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Production fragmentation and factor price convergence

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ABSTRACT

In this analysis, we empirically analyze if the nature of trade matters for international factor price convergence. In particular, we examine whether factor prices converge when country pairs involve with more bilateral production fragmentation arrangements. We apply panel fixed effect techniques using data for five EU countries. The analyses are controlled for alternative trade related indicators such as bilateral trade intensity and bilateral intra-industry trade as well as for industrial similarity variables. We find that bilateral production fragmentation plays a key role in labor cost converging effects of trade.

1. Introduction

The nature of international trade has been changing and has become more closely related with the exchange of goods that are produced in internationally fragmented arrangements by which countries specialize at different stages of a production sequence. Under these international vertical production arrangements, some of the imported goods are used as intermediate inputs in the production of a country's domestic goods, most of which are then exported to other countries either as processed (intermediate) or final consumption goods. [1,2] As a result international production arrangements have initiated a complex cross-country flow of value added.

In this paper, we investigate empirically whether the nature of trade matters and international production fragmentation plays a prominent role, compared to the trade in goods, in the factor price convergence process across countries. Trade in intermediate or processed goods differs from trade in final goods as it involves some kind of technology transfer generating a "productivity effect" that stimulates wage changes in the countries engaging in production fragmentation arrangements (Acemoglu, Gancia, & Zilibotti, 2012; Baldwin & Robert-Nicoud, 2014; Grossman & Rossi-Hansberg, 2008; Jones & Kierzkowski, 1990). Using data for five EU countries (i.e Belgium, France, Germany, Italy, Netherlands) we examine the impact of bilateral production fragmentation on the unit labor cost convergence by controlling the analysis for the impact of bilateral trade intensity, intra-industry trade and industrial similarity indicators. We use panel fixed effect models in our regression analyses to account for both cross-sectional and time fixed effects.

Our empirical analysis suggests that the nature of trade matters in determining the cross country factor price convergence. First of all, increases in trade in value added and intra-industry trade lead factor prices to converge between the country-pairs. This finding is consistent with the theoretical prediction that production fragmentation by generating productivity effects may lead to convergence of

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[1] Hummels et al. (2001) provide compelling evidence on increased trade in intermediates and intensified global production networks across countries. Similarly, Feenstra and Hanson (2003) discuss how outsourcing has been decreasing the domestic content of value added in production by increasing the use of intermediate goods abroad in domestic production.

[2] Johnson and Noguera (2012) and Koopman et al. (2010) document the volume of "value added" trade.

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factor prices. Secondly, there is no significant linkage between standard bilateral trade intensity indicator and factor price convergence.

This paper is related to the literature investigating determinants of international factor price convergence. The factor price equalization (FPE) theorem states that if two countries producing two goods with two different factors of production and having not too different production techniques [3] then free trade would allow them to have the same goods prices that lead to the equalization of factor prices without the need for factor mobilization.[4] Thus, the literature generally focuses on two channels leading to factor price equalization: trade and similarity in factor endowment. Earlier studies focused on international trade in goods but in particular final goods as a main factor leading factor price equalization. However, in subsequent studies the concept of trade in goods per se does not provide sufficient explanation in changing factor prices. The impact of trade on intermediate goods and fragmentation began to appear in Heckscher-Ohlin type models in late 1970's and 1980's but Jones and Kierzkowski (1990) are deemed to be the first to note that fragmentation can be considered as technological progress and should therefore be expected to have complex wage effects. Fragmentation reallocates production efficiently towards countries where wages are lower (Acemoglu et al., 2012). Due to the labor augmented technological progress, production fragmentation (task trade) unlike trade in goods, induces a productivity effect, which increases the wages in low-skilled labor intensive countries taking part in international production chains. As a result, the wage gap between the country pairs engaging in production fragmentation is expected to fall (Grossman & Rossi-Hansberg, 2008). Baldwin and Robert-Nicoud (2014) integrate trade in goods and fragmentation (trade in tasks) literature and provide evidence for fragmentation to generate a productivity effect analogous to the factor price equalization theorem. In sum, theoretical literature provides many alternative models and conditions generating convergence and divergence of factor prices across and within countries due to international trade.[5] There is agreement that it is now largely an empirical issue to be analyzed with real data.

Empirical literature focuses on examining either the validity of the theorem across/within countries[6]; the factors having an impact on the convergence of cross/within country factor prices[7]; the fragmentation impact on the wage gap between skilled and unskilled workers.[8] In the early stage, empirical studies mainly focus on the link between trade in goods and factor prices and mostly consider the case in developed countries (see Tovias, 1982; Gremmen, 1985; Mokhtari & Rassekh, 1989; Trefler, 1993), ignoring trade in intermediate goods and fragmentation.

Feenstra and Hanson (1996, 1999, and 2003) show that international fragmentation of production, which resulted in intensive trade in intermediate goods, is important in explaining wage dynamics both within and between countries.[9] Among recent literature, Egger and Egger (2002), and Egger and Pfaffermayr (2004) and Egger (2006) empirically investigate the international dimension of wage convergence and the role of cross-border fragmentation. Geishecker and Görg (2008) incorporate household panel and industry-level data to investigate the link between international fragmentation and wages. The existing empirical literature generally supports the hypothesis that trade in goods and international fragmentation imply different dynamics to wages and fragmentation has a significant impact on factor price convergence. [10]

None of the empirical studies, however, consider the independent impact of the alternative forms of trade together on the movements of factor prices across the countries. Trade in goods and international production fragmentation take place at the same time. Then, it is important to take alternative forms of trade into account when detecting the appropriate impact of trade on factor prices. Our empirical results suggest that bilateral production fragmentation plays a key role in the underlying convergence effects of trade.

Moreover, we account for the impact of factor endowment similarity, which is ignored in recent empirical literature on factor prices. In addition, intensity of trade and production linkages varies across the trade partners; therefore, we use bilaterally computed variables rather than the volume of trade in intermediates or the share of intermediate goods in imports or other forms of aggregates to focus on bilateral trade and labor cost relations. Doing this allows us to investigate the extent of the link between trade and labor costs between countries integrating their production sequences at different stages. We also test how our benchmark results may change if we use data from 2-digit manufacturing industries exhibiting different trade and industrial conditions.

The rest of the paper is organized as follows. Section 2 explains the empirical model, measurement of variables and estimation methodology. Section 3 presents empirical results for manufacturing industry together with the additional regression analysis. Section 4 concludes the paper.

2. Estimation methodology and definition of variables

2.1. Basic model

The effect of bilateral production fragmentation on factor price convergence is examined empirically by estimating the following equation [11]

[3] That implies trading partners are similar in factor endowment, technology used in production and employment rate.

[4] Samuelson (1948), Lerner (1952),Ohlin (1933).

[5] In addition to those studies discussed above see also Feenstra (1998), Deardorff (2001), Venables (1999), Markusen (2006) ect.

[6] For instance Tovias (1982), Trefler (1993), Davis and Weinstein (2001), Deardorff (2001) and Egger (2006) conduct empirical tests on factor price equalization across countries, while among others Thompson (2013), Acemoglu and Autor (2011) and Feenstra and Hanson (1996, 2003) focus on factor price equalization within countries.

[7] Gremmen (1985), Mokhtari and Rassekh (1989), O'Rouke and Williamson (1992), Copeland and Thompson (2008, 2013).

[8] Feenstra (1998), Acemoglu and Autor (2011) and Egger (2006).

[9] See also the theoretical references discussed in an earlier paragraph.

[10] Egger and Pfaffermayr (2004) and Geishecker and Görg (2008) suggest conditional convergence.

[11] The model combines the Gremmen (1985) and Ng (2010) approaches.