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A Ricardo-Viner Approach to Service Offshoring

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Abstract

Empirical contributions on service offshoring show less pronounced labor market implications than with material offshoring. Since no formal model exists investigating service offshoring in particular, empirical examinations are not based on properly defined hypothesis. This contribution formalizes service offshoring within a Ricardo-Viner specific factors model. As service offshoring is assumed to expand the range of possible offshoring scenarios, results differ from those of material offshoring. The different scenarios have opposite implications and sum up to marginal effects in the aggregate. This theoretical contribution thus is capable of explaining empirical findings so far and provides clear testable hypotheses for future research.

Keywords: service offshoring; trade in services; specific factors model

JEL classification: F16, F40

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1 Introduction

Since offshoring, as the process of firms to import intermediates from abroad, moved into the focus of economic research, a surge in theoretical and empirical contributions emerged investigating implications for domestic markets. Because services have been regarded as non-tradable for a long time, most of these contributions focus on the import of material inputs. Within the last years, the achievements in information and communication technologies have contributed to turn more and more services into tradable goods. Therefore, service offshoring joined material offshoring as an important topic in economic literature recently.

Amiti and Wei (2005) show for the UK that service offshoring, compared to its material counterpart, is on a much lower level but increases at a faster pace. Estimating labor market adjustment effects, however, they find only insignificant effects on job growth in the UK. In a companion paper, Amiti and Wei (2009) show for the US economy that a negative effect occurs when taking more disaggregated industry levels into account. Görg and Hanley (2005) examine plant level data for Ireland and compare the effects with those of material offshoring. They conclude that negative effects on labor demand are more pronounced with material than with service offshoring. Investigating causalities on more disaggregated levels, Crinò (2007) shows for the US that service offshoring raises employment among high-skilled occupations and lowers employment among medium and low-skilled workers. Concerning wages, Liu and Trefler (2009) find no significant effects of service offshoring for the US. In a recent survey, Crinò (2009) summarizes the empirical results: Service offshoring is at a lower level than material offshoring, but increases at a faster pace. While material offshoring seems to have quite strong implications on the labor market, service offshoring exerts at least a small negative effect.

Concerning the theoretical part of the literature, only few contributions examine implications of service offshoring in particular. Bhagwati et al. (2004) e. g. stress three well known trade models graphically and reinterpret them in terms of trade in service intermediates. Results show that the well known effects of material trade occur also with service offshoring: It increases welfare, does not induce any job loss (due to the long run perspective of the models), but implies distributional effects promoting high skilled labor in relative high skill intensive industries. Consequently, since service offshoring overall seems to be nothing else than other forms of goods trade, there should be no need for an extra model investigating service offshoring. However, when sticking to that view, the empirical findings mentioned above seem to be puzzling: How could it be that implications of service offshoring differ from those of material offshoring? Why does service offshoring induce weaker labor market effects? Why are its implications even qualitatively different?

Due to the lack of theoretical models investigating service offshoring in particular, empirical contributions miss clear hypotheses as proper base for their analysis. This contribution provides one possible way to fill this gap. It presents a formal model particularly investigating the implications of service offshoring. In contrast to Bhagwati et al. (2004) it is assumed that service offshoring may well differ in a number of aspects from material offshoring. While there exist several ways how these differences could look like, this contribution focus on one specific dimension: Even if service trade flows may be similar to trade flows of material commodities, service offshoring increases the range of possibilities of which parts of the production process will be offshored. To better understand this dimension recall Jones and Kierzkowski (1990): In order to manage offshoring activities, additional service links are needed to organize the production process. Thus, with respect to service offshoring, an industry could either offshore parts of these service links used to organize production, or services used within the specific production process. Since organizational tasks are less product specific, both scenarios imply different effects. When formalizing service offshoring in this respect, a hypothesis can be distilled which supports the empirical findings mentioned above: Differing from material offshoring, service offshoring adds up to only marginal labor market effects in the aggregate.

The reminder of the paper is structured as follows. Section 2 motivates for the type of model used and provides the necessary assumptions. Service offshoring is formalized using a Ricardo-Viner specific factors model where specific low and high skilled labor are assumed to be employed in two industries with common service labor employed in both industries for organizational issues. Section 3 introduces the model set up and presents the closed economy case. Section 4 extends the model by allowing for service offshoring and investigates the occurring effects in general equilibrium. With this kind of framework it is possible to explicitly differ between offshoring services used in the specific production process of an industry and offshoring organizational service links. In particular, service offshoring can take place in three different ways:

(i) If business services are offshored that are part of the specific production process, the wage of organizational labor increases whereas the wage of more specific low and high skilled labor decreases. Output of the relative high skill intensive industry (the offshoring industry) increases whereas the industry remaining integrated decreases output. Both industries shift production towards less organizational labor.

(ii) If offshoring the organizational service links, results differ fundamentally. The wage of organizational service labor decreases, whereas wages of specific low and high skilled labor increase. Both industries increase output and shift production towards more organizational activities.

(iii) When both offshoring situations occur in tandem, the different results add up to only marginal effects in the aggregate.

Section 5 concludes by summarizing and discussing the main results. Overall, a clear testable hypothesis can be obtained, particularly resulting from the process of service offshoring.

The value added of the paper is thus twofold: First it provides a formal framework for service offshoring and presents a clear hypothesis in line with the empirical findings so far. Second, it discusses formal details of how to use the specific factors model to allow for service offshoring.

2 Assumptions: A Ricardo - Viner Approach

As mentioned above, empirical results illuminate differences in the implications of service offshoring compared to those of material offshoring. The effects of service offshoring are not as significant (concerning e.g. income distribution and employment) and thus less pronounced. This contribution provides a formal model specifically investigating service offshoring in order to base the empirical findings on a properly specified theoretical hypothesis. This section motivates for the use of a specific factors model and presents the assumptions of the framework.

The paper shows that theoretically, service offshoring differs from material offshoring. While there exist several ways how those differences may be formalized, the paper sticks to the assumption of Bhagwati et al. (2004) that trade flows in services are in principle similar to trade flows in goods (what is in line with WTO mode 1), however, it assumes that service offshoring increases the range of possibilities of which production parts could be relocated. Compared to material offshoring, this adds a second dimension to the effects. As Jones and Kierzkowski (1990) show, additional service labor is needed to organize production for offshoring to take place. Combining this Jones and Kierzkowski view of service links with the Bhagwati et al. model, service offshoring can take two different forms: An industry can either relocate service links used to organize production (e.g. business consultants, financial or accounting services) or service labor specific to the commodity's production process (e.g. research and development activities, product marketing, or specific customer sales service). Since these service tasks differ in the degree of product specificity, different implications occur in general equilibrium.

The Ricardo-Viner specific factors model is a well known, easy approach that can be adjusted slightly in order to formalize this idea. Assume a small economy (that faces given world prices $\hat{p} = 0$) with two industries ($i = X, Y$) producing goods of quantity Q_i. The economy is endowed with three factors ($j = H, L, O$): high skilled labor (H),

low skilled labor (L), and organizational labor (O). While Y requires industry specific low skilled labor L and common labor O_Y used to organize production, X produces with sector specific high skilled labor H, also organized by a fraction of the common service labor O_X. Factor as well as goods markets are perfectly competitive with free and costless entry. The factors are assumed to be internationally immobile. Exhibiting a short run perspective, the specific factors are additionally inter-sectoral immobile ($w_L \neq w_H$), whereas the common factor can freely move between the two industries ($w_{OY} = w_{OX} = w_O$). Further on, we assume that the country remains incompletely specialized ($Q_i > 0$) and that the production process is of a constant returns to scale type, implying that the average cost of production is independent of the scale of output.

3 Closed Economy Setting

Following the dual approach[1], we can describe the cost structure of the economy by the zero-profit conditions

$$c_Y(w_L, w_O) = a_L w_L + a_{OY} w_O = 1 \quad (1)$$

$$c_X(w_H, w_O) = a_H w_H + a_{OX} w_O = p \quad (2)$$

with c_i as unit costs, w_j as factor prices, a_j as labor unit requirements, p as the relative price of the high skill intensive good X and the price of the relative low skill intensive good Y as numeraire. The unit cost functions contain factor prices as the only arguments and are concave and linear homogeneous in them. Taking the partial differential of (1) and (2) we obtain equilibrium labor unit requirements

$$a_L = c^Y_{w_L}(w_L, w_O) \quad (3)$$

$$a_H = c^X_{w_H}(w_H, w_O) \quad (4)$$

$$a_{OY} = c^Y_{w_O}(w_L, w_O) \quad (5)$$

$$a_{OX} = c^X_{w_O}(w_H, w_O) \quad (6)$$

as the envelop properties of the unit cost functions (known as Shephard's Lemma). Finally, as the factors are assumed to be completely employed in both industries, the full employment conditions are given by

[1] In contrast to the primary approach, that maximizes output constraint by factor costs, the dual approach in international trade theory minimizes unit costs.

$$O = a_{OY}Q_Y + a_{OX}Q_X \quad (7)$$

$$L = a_L Q_Y \quad (8)$$

$$H = a_H Q_X. \quad (9)$$

Solving the model simultaneously

With three factors employed in two industries, there is the necessity to solve the model simultaneously. As first step, taking the total differential of (1) and (2) in order to minimize unit costs, we obtain

$$\hat{c}_Y = \theta_L \hat{w}_L + \theta_{OY} \hat{w}_O = 0 \quad (10)$$

$$\hat{c}_X = \theta_H \hat{w}_H + \theta_{OX} \hat{w}_O = \hat{p} \quad (11)$$

with factor income shares $\theta_{ij} \equiv \frac{a_j w_j}{p_i}$ and a "hat" over the variables denoting percentage changes. As next step, log differentiate (3) - (6) in order to obtain

$$\hat{a}_L = \theta_{OY}\sigma_Y(\hat{w}_O - \hat{w}_L) \quad (12)$$

$$\hat{a}_H = \theta_{OX}\sigma_X(\hat{w}_O - \hat{w}_H) \quad (13)$$

$$\hat{a}_{OY} = -\theta_L\sigma_Y(\hat{w}_O - \hat{w}_L) \quad (14)$$

$$\hat{a}_{OX} = -\theta_H\sigma_X(\hat{w}_O - \hat{w}_H) \quad (15)$$

as the percentage change in equilibrium labor unit requirements with σ_i as the elasticity of substitution between the specific and the common factor in industry i. Taking the total differentials of the full employment conditions (7) - (9), we obtain

$$\lambda_{OY}\hat{Q}_Y + \lambda_{OX}\hat{Q}_X = \hat{O} - (\lambda_{OY}\hat{a}_{OY} + \lambda_{OX}\hat{a}_{OX}) \quad (16)$$

$$\hat{Q}_Y = \hat{L} - \hat{a}_L \quad (17)$$

$$\hat{Q}_X = \hat{H} - \hat{a}_H \quad (18)$$

as goods market equilibrium with labor shares $\lambda_{Oi} \equiv \frac{O_i}{O}$.

Closing the model

Due to the small country assumption ($\hat{p} = 0$), it is quite easy to solve (10) and (11) for the percentage change in low and high skilled wages (the specific factors) depending on the wage of organizational labor (the common factor)

$$\hat{w}_L = -\frac{\theta_{OY}}{\theta_L}\hat{w}_O \tag{19}$$

$$\hat{w}_H = -\frac{\theta_{OX}}{\theta_H}\hat{w}_O. \tag{20}$$

Now, in order to relate also the percentage change in labor unit requirements on the wage of the common factor, insert (19) and (20) into (12) - (15) to achieve

$$\hat{a}_L = \theta_{OY} e_{OY} \hat{w}_O \tag{21}$$

$$\hat{a}_H = \theta_{OX} e_{OX} \hat{w}_O \tag{22}$$

$$\hat{a}_{OY} = -\sigma_Y \hat{w}_O \tag{23}$$

$$\hat{a}_{OX} = -\sigma_X \hat{w}_O \tag{24}$$

with e as the aggregated elasticity of demand for organizational labor. As next step, insert the equilibrium change in the specific factor's labor unit requirements (21) and (22) into the output equations (17) and (18) in order to achieve

$$\hat{Q}_Y = \hat{L} - \theta_{OY} e_{OY} \hat{w}_O \tag{25}$$

$$\hat{Q}_X = \hat{H} - \theta_{OX} e_{OX} \hat{w}_O \tag{26}$$

as the percentage change in output equilibrium, also depending on the wages of the common factor. Finally, in order to solve for the change of the wage of common organizational labor, insert the equilibrium change of the industries' output (25) and (26), as well as the change in labor unit requirements of organizational service labor (23) and (24) into (16). Thus, we obtain the change in equilibrium wages of organizational labor depending on the supply of the three factors

$$\hat{w}_O = -\frac{1}{\Delta}[\hat{O} - (\lambda_{OY}\hat{L} + \lambda_{OX}\hat{H})] \tag{27}$$

with $\Delta = \lambda_{OY} e_{OY} + \lambda_{OX} e_{OX}$ as the aggregate general equilibrium elasticity of demand for organizational labor O. Also the industries' output pattern can now be related to the supply of the three factors. Therefore, insert (27) into (25) and (26) in order to obtain

$$\hat{Q}_Y = \hat{L} + \frac{\theta_{OY} e_{OY}}{\Delta}\left(\hat{O} - (\lambda_{OY}\hat{L} + \lambda_{OX}\hat{H})\right) \tag{28}$$

$$\hat{Q}_X = \hat{H} + \frac{\theta_{OX} e_{OX}}{\Delta}\left(\hat{O} - (\lambda_{OY}\hat{L} + \lambda_{OX}\hat{H})\right). \tag{29}$$

4 Implications of Service Offshoring

With the percentage change of common organizational wages (27) as well as the industries' output (28) and (29) depending on the supply of the three factors, we have the necessary framework that can be extended with service offshoring in this section. Following the idea of Bhagwati et al. (2004), service offshoring is introduced as an increase in the supply of service labor. It is important to note that this does not violate the assumption of factors being internationally immobile. Rather, formalizing service offshoring in this way implies a factor bias similar to skill augmenting technical progress. Thus, when there is e.g. an increase in service offshoring of one percent, one additional percent of service employees need to be considered in the new equilibrium. Let's additionally assume that only high skilled services are offshorable (since low skill intensive services often involve labor mobility and thus are not considered as tradable in terms of WTO mode 1).

As mentioned above, the key feature of the framework in this contribution is a special attention on which kind of services get offshored. Jones and Kierzkowski (1990) mention that service links are an essential part for organizing production and increase if any kind of offshoring takes place (at the time of Jones and Kierzkowski (1990), only material offshoring was considered). Having this pattern in mind and considering that meanwhile many services got tradable, there are three scenarios of how service offshoring may take place:

(i) There is the possibility to offshore services that are part of the high skill intensive industry's specific production process. One could think e.g. of establishing a customer relationship center abroad or contracting the programming of specific software components to a foreign consultant. In terms of the specific factors model used here, this scenario would increase the supply of specific high skilled labor ($\hat{H} > 0$).

(ii) Service links that are necessary to organize production could be offshored as well - the situation considered graphically in Bhagwati et al. (2004). One could think e.g. of buying additional consulting tasks from abroad in order to manage globalization. In this scenario, supply of the common factor organizational labor would increase ($\hat{O} > 0$).

(iii) And consequently, both service offshoring possibilities can occur simultaneously ($\hat{H} > 0$ and $\hat{O} > 0$).

Scenario i: Offshoring specific parts of the production process

In scenario i, services are offshored that are specific in the high skill intensive industry's production process. Assume e.g. that service offshoring increases the supply of specific high skilled labor by one percent ($\hat{H} = 1$ whereas $\hat{O} = \hat{L} = 0$). Considering this in (27), we obtain

$$\hat{w}_O|_{\hat{H}=1} = \frac{1}{\Delta}\lambda_{OX} \tag{30}$$

as an increase in the wage of organizational labor. Consequently, following the small country assumption and the zero profit conditions, wages of the specific factors have to decrease. This can be shown formally by inserting $\hat{w}_O|_{\hat{H}=1}$ into (19) and (20). Thus, we obtain

$$\hat{w}_L|_{\hat{H}=1} = -\frac{\theta_{OY}}{\theta_L}\frac{\lambda_{OX}}{\Delta} \tag{31}$$

$$\hat{w}_H|_{\hat{H}=1} = -\frac{\theta_{OX}}{\theta_H}\frac{\lambda_{OX}}{\Delta} \tag{32}$$

as the decrease in wages of specific low and high skilled labor (the one that is offshored in this scenario). In order to solve for the implications of scenario i on the industries' output, consider (28) and (29) and substitute for the increase in the supply of high skilled labor $\hat{H} = 1$. Thus, we obtain

$$\hat{Q}_Y|_{\hat{H}=1} = -\frac{\theta_{OY}e_{OY}\lambda_{OX}}{\Delta} \tag{33}$$

$$\hat{Q}_X|_{\hat{H}=1} = 1 - \frac{\theta_{OX}e_{OX}\lambda_{OX}}{\Delta}. \tag{34}$$

Since $0 < \theta_{OX}e_{OX}\lambda_{OX} < e_{OX}\lambda_{OX} < \Delta$, it follows that $0 < (1 - \frac{\theta_{OX}e_{OX}\lambda_{OX}}{\Delta}) < 1$. Thus, while output of the low skill intensive Y industry decreases, output of the high skill intensive X industry increases, however, with a percentage rate smaller than unity (the increase of offshoring activity, that we assumed to be one percent). Finally, considering (21) - (24) and substituting for $\hat{w}_O|_{\hat{H}=1}$ yields

$$(\hat{a}_L - \hat{a}_{OY})|_{\hat{H}=1} = (\theta_{OY}e_{OY} + \sigma_Y)\frac{1}{\Delta}\lambda_{OX} \tag{35}$$

$$(\hat{a}_H - \hat{a}_{OX})|_{\hat{H}=1} = (\theta_{OX}e_{OX} + \sigma_X)\frac{1}{\Delta}\lambda_{OX} \tag{36}$$

as the implications on relative labor unit requirements, the industries' production structure. Due to the predominance of the wage effect, both industries shift production towards relative less organizational labor intensive parts. While organizational labor

moves from the low skill intensive Y to the high skill intensive X industry in order to manage the offshoring activity, the increases of high skilled labor supply is more pronounced than the reallocation of organizational labor ($\hat{H} = 1 > \hat{O}_X > \hat{L} = 0 > \hat{O}_Y$).

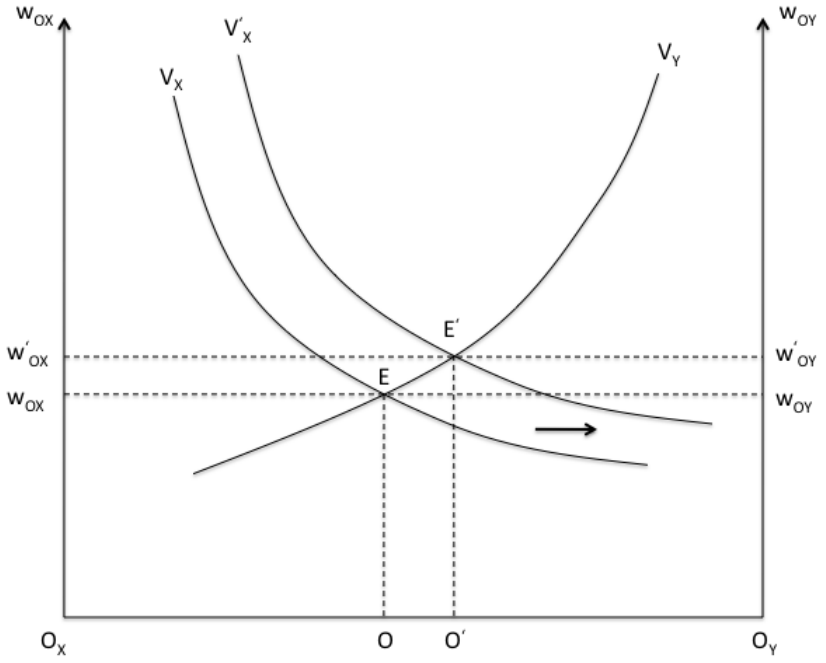

Figure 1: Offshoring services used in the high skill intensive production process

These implications can partly be illustrated by Figure 1 which depicts wages of organizational service labor on the vertical axis and its supply (as well as allocation) on the horizontal axis, all in terms of the numeraire. Offshoring specific high skilled labor (scenario i) shifts the V-line (value marginal product of organizational labor) of the high skill intensive X industry horizontally to the right by one percent. This increases the wage of organizational labor w_O to $w_O^{'}$. The value of output in the high skill intensive industry is given by the area under V_X, up to the quantity of organizational labor employed in that industry ($O_X O$). When offshoring specific high skilled service labor, the value of output in the offshoring industry increases, whereas the value of output in the Y industry, that holds to its integrated production process, decreases by the area $OO^{'}E^{'}E$. The offshoring activity in the X industry requires additional use of organizational service labor. Thus, organizational labor of the quantity $OO^{'}$ moves from the Y to the X industry. The distributional effects of specific low and high skilled labor are more complex since supply of H increases (not depicted in this figure). However, since wages of the specific factors correspond to the areas under the V-lines down to the horizontal w_O-lines, it can be seen that the wage of specific low skilled labor decreases by $EE^{'}w_{OY}^{'}w_{OY}$.

Scenario ii: Offshoring common organizational service links

Examining offshoring of common organizational service labor (scenario ii) we assume that the supply of the common factor organizational labor increases by one percent ($\hat{O} = 1$, whereas $\hat{H} = \hat{L} = 0$). This case is examined graphically in Bhagwati et al. (2004). In order to formalize this scenario we focus on distributional implications as first step. Consider (27) and substitute for $\hat{O} = 1$ yields

$$\hat{w}_O|_{\hat{O}=1} = -\frac{1}{\Delta} \tag{37}$$

as the percentage change of the common organizational labor. When relocating commonly used service labor abroad, their wage decreases. Due to the small country assumption it follows from the zero profit conditions (10) and (11) that wages of the specific factors increase. Therefore, remember (19) and (20) under consideration of $\hat{w}_O|_{\hat{O}=1}$, we obtain

$$\hat{w}_L|_{\hat{O}=1} = \frac{\theta_{OY}}{\theta_L}\frac{1}{\Delta} \tag{38}$$

$$\hat{w}_H|_{\hat{O}=1} = \frac{\theta_{OX}}{\theta_H}\frac{1}{\Delta}. \tag{39}$$

Since $0 < \lambda_{OX} < 1$, the magnitude of the effects are more pronounced in scenario ii as compared to scenario i ($\left|\hat{w}_j|_{\hat{O}=1}\right| > \left|\hat{w}_j|_{\hat{H}=1}\right|$). While the difference in sign is robust to all the parameter settings, the comparison of the magnitude depends on the amount of organizational labor employed in the high skill intensive X industry, the aggregate demand elasticity of organizational labor, as well as the magnitude of service offshoring in the two scenarios (what is assumed to be equally one percent here).

To examine the industries' output, consider (28) and (29) and take $\hat{O} = 1$ into account. Therefore, we achieve

$$\hat{Q}_Y|_{\hat{O}=1} = \frac{\theta_{OY}e_{OY}}{\Delta} \tag{40}$$

$$\hat{Q}_X|_{\hat{O}=1} = \frac{\theta_{OX}e_{OX}}{\Delta} \tag{41}$$

as equilibrium on the goods market. Both industries expand by increasing production when offshoring the common service labor. In order to solve for the change in the industries production structure, remember (21) - (24) under consideration of $\hat{w}_O|_{\hat{O}=1}$ to obtain

$$(\hat{a}_L - \hat{a}_{OY})|_{\hat{O}=1} = -(\theta_{OY}e_{OY} + \sigma_Y)\frac{1}{\Delta} \tag{42}$$

$$(\hat{a}_H - \hat{a}_{OX})|_{\hat{O}=1} = -(\theta_{OX}e_{OX} + \sigma_X)\frac{1}{\Delta}. \tag{43}$$

Since the wage of organizational service labor decreases in this scenario, both industries shift production towards more organizational service labor and thus, employ relative less specific factors. Both industries need more organizational labor to organize the offshoring activities. The implications of scenario ii are depicted in Figure 2.

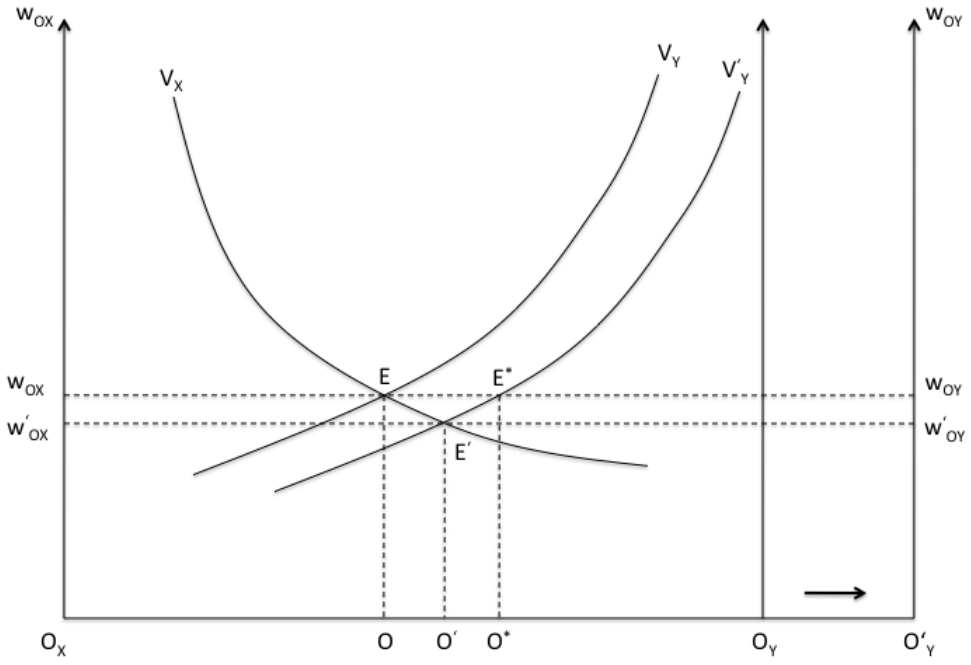

Figure 2: Offshoring organizational service labor

Offshoring of the common service labor extends the supply of the common factor (depicted on the horizontal axis). There is one percent more organizational service labor available ($O_Y O'_Y \triangleq OO^*$). In the new equilibrium E', wages of organizational labor decreases from w_O to w'_O. Both industries need more organizational labor to organize the offshoring activity. Thus, the additional supply of organizational labor is allocated with OO' in the high skill intensive X and $O'O^*$ in the low skill intensive Y industry. Wages of specific high and low skilled labor increase by $w'_{OX} w_{OX} EE'$ in the X and $w'_{OY} w_{OY} E^* E'$ in the Y industry. Also output as the integral of the V-lines increases in both industries.

Scenario iii: Offshoring both kinds of services - the aggregate

As third scenario, consider the aggregated situation when industries offshore specific high skilled service labor as well as common organizational service links ($\hat{H} = \hat{O} = 1$, whereas $\hat{L} = 0$). Substituting the expansion of factor supply into (27) yields

$$\hat{w}_O|_{\hat{H}=\hat{O}=1} = -\frac{1}{\Delta}(1 - \lambda_{OX}) \tag{44}$$

as the percentage change of organizational service labor. The result corresponds to the mean of the increasing tendency in scenario i (30) and the decreasing force in scenario ii (37) and thus, depending on the parameter values already mentioned above, sums up around zero. Due to the assumptions made in this contribution, the downward impact of scenario ii is more pronounced than the upward impact in scenario i. Therefore, the overall change of the wage of organizational labor is slightly negative in scenario iii ($\lambda_{OX} = \frac{O_X}{O} < 1$). However, (44) could also be positive if e.g. offshoring of the specific high skilled services would be assumed to be bigger than offshoring of the common organizational service links ($\hat{H} > \hat{O}$). The most important point to notice here is that, in the aggregate, the implications on changes of the wage of organizational service labor smoothes out the more intensive effects in the disaggregated scenarios.

Consequently, following the zero profit conditions (10) and (11) and the small country assumption, the change of the wages of the specific factors is described by

$$\hat{w}_L|_{\hat{H}=\hat{O}=1} = \frac{\theta_{OY}}{\theta_L}\frac{1}{\Delta}(1-\lambda_{OX}) \tag{45}$$

$$\hat{w}_H|_{\hat{H}=\hat{O}=1} = \frac{\theta_{OX}}{\theta_H}\frac{1}{\Delta}(1-\lambda_{OX}). \tag{46}$$

Again, the implications on wages smoothe out the effects occurring in the more disaggregated scenarios. In order to solve for the change in output, consider (28) and (29) and substitute for the increase in factor supplies to achieve

$$\hat{Q}_Y|_{\hat{H}=\hat{O}=1} = \frac{\theta_{OY}e_{OY}}{\Delta} - \frac{\theta_{OY}e_{OY}}{\Delta}\lambda_{OX} \tag{47}$$

$$\hat{Q}_X|_{\hat{H}=\hat{O}=1} = 1 - \frac{\theta_{OX}e_{OX}\lambda_{OX}}{\Delta} + \frac{\theta_{OX}e_{OX}}{\Delta}. \tag{48}$$

Since $0 < \lambda_{OX} < 1$, output in the Y industry increases ($\hat{Q}_Y > 0$). As more organizational labor is employed in the high skill intensive X industry, as lower is the increase in output of the Y industry. Again, the sign of (47) depends crucially on which service labor is offshored more intensively, but is closer zero than in the disaggregated scenarios anyway. In contrast, since output in the X industry increases in both disaggregated scenarios, it increases in any case in the aggregate (with the assumptions made here, the increasing rate is bigger than unity, $0 < \hat{Q}_Y < 1 < \hat{Q}_X$).

Substituting $\hat{w}_O|_{\hat{H}=\hat{O}=1}$ into (21) - (24) yields the change in the industries' production structure

$$(\hat{a}_H - \hat{a}_{OX})|_{\hat{H}=\hat{O}=1} = -(\theta_{OX}e_{OX} + \sigma_X)\frac{1}{\Delta}(1-\lambda_{OX}) \tag{49}$$

$$(\hat{a}_L - \hat{a}_{OY})|_{\hat{H}=\hat{O}=1} = -(\theta_{OY}e_{OY} + \sigma_Y)\frac{1}{\Delta}(1-\lambda_{OX}). \tag{50}$$

Following the wage effects, also the implications on relative labor unit requirements are less pronounced in the aggregate. The implications are depicted in Figure 3.

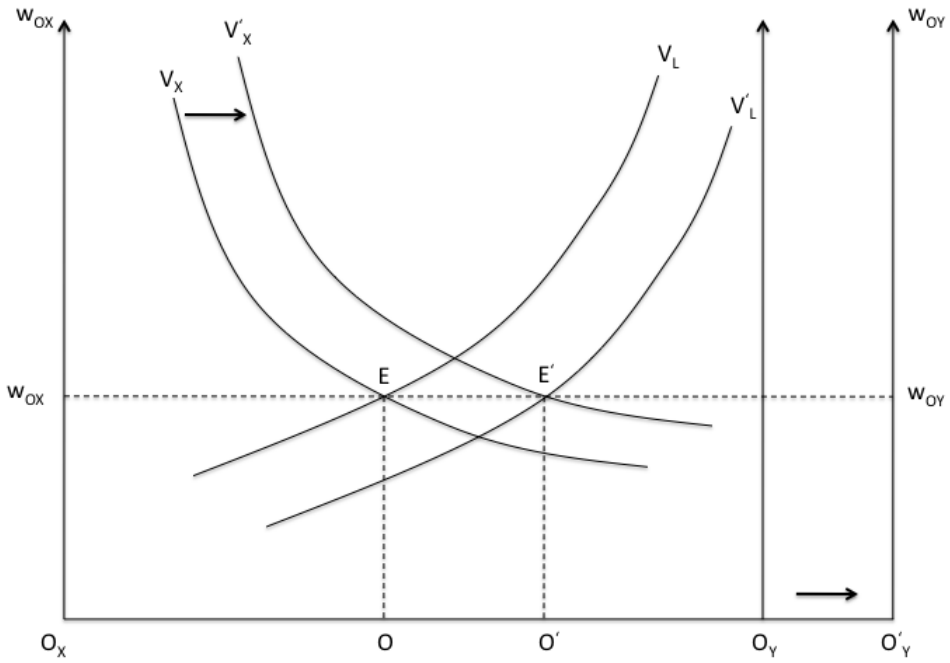

Figure 3: Service offshoring in the aggregate

When service offshoring occurs in the aggregate, the supply of common organizational labor increases ($O_Y O_Y^{'}$) and the line of the value maginal product in the high skill intensive industry V_X shifts horizontally to $V_X^{'}$. As can be seen in this figure, due to the combined effects of both scenarios, the wage of organizational service labor adds up in marginal changes (here to zero). Consequently, also the returns to the specific factors do not change. Output in the X industry increases, whereas there is no change in the output of the low skill intensive Y industry.

5 Conclusion

As services are increasingly tradable, research started to discuss common topics of international trade also with respect to trade in services. Service offshoring is one of these topics where literature started to investigate the implications recently. While empirical contributions found far less pronounced effects of service offshoring compared to those of material offshoring, a theoretical explanation is still lacking for the puzzle. As a by-product, empirical contributions are not based on a clearly specified theoretical hypothesis. Following Bhagwati et al. (2004) that, by and large, service offshoring is nothing else than goods trade, it seems that there is no need for a formal model partic-

ularly investigating the effects of service offshoring. This, however, contrasts with the empirical results so far.

This contribution formalizes service offshoring in order to provide a theoretical basis that is able to substantiate the empirical findings. In contrast to Bhagwati et al. (2004) results show that service offshoring differs from material offshoring. When expanding the Bhagwati et. al. framework with the Jones and Kierzkowski (1990) view, service offshoring increases the range of possibilities of which parts of the production process can be offshored. An industry can either relocate services used within the specific production process, or service links used to organize production. Since organizational tasks are less product specific, both scenarios exhibit different implications. As the effects hint in opposite directions, they sum up to only marginal implications in the aggregate. Thus, while formalizing service offshoring within a Ricardo Viner specific factors model, this contribution provides the respective theoretical hypothesis for the empirical results found so far.

The way how service offshoring is formalized here is only one possibility to focus on differences with respect to material offshoring. There are several ways to examine particular properties of service offshoring beyond this view. The tradability of services could e.g. be questioned in general. Are trade flows in services really similar to trade flows in material goods? It would be worthwhile investigating this core assumption of WTO mode 1 theoretically. If service trade flows differ from the trade flows of material goods, how does this affect traditional trade implications? Also from an empirical point of view, there is the need for much more evidence with respect to service offshoring. Due to limited data availability on trade in services, the few number of empirical studies is by far not sufficient to establish general conclusios. Further on, keeping the findings of this contribution in mind, the differences on how the offshored services contribute to production should be taken into account when collecting data. Additionally, the way how to measure service offshoring would also be a topic of interest. Can the same indices that are used to capture material offshoring also be applied to service offshoring? Or are there specific characteristics that require specific methods?

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