of inputs, and the structure of the value chain, which is not as extended as in goods production perhaps argues for less need for the intrafirm mode overall. Also, large segments of services trade are relatively recent. The growing importance of services worldwide, increasing tradability in services, and the opening up of services sectors in developing countries may alter things somewhat. It should be noted that in the four types of services recognized by the General Agreement on Trade in Services (GATS) only Mode 1 (cross-border supply) and partly

Mode 4 (supply through movement of natural persons, e.g. consulting) are compatible with intrafirm trade. The general conflation of production and consumption in the mode of delivery, customization and home country bias favor locally based sales, even if they are not generated by locally owned enterprises. For example, sales by US

multinationals abroad have grown far more rapidly than exports of US services.

Figure 3 seems to suggest that the highest intrafirm shares are in those sectors, such as R&D, high-tech, consulting, information technology etc., where US multinationals have set up captive operations in Bangalore, New Delhi (in India), as well as in other cities in emerging economies, for provision of intermediate service “inputs”.

Figure 4 corroborates the high level of intrafirm imports in “other private services”, which include business, professional, and technical services, insurance and financial services. The high shares of intrafirm payments to India and China based affiliates reflects the intense importing activity carried out by parent firms from captive offshoring units set up by US companies in these countries. On the other hand, in the absence of disaggregated data one can surmise that the high intrafirm shares of payments to Japan and Germany are perhaps the payments of US based affiliates to parent Japanese and German multinationals headquartered there.

4. Intrafirm Trade in R&D or Offshoring of R&D and Innovative Activity

Intrafirm trade in R&D activity is the latest stage of intrafirm trade that started with manufacturing and then extended to services. In the more specific case of intrafirm imports of intermediates or offshoring, the process has climbed up the value chain, starting with offshoring of simple component production, going on to high-tech manufacturing and information technology enabled services activity, and thence to the creation of fully owned, operated and managed R&D centers of western multinationals in the relatively less costly and skill-abundant countries of East Europe, India and China.

As pointed out by Bardhan and Jaffee (2009), factors that determine the global distribution of corporate R&D activity are access to skilled labor, a functioning intellectual prop-

Figure 4

Shares of Intrafirm Trade, in Other Private Services, 2007

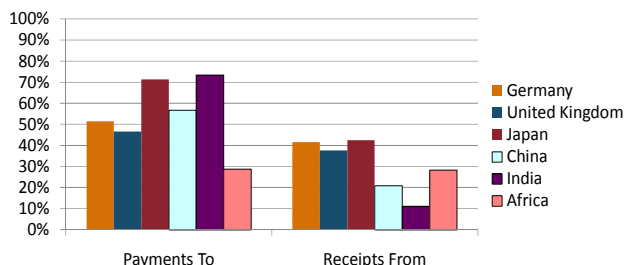
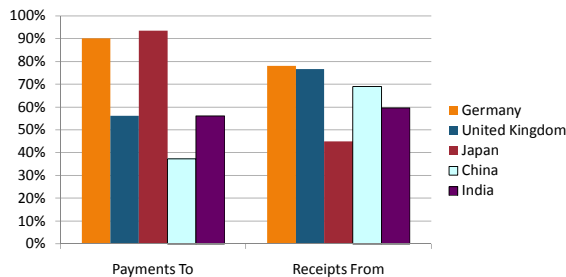


Figure 5

Shares of US Intrafirm Royalties and License Fees, 2007



erty rights regime (IPR), potential market size and sophistication in the potential target countries, and evolving business strategy of the parent firm. The organizational form of R&D trade and offshoring is determined by the critical nature of the activity performed and its uncertain returns. As both Figures 3 and 5 indicate (although intrafirm royalties and license fees may not accurately reflect intrafirm trade in R&D), wholly owned subsidiaries have been the organizational vehicle of choice for most US high tech firms engaged in product development, basic algorithmic research and research/design work of a fundamental nature. A significant number of R&D operations carried out by US firms in countries such as India, China and Russia, e.g. Intel, Microsoft, Google and others, particularly by large multinationals but also some specialized, niche high-tech firms, have been under the aegis of the parent firm, since carrying out R&D abroad under parent firm umbrella is meant to protect proprietary business secrets and intellectual property rights, thus allaying concerns of the shareholders and investors back home. Some vertical disintegration, however, has also taken place. In the case of offshoring of R&D to third parties on a contract basis, the key issues seem to be cost savings and relatively more clearly defined work at the marginal end of the innovation spectrum.

Intrafirm trade is alive and flourishing. Over the decades it has progressed from intrafirm trade in manufactured goods to intrafirm trade in services, and now in R&D. Of particular relevance have been intrafirm imports of intermediate goods and services by firms based in developed countries, or captive offshoring. They too have embraced ever more complex and high-value added activity. Indeed, technological advances and increased globalization seem to have given an added boost to cross-border investments, and increased the scale and scope of intra-firm trade.

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