



Offshoring and intellectual property rights reform[☆]

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ABSTRACT

This paper empirically assesses the responsiveness of US offshoring to intellectual property rights (IPR) reforms in 16 countries. We construct a measure of US offshoring at the industry level based on trade in intermediate goods, covering 23 industries for the period 1973–2006. For each industry, we differentiate between broad offshoring and intra-industry offshoring activities. We conduct a difference-in-difference analysis using the IPR reform years proposed in Branstetter et al. (2006, *Quarterly Journal of Economics*). We find that following IPR reform, neither broad nor intra-industry offshoring intensities change for the typical US industry at conventional levels of significance. However, high-tech (patent-sensitive) industries substantially expand their intra-industry offshoring activities, whereas low-tech (patent-insensitive) industries do not change their intra-industry offshoring activities in a statistically significant way. In addition, high-tech industries increase their broad offshoring relative to low-tech industries, but the effects are smaller and less robust than those estimated for intra-industry offshoring.

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1. Introduction and literature review

Over the past three decades, global trade policies and the composition of world trade have changed dramatically. Many developing countries (the South) started raising their intellectual property rights (IPRs) protection levels and building the necessary institutional framework. This transformation received an additional push in 1995 with the signing of the TRIPS agreement (Trade Related Aspects of IPRs) under the World Trade Organization umbrella, which called for establishing at least a minimum level of IPR protection by 2006.¹

As the global movement towards stronger IPR protection picked up pace, the issue has generated intense debate among policy makers.

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¹ See Maskus (2000) for a comprehensive overview of IPRs and globalization.

The proponents of TRIPS have argued that such a move would reduce the imitation risk faced by Multinational Firms (MNFs) and would encourage more technology transfer and overseas activities. Moreover, it was emphasized that a stronger IPR regime would boost innovation incentives for all firms and thus accelerate global technological progress. Meanwhile, opponents have argued that TRIPS would simply lead to a transfer of rents from the South to the developed world (the North) and hinder the South's ability to implement newly-invented Northern technologies. Thus, the prospects of increased trade and MNF activity were the central motivations for the South to raise their IPR protection and further sign on to TRIPS.

During the past three decades, North–South trade has indeed expanded dramatically. A central feature of this new era of globalization has been the rapid rise in intermediate goods trade, a phenomenon which is referred to as “offshoring”. More specifically, Northern producers fragmented their production processes into a variety of intermediate goods/services, sometimes referred to as tasks,² and distributed them across the globe seeking the lowest-cost production locations. Production of intermediate products took place either within the boundaries of the MNFs (i.e., through foreign affiliates) or outside the boundaries (i.e., through arm's length subcontracting to Southern

² See Grossman and Rossi-Hansberg (2008).

producers or through direct purchases from Southern manufacturers). A large literature has emerged, documenting and investigating the acceleration in trade and offshoring.³

Interestingly, only a few studies have empirically analyzed the effects of IPR regime changes on trade and MNF activities. For example, Maskus and Penubarti (1995) and Smith (1999) examine the relationship between IPR protection and trade using US data at the industry and state levels, respectively. Branstetter et al. (2006, 2011) examine the link between IPRs and MNF activity by considering a variety of MNF measures (such as affiliate assets, affiliate R&D, affiliate overseas sales, intra-firm royalty payments and such).⁴ However, none of the papers in this literature examine the issue by using an offshoring measure based on intermediate goods trade.

In this paper, our first goal is to construct a measure of US offshoring at the industry level that is mapped against the trading partners of the US and based on intermediate-goods trade. In doing so, we follow a methodology similar to the one used by Feenstra and Hanson (1996, 1999). Specifically, we define *broad offshoring* intensity for an industry-country pair as the value of intermediate goods that a US industry imports from *all* industries of a given country to produce one dollar worth of output. Following the spirit of Feenstra and Hanson (1999, p. 24), we also consider *intra-industry* offshoring intensity (also known as narrow offshoring), which measures offshoring (again understood as imported intermediate inputs) that takes place *within* the same industry. To construct the offshoring measures, we use input–output coefficients and bilateral imports at the US industry level, covering the period 1973–2006.

Our second goal is to empirically assess the responsiveness of US offshoring to IPR reforms in its trading partners. We identify the timing of IPR reforms in a total of 16 developing countries by following Branstetter et al. (2006). Our empirical strategy is to conduct a difference-in-difference analysis in the spirit of Branstetter et al. (2006, 2011). More specifically, we regress our offshoring measures on a dummy variable which takes the value of zero before reform and one in the year of reform and thereafter, controlling for industry, time, and country effects, as well as country-specific linear time trends. We further extend the analysis by sorting the industries as *high-tech* (i.e., patent sensitive) and *low-tech* (i.e., patent insensitive) in order to account for patent-sensitive industries being possibly more inclined towards offshoring after IPR reform.

We first run regressions without differentiating between industry types. These regressions imply that following IPR reform, neither broad offshoring nor intra-industry offshoring intensities change for the typical US industry at conventional levels of significance (5% or lower). We then run our regressions by distinguishing between high-tech and low-tech industries. These regressions uncover differential responses based on industry types. First, in the context of broad offshoring, we observe some evidence for increased offshoring by high-tech industries relative to low-tech industries. In particular, our baseline specification implies that high-tech industries increase their broad offshoring intensity by 31% relative to the insignificant 4% increase in low-tech industries. We should note though that the 31% estimate is only marginally significant (at 10% level) and becomes insignificant under some alternative specifications. Second, in the context of intra-industry offshoring, we now observe strong evidence for a differential response in relative terms. Our baseline specification implies that high-tech industries increase

their intra-industry offshoring intensity by 128% relative to the insignificant 21.2% decrease in low-tech industries. In this case, the estimate of 128% is significant at conventional levels. Under alternative specifications, the estimates for the relative impact retain their significance albeit they lose some of their value.

We also examine the changes in offshoring intensities in high-tech industries on their own (as opposed to focusing on the changes relative to low-tech industries). This simply involves testing the null hypotheses that the sum of the estimated effects reported above is equal to zero. We cannot reject the null hypothesis for the regressions with broad offshoring as the dependent variable at conventional levels of significance. However, we can reject the null hypothesis for the regressions with intra-industry offshoring as the dependent variable. Our baseline specification implies that high-tech industries increase their intra-industry offshoring by 79.6%. As a lower bound we obtain an estimate of 38.1%. We view these estimates as implying a sizable offshoring impact because intra-industry offshoring accounts for half of all offshoring by high-tech industries to our sample of 16 countries.⁵

In addition, we conduct an event-study analysis using the methodology of Jacobson et al. (1993). Our objective is to assess whether the timing of reform coincides with the timing of changes in offshoring and also address possible concerns about endogeneity of reform. To do this, we normalize the year of IPR reform to zero and regress our offshoring measure on a set of dummies for pre- and post-reform years. We find that prior to IPR reform neither broad offshoring nor intra-industry offshoring intensities show a statistically significant upward trend. We interpret this finding as alleviating concerns about endogeneity of reform with respect to offshoring.

On the contrary, after IPR reform we observe that both broad and intra-industry offshoring intensities show an upward trend but with some lag, a reasonable result given that major institutional reform takes time to be fully enforced and implemented. In particular, the lagged effects are observed exclusively in high-tech industries. Following IPR reforms, broad offshoring intensities in high-tech industries increase relative to low-tech industries. The relative differential equals 15.3% at 2 years after reform, gradually increases with each year, and reaches 35.7% by 5 years after reform and thereafter. In terms of high-tech industry own effects (as opposed to effects relative to low-tech industries), we find that broad offshoring intensities in high-tech industries increase by 59.5% about 5 years after reform and thereafter.

For intra-industry offshoring, we have similar results. Intra-industry offshoring intensities increase in high-tech industries relative to low-tech industries. The relative differential is 45.3% at 3 years after reform, increases gradually and reaches a differential of 124.3% by 5 years after reform and thereafter. With regard to own effects, we find that broad offshoring intensities increase in high-tech industries by 92.5% about 5 years after reform. All of the estimates reported above are statistically significant at conventional levels. In terms of magnitudes, these results are roughly in line with the difference-in-difference aforementioned estimators.

To sum up, following IPR reform, we find strong evidence for increased intra-industry offshoring in high-tech industries and also some evidence for increased broad offshoring in these industries. In both the differences-in-differences specifications and the event study analysis, the intra-industry offshoring estimates are much larger and more robust than broad offshoring estimates. We should note that the event-study estimates provide stronger evidence for increased broad offshoring vis-à-vis the differences-in-differences estimates.

Our paper differs from the empirical IPR–trade literature on a number of accounts. First, we construct a unique intermediate-goods-based

³ See Feenstra (1998) and Campa and Goldberg (1997) for an overview of offshoring by advanced countries. See Hummels et al. (2001) for an empirical investigation of vertical specialization in world trade. See Tang (2006) for an empirical analysis of how declining communication costs affect trade in differentiated goods. See Baier and Bergstrand (2001) for an empirical analysis of rising trade levels and their causes. Most of the literature identifies reductions in tariffs, transportation and communication costs as the main driving forces behind the expansion in trade and offshoring. The notable exception is Baier and Bergstrand (2001) who find that two-thirds of the growth in world trade can be explained by income growth.

⁴ See also Javorcik (2004), Bilir (forthcoming) and Ivus (2010).

⁵ The importance of narrow offshoring is well documented in the literature. A recent study by Agnese and Ricart (2009), which considers offshoring aggregated over all trading partners, finds that narrow offshoring by the US accounts for around one third of broad offshoring. In addition, offshoring activities in general play a key role in global trade. According to World Investment Report, 2013, 60% of global trade consists of trade in intermediate goods and services (p.122).

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