Trade and Direct Investment in Producer Services and the Domestic Market for Expertise

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Abstract

Foreign producer services such as managerial and engineering consulting can provide substantial benefits of specialized knowledge that would be costly in terms of both time and money for domestic firms to develop on their own. This has important implications for public policy since policies that impact on trade and direct investment in services are often quite different from those that impact on trade in goods. We build on earlier monopolistic-competition models of intermediate producer services in this paper. Results show that: (1) while foreign services are partial-equilibrium substitutes for domestic skilled labor, they may be general-equilibrium complements, (2) service trade can provide crucial missing inputs that reverse comparative advantage in final goods, (3) the "optimal" tax on imported services may be a subsidy, and (4) in our dynamic formulation, there may be earnings losses for immobile workers along a transition path that suggest potentially important equity consequences of reform.

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1. Scope of the Paper

A growing body of evidence and economic theory suggests that the close availability of a diverse set of business services is important for economic growth. The key idea in the literature is that a diverse set (or higher quality set) of business services allows downstream users to purchase a quality adjusted unit of business services at lower cost. As early as the 1960s, the urban and regional economics literature (e.g., Greenfield, 1966; Jacobs, 1969; Chinitz 1961) recognized the importance of non-tradable intermediate goods (primarily producer services produced under conditions of increasing returns to scale) as an important source of agglomeration externalities. The more recent economic geography literature (e.g., Fujita, Krugman and Venables, 1999) has also focused on the fact that related economic activity is economically concentrated due to agglomeration externalities.[1]

In this paper we develop a theoretical model to quantitatively assess the importance of liberalization of restraints on foreign providers of producer services. Based on the evidence we have mentioned, we make three key assumptions in our model: (1) a larger variety of producer services lower the quality adjusted costs of these services for downstream industries; and (2) producer services are produced under conditions of increasing returns to scale (Faini 1984), and (3) key inputs to producer services (e.g., foreign personnel) are affected by very different barriers than trade in goods.

We prefer to remain somewhat vague regarding a generic definition of producer services. The types of activities we are interested are business services which are intermediate inputs. Second, the services we are interested in generally involve an exchange of knowledge, which has been accumulated by the seller through previous investments. Third, these services are generally customized to some extent, solving particular problems of the buyer, and they are not generally good substitutes for the services of other firms. Thus there is firm-level product differentiation.

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[1]See Markusen, Rutherford and Tarr (2000) for additional evidence of the importance of locally available business service suppliers for productivity..

Finally, our services generally require a personal presence in a country or at least personal contact and discussions between the service provider and the client. In particular, restrictions on goods trade only affect service trade indirectly, while restrictions on foreign investment, right of establishment, the movement of business personnel, and lack of intellectual property protection and contract enforcement have major, direct impacts.[2]

In summary then, we are interested in services that have the following general characteristics: (a) intermediate goods; (b) intensive in skilled labor and other knowledge capital; (c) produced with increasing returns; (d) differentiated by firm and possibly by firm nationality; (e) traded inputs to services are subject to high or prohibitive transactions costs from barriers to foreign ownership, movement of business personnel, etc.

"Imported" services (or more correctly services produced with imported inputs such as personnel) with these characteristics offer a number of important advantages to developing or transition economies. First, they may complement rather than substitute for domestic producer services, the differentiated-product characteristic just mentioned. Second, they economize on scarce domestic skilled labor which is then freed for other uses, the factor-intensity property noted above.

Third, imported services allow countries to obtain in the present expertise or crucial missing inputs that are not otherwise available and would take considerable time or resources to develop, illustrating the scale-economies property. In a static model, this could be captured by simple scale economies with fixed costs in terms of skilled labor, or in a dynamic model by a learning-by-doing or investment processes which requires a time lag between skilled-labor inputs and service output.

The purpose of this paper is to take several steps toward incorporating the types of producer services just discussed into applied general equilibrium models. The first step in this process is to adopt

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[2]We do not formally model the distinction between “trade” (e.g., arm’s length, one-off contracts to provide a service) versus FDI where the foreign firm establishes an owned subsidiary.

a formal theoretical approach. Our formulation will build on existing work, including Ethier (1982), Markusen (1989), Francois (1990a,b), and Stibora and de Vaal (1995). Either's approach is to view the range of intermediate inputs as endogenous, with a Smithian division-of-labor property that a larger range of intermediates increases total factor productivity. Markusen (1989) extended this to look at economies which can trade only final goods versus economies that can trade intermediates.

The second contribution of this paper will be to obtain a quantitative assessment of the impact of this approach by embedding it in *both* static and dynamic applied general-equilibrium models. The static model considers the implications of FDI in a model where the supply of domestic skilled labor is fixed. Closed form analytic solutions to these complex models have not been derived. Thus we solve the model numerically for a range of parameters. Moreover, only through the use of a numerical model are we able to obtain a quantitative assessment of the the impact of FDI liberalization in business service sectors on key economic variables including Hicksian equivalent variation, the quantity of domestic service providers and on the returns to skilled labor in the business services sector.

Our dynamic model provides a means of assessing the time and private adjustment costs involved in moving from an initial equilibrium to a new steady-state equilibrium by modeling the transition under consistent expectations by firms and consumers. Given an assumption of imperfect intersectoral immobility of existing workers, there are potentially important equity consequences of reform. In our dynamic extension we focus on adjustment in the stock of skilled labor within the economy, assuming that existing skilled workers need training to enable them to move directly into the foreign service-firm enclave, and that some share of the skilled workers are immobile.

Before proceeding, we will mention of a couple of interesting results. First, we use a static model to show that liberalization of rules to permit inward trade and FDI in producer services may imply that these services are general-equilibrium complements to domestic skilled labor, even though they appear to substitute for domestic skilled labor in a partial-equilibrium sense. Thus, it is likely that

foreign services may foster the accumulation of skilled workers. Second, allowing inward trade and FDI in producer services may significantly affect the pattern of trade in goods. As in the "key input" argument above, these services may reverse the direction of trade, permitting the host country to successfully export advanced products. Third, we find that the transitional process may involve substantial changes in the market for skilled labor, particularly if we assume that workers in foreign enterprises require specialized education. These effects depend on assumptions regarding the share of existing skilled workers that are immobile. If a high share of skilled workers are immobile, wages of immobile skilled workers could fall significantly during the transition, and the transition process could take several years to complete.

Finally, due to data limitations, most of the values for the various shares and elasticities are assumed without firm empirical support. Thus, the results should be considered illustrative, but speculative.

2. Modeling Trade and FDI in Producer Services[3]

Our basic approach will be to model producer services as intermediate inputs. These intermediate inputs will be differentiated from one another and may also be differentiated according to whether or not they are produced domestically or by foreign firms. Both types of services are produced with increasing returns to scale due to fixed costs.

There will be two final goods, *X* and *Y*, and two primary factors available on the domestic market, *S* and *L*. *S* will denote skilled labor and *L* will denote all other factors, aggregated into a composite factor to simplify the model. *S* and *L* are in fixed aggregate supply and immobile between countries. The production function for *Y* is written in Cobb-Douglas form to facilitate comparison with *X*, but in the numerical model we allow the more general CES production function.

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[3]See Markusen, Rutherford and Tarr (2000) for a complete specification of the model and further details on the derivations.

(1) $$Y = S_y^{\alpha_y} L_y^{(1-\alpha_y)}$$

Services are an intermediate input into *X* production. The composite of all services inputs Z enters into the production of X:.

(2) $$X = S_x^{\alpha_x} L_x^{\beta_x} Z_x^{(1-\alpha_x-\beta_x)}$$

Later, in some illustrative simulations, we will assume that in direct *S* and *L* requirements, *X* is skilled-labor intensive relative to *Y*, in the sense that $\alpha_x/\beta_x > \alpha_y/\beta_y$.

Services are produced by imperfectly competitive firms. There is a one to one correspondence between the firm and their differentiated service varieties. There are both domestic and foreign firms producing services inputs. Z_x is a CES function of *ZD* and *ZM*, each of which is in turn a CES function of the individual *ZD* and *ZM* varieties, zd_i and zm_j respectively.

(3) $$Z_x = (ZD^{\gamma} + ZM^{\gamma})^{1/\gamma}$$

(4) $$ZD = \left[\sum_i^{n_d} zd_i^{\delta}\right]^{1/\delta} \qquad ZM = \left[\sum_j^{n_m} zm_j^{\epsilon}\right]^{1/\epsilon}$$

where n_d and n_m are the number of domestic and imported service varieties, respectively. The elasticities of substitution within product groups are: $\sigma_d = 1/(1-\delta)$ and $\sigma_m = 1/(1-\epsilon)$. We require that δ and ϵ are between 0 and 1, which implies that the elasticities of substitution within product groups exceed unity.

Domestic intermediate inputs *ZD* are produced using domestic skilled labor and the composite factor. Imported services *ZM* are produced from domestic skilled labor the composite domestic factor and a composite imported factor. Examples of these imported inputs, which will be denoted *V*, are: specialized technical expertise, advanced technology, management expertise and marketing expertise. The

variable V is thus quite general and denotes a key difference between foreign and domestic production structures.

zd_i and zm_i are produced with a fixed and a variable cost. Let C^D and C^M be the cost function for producing individual domestic and foreign varieties. We impose a symmetry assumption within firm types, i.e., all foreign firms have identical cost structures, and all domestic firms that operate have cost structures identical to other domestic firms. *cd* and *cm* represent unit variable cost functions and *fd* and *fm* represent the fixed costs functions for domestic and foreign varieties respectively. Let r be the price of S, w be the price of L, and p_v be the price of V. Cost functions for domestic and foreign intermediates are thus:

(5) $$C^D(r,w,zd) = cd(r,w)zd + fd(r,w)$$

(6) $$C^M(r,w,p_v,zm) = cm(r,w,p_v)zm + fm(r,w,p_v)$$

The trade balance condition requires that net exports of X and Y equal net payments for foreign services. Let p_x^* and p_y^* denote the world prices of X and Y (which may differ from domestic prices if there are taxes or subsidies). Trade balance is given by:

(7) $$p_x^*(X_p - X_c) + p_y^*(Y_p - Y_c) - p_v^* V = 0$$

where the demand for foreign services is given by the number of foreign services times the derivative of the cost function for a given foreign service with respect to the cost of imports::

(8) $$V = n_m C_{p_v}^M$$

To simplify the interpretation of results, we assume "large-group monopolistic competition." That is, individual firms believe they are too small to influence the composite price of their group.

Consider first the marginal product of an individual service zm_i in the aggregate output of the service sector Z_x Let p_x denote the domestic price of X and p_{zmi} denote the price received by the producer of a representative zm_i. Since final X production is assumed competitive, p_{zmi} is the value of the marginal product of zm_i in producing X. Large-group monopolistic competition is the assumption that an individual firm views Z_x as fixed or parametric, and here by extension views ZM and ZD as fixed. Thus, the individual firm views all composite prices and quantities as fixed except for its own output zm_i. This implies that marginal revenue takes on a very simple form.

$$\textbf{(9)} \qquad MR_{zm_i} = p_x(1-\alpha_x-\beta_x)S_x^{\alpha_x}L_x^{\beta_x}Z_x^{-\alpha_x-\beta_x}\left[ZD^{\gamma}+ZM^{\gamma}\right]^{\frac{1}{\gamma}-1}ZM^{\gamma-\epsilon}\epsilon zm_i^{\epsilon-1} = \epsilon p_{zm_i}$$

Setting marginal revenue equal to marginal cost implies that the ratio of price to marginal cost is $1/\epsilon$.

We have assumed that all foreign varieties have an identical cost structure and the demand for all foreign varieties is identical. These "symmetry" assumptions imply that the output and price of all foreign firms that operate will be identical. We can thus write $zm_i = zm$ and $p_{zmi} = p_{zm}$ for all i. Similar conclusions follow for domestic firms.

Then equilibrium for a symmetric group of service firms (*zm* or *zd*) requires that two equations are satisfied: marginal revenue equals marginal cost; and zero profits. Solving these equations to find *zm*, output per firm, we get:

$$\textbf{(10)} \qquad zm = \frac{\varepsilon}{1-\varepsilon}\frac{fm(r,w,p_v)}{cm(r,w,p_v)} = (\sigma_m - 1)\frac{fm(r,w,p_v)}{cm(r,w,p_v)}$$

The output of a given variety is larger when fixed costs are larger relative to marginal costs (scale economies are larger) and when the varieties are better substitutes. Similar results apply for domestic type firms.

Dual to the output indices in equation 4 are cost functions. Substituting the symmetry of the

equilibrium into the cost functions for a unit of *ZM* or *ZD*, implies that *CM* and *CD* can be written as:

$$\textbf{(11)} \qquad CM = \frac{p_{zm}}{n_m^{\sigma_m - 1}} \qquad \text{and} \qquad CD = \frac{p_{zd}}{n_d^{\sigma_d - 1}}$$

where p_{zdi} is the price of the output of a domestic firm and n_d and n_m are the number of domestic and foreign firms. Since the elasticities of substitution exceed unity, the cost of obtaining an aggregate unit of foreign or domestic services decreases as the number of varieties increases. That is, additional varieties convey an externality on the final goods sector *X* by lowering its costs of obtaining a unit of composite services. The elasticity of the cost of a composite unit of foreign services with respect to the number of foreign varieties is $1/(1-\sigma_m)$. Thus, an additional foreign variety conveys a smaller externality on the final goods sector the better foreign varieties substitute for each other. A similar argument applies for domestic varieties.

We make the "small country assumption," that prices to our country are fixed. This means we assume, in addition to fixed prices of X and Y, that there are a large number of potential foreign firms in production in the rest of the world so the domestic market has no "world" effect on the number of multinationals.

3. Modeling Transitional Dynamics

In this section we present an extension of the static model above which we employ in the dynamic simulations. We assume that liberalization of FDI in services is an unanticipated policy reform and the economy is initially on a steady-state growth path with FDI prohibited. We calibrate the dynamic model to precisely the same dataset employed to illustrate the static model. The model assumes a growth in new vintage labor and a utility discount factor consistent with a balanced baseline GDP growth rate of 2% per annum and an interest rate of 5% per annum. We adopt the convention in variable notation that upper case letters represent stocks and lower case letters represent flows.

Savings and investment are determined implicitly by the consumption decisions of a forward-

looking representative agent who allocates wealth to maximize intertemporal welfare:

$$\textbf{(12)} \qquad W = \sum_t \Delta^t U_t(X_{c_t}, Y_{c_t})$$

In this dynamic model, we define L_t as the stock of unskilled labor in period t (as opposed to a composite of primary factors other than skilled labor). Consistent with a labor market in which workers enter the workforce at age 20 and retire at age 70, we assume an exogenous retirement rate of 2% per year. Along the dynamic growth path new vintage workers enter the labor market in each period, and they must choose whether to enter school or the unskilled workforce. School graduates subsequently choose either to work in the domestic or FDI service industry. The new-vintage labor market clearance condition, where n_t is the number of new workers in year t, is:

$$\textbf{(13)} \qquad \ell_t + s_t^{\beta} = n_t$$

The parameter $\beta>1$ reflects diminishing returns in the productivity of skilled workers, i.e. marginal graduates are less productive than the earlier participants.[4] New skilled workers (s_t)) (new graduates) may subsequently choose to enter the domestic ($s_t^{D)}$ or FDI (multinational, s_t^M) skilled labor markets:

$$\textbf{(14)} \qquad s_t^D + s_t^M = s_t$$

while the unskilled workforce likewise evolves:

$$\textbf{(15)} \qquad L_{t+1} = \lambda L_t + \ell_t$$

where $\lambda= 1- \delta$ where δ is the rate of attrition from the workforce by unskilled workers. We assume in the dynamic model that the cost of producing a new skilled worker for the domestic or FDI markets is identical.

Given a dynamic model, we have the capacity to assess the adjustment costs of workers. Cross-

[4] In this model unskilled workers are measured in units proportional to population, but skilled workers are measured in efficiency units. For our reference calculations we take $\beta=10/7$.

country evidence on the adjustment costs of labor indicates that the *social* adjustment costs of trade and FDI liberalization are typically rather low relative to the fears of policy-makers, unless there are significant labor market distortions. Moreover, even the private costs of adjustment are low for workers who were not earning rents (Matusz and Tarr, 2000). Restrictions on the ability of firms to terminate labor and other labor market distortions that limit mobility, as well as a poor climate for investment (due to macroecomic instability or lack of the rule of law) can, however, lead to prolonged periods of adjustment to trade and FDI liberalization for labor.

In this model we introduce a proxy for various labor market distortions that can lead to large adjustment costs of workers. We assume that a fraction of *existing* skilled workers have human capital that is specific to the firm type in which they work. These workers cannot be trained for the other type firms, i.e., a fraction of the workforce is unable to gain employment in foreign firms. In contrast, all new workers can freely choose between domestic and multinational firms. The base year supply of skilled workers is then divided between those working in the domestic and multinational firms:

$$\textbf{(16)} \qquad \bar{S}_0 = S_0^D + S_0^M$$

and there is an upper bound on the share who are capable of working in the multinational sector:

$$\textbf{(17)} \qquad S_0^M \leq \phi \, \bar{S}_0$$

In the central scenarios, we take $\phi = 0.5$. Subsequent to the initial reallocation of skilled workers across the two sectors, these human capital stocks evolve according to the standard capital accounting relationship:

$$\textbf{(18)} \qquad S_{t+1}^k = \lambda \, S_t^k + s_t^k \qquad k \in \{D, M\}$$

When skilled workers are immobile (ϕ is small), there may be an initial disparity in real wages between workers in different types of firms during the adjustment process.[5] As new skilled workers enter the

[5] Since the skilled workers remain employed during the transition, the adjustment costs are private not social.

workforce, they move into the sector paying the highest return, and wage differences between foreign and domestic firms disappear. During a transition period where (30) is binding,, all new graduates adopt jobs in the FDI service sector. Thus, the model formulation allows and exhibits "bang-bang" adjustment paths.

In differentiating domestic and multinational skilled workers, we replace equation (8) by two equations, one for domestic workers:

(19) $$S_t^D = S_{yt} + S_{xt}^D + n_{dt} C_{rt}^D$$

and a second for skilled workers employed in multinational firms and those in the X sector that are capable working in the multinational sector:

(20) $$S_t^M = S_{xt}^M + n_{mt} C_{rt}^M$$

Prior to liberalization, skill-intensive services (*Z*) and skill-intensive goods (*X*) are produced using only domestic inputs. In the long-run, following reform, both are produced using both domestic and multinational inputs (see equation 3). During the transition, however, the relative cost of new- versus old production techniques determines how these goods are supplied. During the transition, the supply of *X* is therefore the sum of production from *conventional* domestic sources and new multinational firms:

(21) $$X_t = (S_{xt}^D)^{\alpha_x} (L_{xt}^D)^{\beta_x} (Z_t^D)^{1-\alpha_x-\beta_x} + (S_{xt}^M)^{\alpha_x} (L_{xt}^M)^{\beta_x} (Z_t^M)^{1-\alpha_x-\beta_x}$$

4. Simulation Results

(a) What is the Counterfactual. The are a myriad of barriers applied against foreign direct investment by multinational services providers. These include limitations on the use of expatriate labor,

domestic content requirements, restrictions on the expatriation of profits, denial of licences to operate or sell services, restraints on how a firm can do business (such as joint venture requirements with national entities), requirements to transfer technology, and simply increasing the red tape costs of multinationals. Most, but not all such barriers, are non-tariff barriers that raise the costs to mulinational firms of supplying services. Recent estimates of the ad valorem equivalence of barriers against multinational services providers exhibit an enormous variance, but for some countries and products, the cost of domestic services may be elevated by as much as 1000 percent. (See Warren (2000) or Kang (2000) for examples.)

We model the variable V as the key input required for foreign direct investment, and we shall assume that any barriers imposed on multinational investment fall on the cost of importing V. In principle, the costs of barriers could fall on the output of the multinational firm or on the use of its domestic resources. But insofar as many barriers restrain how the business operates or the nature of the firm, we prefer to assume that the cost of barriers falls on the foreign input V.

To understand our policy simulations, we must explain further the value of p_v and the meaning of changes in its value. Since this is a real model, all prices are relative to our numeraire, which is the cost of one unit of utility using our specified utility function. Thus, p_v is the cost of a unit of V in terms of the basket of goods consumed by the representative agent. Our small country assumption implies that there is a foreign supply price of V, which we denote p^s_v, where again this supply price is relative to our numeraire. We assume that there are

regulatory barriers or red tape that result in a difference between the foreign supply price of V and the price of a unit of V to the importing country. The difference, $p_v - p^s_v$, is dissipated due to regulatory barriers. That is, p_v is the real resource cost to the domestic economy of an imported unit of V.[6]

[6]An alternate interpretation of p_v is the international "term-of-trade" for V. A lower p_v denotes better terms of trade insofar as how much X or Y the country must pay for the imported input V. From the point of view of the *domestic* economy, either interpretation is the same.

In our policy simulations we shall lower the value of p_v toward the foreign supply price p^s_v. It is perhaps easier to think of this if we define *t* as the ad valorem equivalent of the barriers agains foreign direct investment. Then $p_v = p^s_v (1+t)$. Lowering p_v is thus equivalent to our small open economy lowering t, the ad valorem equivalent of its barriers against multinational service providers.

We assume that in the initial equilibrium of the model, the barriers against multinational investment are so high that no foreign firms sell in the domestic market. That is, the ad valorem equivalence of the barriers against multinational investment are infinite. The first column of Table 1 shows results of this initial equilibrium, when imports of *V* are banned. Hence the value zero is displayed in two rows of column one: the number of foreign service firms; and imports of the variable V. The country exports *Y* and imports *X*, and there is no trade in *V* (trade balance requires that the last three entries in a column sum to zero). We choose units of other variables displayed so that they are unity in the initial equilibrium.

In Table 1, the columns are headed by various values of p_v, and by the equivalentl ad valorem barrier to imports of inputs of V (in percentage terms). We set the foreign supply price $p^s_v = 0.2$. As we move from the left to the right in Table 1, we are progressively decreasing the barriers against foreign direct investment from infinite to zero. The ad valorem equivalent of the barriers against imported specialized inputs falls from infinite and 400 percent in columns 1and 2 and to zero in column 6 where $p_v = 0.2$.

Often numerical general equilibrium models avoid initial calibrations in which there are inactive production activities or trade links. Or, if there is an initially inactive trade link (aircraft exports from Sri Lanka to the US), the link is omitted from the model: i.e., an inactive link is always inactive. In our case, this is not an appropriate procedure. We very much want to consider initial situations in which FDI is prohibited in a sector, and liberalization opens the closed sector. The difficulty is obtaining information on how profitable the excluded activity would be if the barrier were removed. This will obviously be

quantitatively important to the results. In our case, we assume that multinationals can sell at equal costs if the barriers on specialized imported inputs raise the net cost of these inputs by 400 percent.

(b) Parameter Specification. We have chosen a structure of production that provides for firm-type product differentiation in services where the final good sector X distinguishs national differences (see equation (3)). When the elasticities of substitution are equal at all levels, i.e., $\gamma = \delta = \epsilon$, the CES function reduces to strictly firm-level product differentiation. In this case, the final good sector is completely indifferent between a domestic of foreign variety. Decreasing n_m by one is perfectly matched in final sector productivity by increasing n_d by one; only the total number of varieties matters. If the costs of producing domestic or foreign services are not that different, and they are collectively a small part of total GDP, then we can get dynamic bang-bang solutions in which a small change in relative costs shift us from only domestic services being produced to only foreign services.

We have therefore set, the elasticity of substitution between aggregate domestic services and aggregate multinational services at 3, and the elasticity of substitution among services of one firm type (domestic or foreign) at 5.[7] Then a domestic and foreign variety are poorer substitutes for one another than two domestic (or two foreign) varieties are for each other. Moreover, the marginal productivity of either the domestic or foreign aggregate *ZD* and *ZM* goes to infinity as its share goes to zero. Then, as long as either foreign or domestic varieties are permitted to be produced and sold, they will both exist in the market.

The model is calibrated so that imported services *ZM* have a 10% value share in *X* production at a price of 1.0 for *V*, and *V* has only a 40% value share in producing *ZM*. Thus *V* has a 4.0% value share in *X* initially and about 2% of initial income of the home country. The various shares and elasticities are assumed without firm empirical support.

(c) Comparative Static Results. Table 1 shows some simulation results from the static model.

[7]Define σ = the elasticity of substitution of Z_x. Then from equation (3), $\sigma = 1/(1- \gamma)$.

When the barriers against foreign service providers are relaxed, the cost of using V in the production of services by multinationals falls, and the imports of V increase monotonically across row 8. Positive profits implies that equation (17) is not satisfied. Entry by foreign service providers must occur until the price of foreign services is driven down to restore equilibrium. But the lower prices by foreign service providers results in a substitution in demand away from domestic service providers and a decline in the number of domestic service providers. Hence, as we move from the left to right in Table 1, we see that the number of foreign service providers (n_m) increases (row 5) and the number of domestic service providers (n_d) decreases (row 4).

As explained with equation (22), additional varieties convey an externality on the final goods sector *X* by lowering its costs of obtaining a unit of composite services. Equivalently, additional service varieties increase total factor productivity in the sector (X) that uses services. As the barriers against multinational service providers fall (from $p_v = 1$ to $p_v = 0.2$), the total number of varieties increases. The increase in total factor productivity from additional varieties results in an increase in welfare as shown in row 1.[8] We might draw attention to the very large changes in welfare in Table 1. Despite the fact that the cost of the V input is only about 2% of initial income of the country, comparing columns 2 and 6 of row 1, we see that a fall in the cost of *V* from 1 to 0.2 produces a 12 percentage point increase in welfare (1.03 to 1.15), a result that is due to the productivity-variety effect.

One of the most interesting results is displayed in row 2. The real wage of skilled labor rises monotonically across the row. As barriers to foreign service providers fall, the X sector substitutes foreign services for domestic services and there is a substitution effect away from domestic skilled labor because foreign service providers use skilled labor less intensively than domestic service providers. (*V* economizes on domestic skilled labor in producing *ZM*). But the reduction in the quality adjusted cost of

[8]Although the total number of varieties decreases between columns one and two, total factor productivity increases. As explained in footnote 10, since there are zero foreign varieties in column one, an additional foreign variety has higher marginal productivity than a domestic variety.

services lowers the cost of final output in the X sector and induces an output expansion there. In our simulation, the expansion of output in the X sector increases the *X*-sector's direct demand for skilled labor. The output effect dominates the substitution effect resulting in an increase in the demand for skilled labor on balance. Thus, V and skilled labor are partial equilibrium substitutes but general equilibrium complements. These results are particularly dramatic if we want to think of *V* as largely consisting of imported skilled workers: they are clearly a general-equilibrium complement to domestic skilled labor.

Results for the trade pattern are especially interesting. With high barriers to foreign service providers, the economy imports the service intensive good X and exports Y. As the barriers against foreign service providers fall, the economy can produce the good X more cheaply. In column 2, imports of X are eliminated, and trade consists of a small export of *Y* to pay for imported *V*. As the barriers fall further, the pattern of trade in goods is reversed in the right-hand two columns of Table 1. When *V* is sufficiently cheap, the country imports *Y* and exports *X*.

Results for the primary factor L, which is a composite of unskilled labor and other primary factors are displayed in row 3. These results exhibit a tradeoff between the Stolper-Samuelson effect and the Dixit-Stiglitz (1977) effect. L is used intensively in Y, and Y is the contracting sector. So the Stolper Samuelson theorem suggests that the real price of L, the factor used intensively in Y, should fall. On the other hand, increased variety lowers the cost (and therefore price) of producing a unit of the service composite, which, ceteris paribus, tends to reduce the price of the good of X (the good that uses services intensively). These competing effects just about cancel each other in the simulations. The price of skilled labor increases *relative* to the price of L, consistent with Stolper Samuelson, but unlike the usual Heckscher-Ohlin model, the real prices of both can rise due to the Dixit-Stiglitz price index effect.

Finally, column 2 of Table 1 in which $p_v = 1$ is a very important special case and requires some explanation. Let w_0 and r_0 be the initial equilibrium values of w and r in column 1, where foreign FDI is banned. For *zd* = *zm* (domestic and imported varieties produced in the same quantity), we choose units of

V such that p_v =1 is the value of p_v that satisfies the equality

(22) $$cd(r_0, w_0)zd + fd(r_0, w_0) = cm(r_0, w_0, p_v)zm + fm(r_0, w_0, p_v)$$

That is, at the initial prices with FDI-banned, p_v = 1 means that cost of one unit of output from a representative foreign firm is equal to cost of a unit of output from a domestic firm. This is an interesting case because, in traditional competitive models, no entry would occur and the initial no-FDI equilibrium would continue to be an equilibrium once entry is permitted. However, due to the demand for both foreign and domestic varieties, both must exist in equilibrium unless they are banned (see footnote 10). Thus, even with no cost advantage, foreign service providers will enter. In a competitive model without variety productivity effects, the second column would be identical to the first; but in our model, the second column in fact shows a welfare increase of 3%.

(d) Optimal Trade Tax or Subsidy. Earlier, we noted that the entry of a new service producer confers a positive productivity boost or "externality" on existing producers. To put is somewhat differently, a well-known result in this type of model is that the number of firms in market equilibrium is below the optimal number. The first best instrument to deal with this is a subsidy that does not discriminate between foreign or domestic service providers. Assuming this is not available we consider the optimal tax or subsidy on imported *V*.

For the purpose of this exercise only, we take 0.4 as the price that corresponds to no tax on foreign inputs V. In Figure 1, we start from an equilibrium where the price of V is 0.4 and the welfare change is 1.07. All welfare changes in Figure 1 are measured relative to this equilibrium. Figure 1 shows that the optimal tax on V is in fact negative, the optimum is a subsidy of about 25%. The extra imported varieties could be thought of as having a productivity-enhancing effect on final production: final production exhibits increasing returns in intermediates. The productivity effect is reflected in Table 1 by the fact that the real prices of *both* factors may increase relative to the benchmark. A related result is found in Lopez-de-Silanes, Markusen, and Rutherford (1994), where the authors find that the optimal

tariff on auto parts imported into Mexico is negative. For theoretical foundations of this problem, see Markusen (1989, 1990). We caution, however, that political economy considerations imply that implementation of either the first or second best policy interventions discussed will likely be highly problematical and subject to abuse.

(e) Dynamics. We compute the initial steady state equilibrium with imports of V banned. We then assume that the imports of V are allowed, but barriers are not fully removed. That is, in deriving the counterfactual growth path, we assume that $P_v = 1$, or t=400%. We then observe the changes in variables of the model compared to the initial steady state

The dynamic transition could require significant changes in the labor market, as illustrated in Figure 2 (recall that a lower-case *s* is a flow of new skilled workers, an upper case *S* is a stock). In this simulation, the transition to a new steady state takes about 7 years. During approximately the first seven years, all new entrants to the skilled labor market choose to work in the FDI sector.

The reason for this corner solution is indicated in Figure 3. In the long run, the wages for skilled workers in domestic and FDI firms are equalized, but during the transition, our assumption of imperfect mobility results in substantial differences in these wages. As indicated in the figure, liberalization initially raises the return to skilled workers in the FDI sector (r^M) by 15%; the return to skilled workers in the domestic sector (r^D) falls by about 12.5% and does not return to its initial value for five years. During this time the unskilled wage (w^U) rises by about 10%.

Figure 4 indicates how trade in goods (*X* and *Y*) and imported services (*V*) adjust through the transition process. As in the comparative static model, the economy initially is a net importer of X. As the number of FDI service firms rises, however, the economy becomes more efficient at producing X and imports of these goods decline. After 5 years, the economy becomes a net exporter of *X* . On the new steady-state, both *X* and *Y* are exported, and only *V* is imported.

In Figure 5, we examine how sensitive the wages of immobile skilled workers are in the transition

as a function of the share of (old) skilled workers who are immobile between domestic and multinational firms as shown in Figure 5. Recall that the central case in Figures 2-4 sets this share at 50%. When the mobile fraction increases to 60% of the initial workforce, the return to these workers increases almost immediately. When the fraction is 30%, the wage of skilled workers falls and remains below the initial steady-state for about ten years. In all cases, the wages of immobile skilled workers converges to the wages of mobile workers, but with the immobility share at 30%, convergence takes about 15 years.

5. Conclusions

Although there is a clear trend among developing countries to liberalize their policies with respect to inward foreign direct investment (UNCTAD, 1995, 272-275), many developing countries continue to impose restraints on FDI in general and in services in particular. These policies may be motivated by the fear that foreign service providers will harm domestic skilled workers. For example, examination of the commitments on services of WTO members in their GATS schedules reveals that 32 countries (mainly in Africa and Latin America) have scheduled "horizontal restrictions" that require foreign firms to use and train domestic skilled workers. In many cases these restraints may impede the foreign firm from importing the specialized people it would desire.

One of the more interesting results of our static and (in the long run) dynamic model is that the real wage of domestic skilled labor increases with liberalization of policies against foreign service providers, and the more foreign firms there are in the domestic market the more the real wage of domestic skilled workers increases. Thus, despite the fact that foreign firms import an input (V) and thereby use domestic skilled labor less intensively than domestic firms, additional foreign firms benefit domestic skilled labor. The reason is that additional foreign firms lower the cost of the intermediate service product in final goods production and thereby increase the relative importance of the final good sector (X), which uses services relatively intensively. Thus, in a general equilibrium sense, domestic skilled labor and the specialized foreign input V are complements. One possible interpretation of this result is that the policies

of certain developing countries that restrain the import of foreign inputs or force foreign multinationals to use domestic skilled factors in place of foreign inputs may not only result in lost national income, but may hurt the factor of production they are designed to assist.

We showed, with our static model, that liberalization could lead to gains between 3 and 15 percent of GDP, depending on parameter assumptions. These are very large gains relative to what we might expect from a static model given that the imported input is only about 4% of X output, or about half that as a share of host-country income. The source of these large gains is that additional intermediate service firms increase the productivity of the final goods sector that uses these firms services as intermediate inputs. More service firms allow final goods producers to use more specialized expertise, in the same way that larger markets allow for more specialized machine tools.

In our dynamic model, the total number of firms and total factor productivity in the economy increases steadily from the first period, but for the first 5 years the domestic industry progressively declines. Eventually the domestic industry stabilizes (the marginal product of domestic firms increases as the number of domestic firms declines). We assume that their human capital is specific to domestic firms and that all new entrants to the workforce and a given share of the existing skilled worker workforce can be trained to work in the foreign owned firms. Consequently, real wages are higher in foreign firms during an initial period and all new domestic entrants to the skilled labor force enter foreign firms during that time. The potential losers during the transition are skilled workers specific to the domestic industry. These workers incur losses only when we make the rather strong assumptions that at least fifty percent are immobile. When we assume that 50% (or more) of the initial skilled workforce is immobile (or specific to the domestic services sector), after 7 years (or longer) real wages of skilled workers are equalized across foreign and domestic owned service firms and are higher as a result of the liberalization of FDI in the service sector. With 60% or more of the skilled workforce is mobile, there are virtually no adjustment costs since even the wages of immobile skilled labor increase very rapidly.

Finally, in the dynamic model , the real prices of both skilled and unskilled labor rise over the long run, and thus the economy avoids the curse of Stolper-Samuelson in which one factor must be made worse off. Everyone gains in the long run, and the economy switches (in our example) to exporting a good that was previously imported due to "missing inputs."

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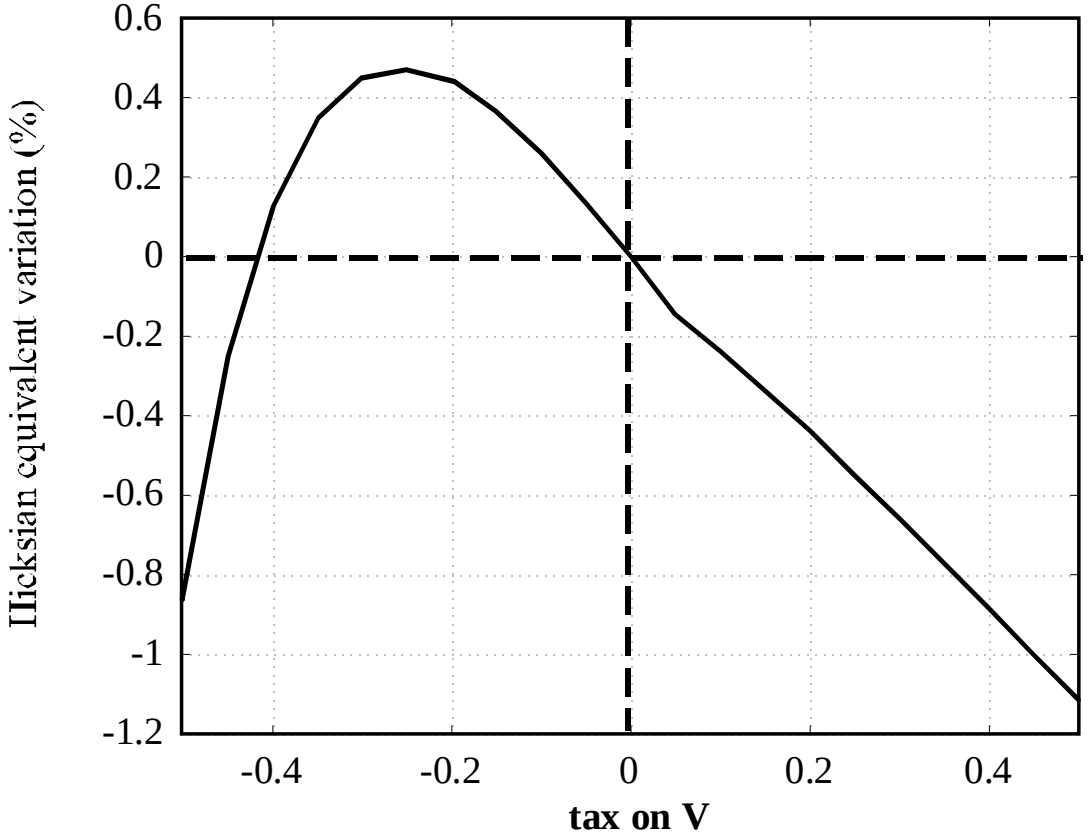
Table 1: Impact of lowering the barriers against imported specialized inputs (skilled labor, blueprints, patents, etc.) of multinational services providers

PRICE OF SPECIALIZED INPUTS V* TO THE HOME COUNTRY OR % AD VALOREM BARRIER AGAINST IMPORTED SPECIALIZED INPUTS						
PRICE	+INF	1.00	0.80	0.60	0.40	0.20
% BARRIER	+INF	400	300	200	100	0
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES						
1. Welfare	1.00	1.03	1.03	1.05	1.07	1.15
2. Real wage of skilled labor	1.00	1.07	1.07	1.11	1.14	1.40
3. Real price of other primary factor (the composite factor)	1.00	0.99	1.01	1.00	1.02	0.96
4. No. of domestic service firms	1.00	0.45	0.35	0.24	0.11	0.03
5. No. of foreign service firms	0.00	0.51	0.67	0.98	1.42	2.80
6. Net imports of X	1.00	0.00	0.00	-0.41	-0.63	-3.01
7. Net imports of Y	-1.00	-0.26	-0.31	0.00	0.11	2.18
8. Net imports of V	0.00	0.26	0.31	0.41	0.52	0.83

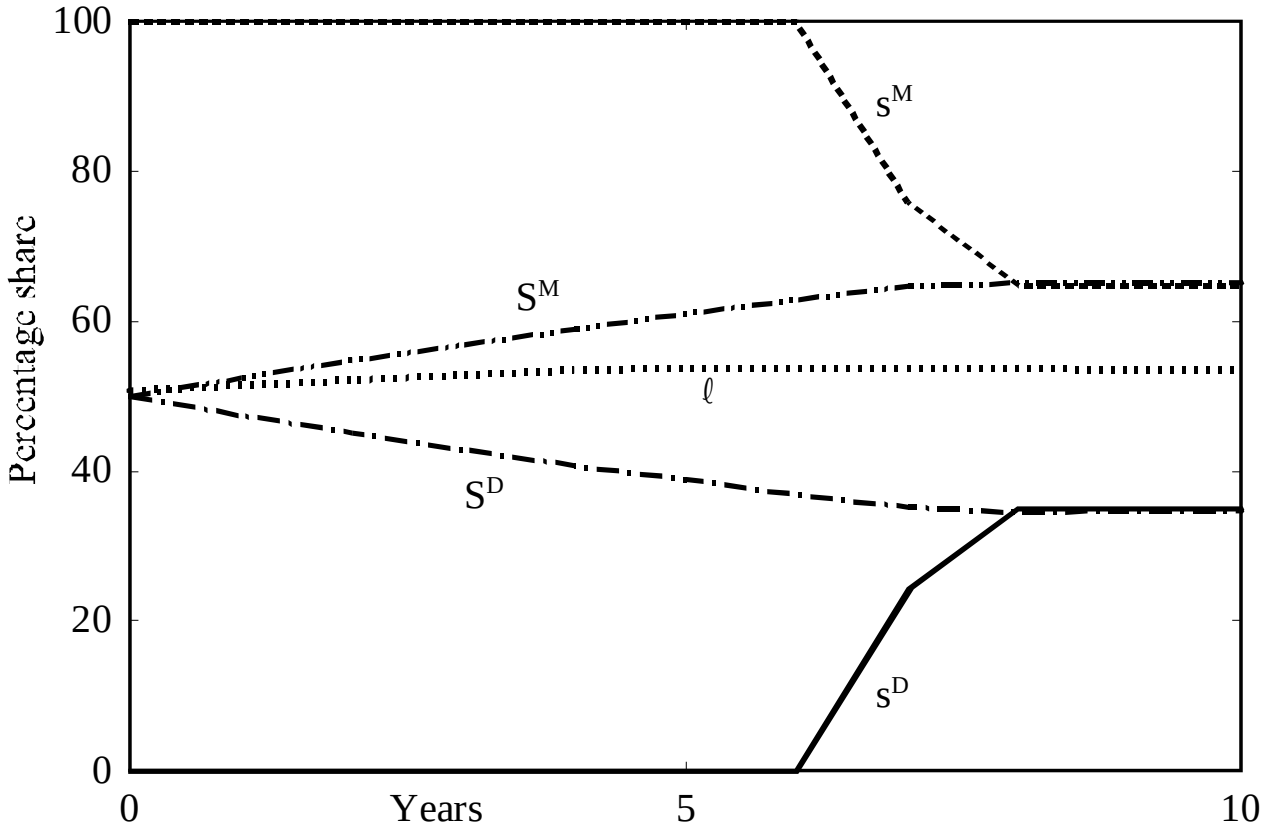
*We set 0.2 as the international supply price of the specialized input V. Prices above 0.2 are due to barriers against importing the input and represent real resource costs to the home country. The ad valorem equivalent of the barriers against the inputs are listed below the price of V.

Figure 1: Welfare Effects of a Tax or Subsidy on Inputs to Foreign Service Providers



Starting from an equilibrium with no tax on imported inputs V we see that taxes monotonically reduce welfare. Excluding first best non-discriminatory subsidies, we see that subsidies to imported inputs V raise welfare for subsidies up to 25% due to the increased varieties of services. Subsidies higher than 25% lower welfare relative to a subsidy of 25%.

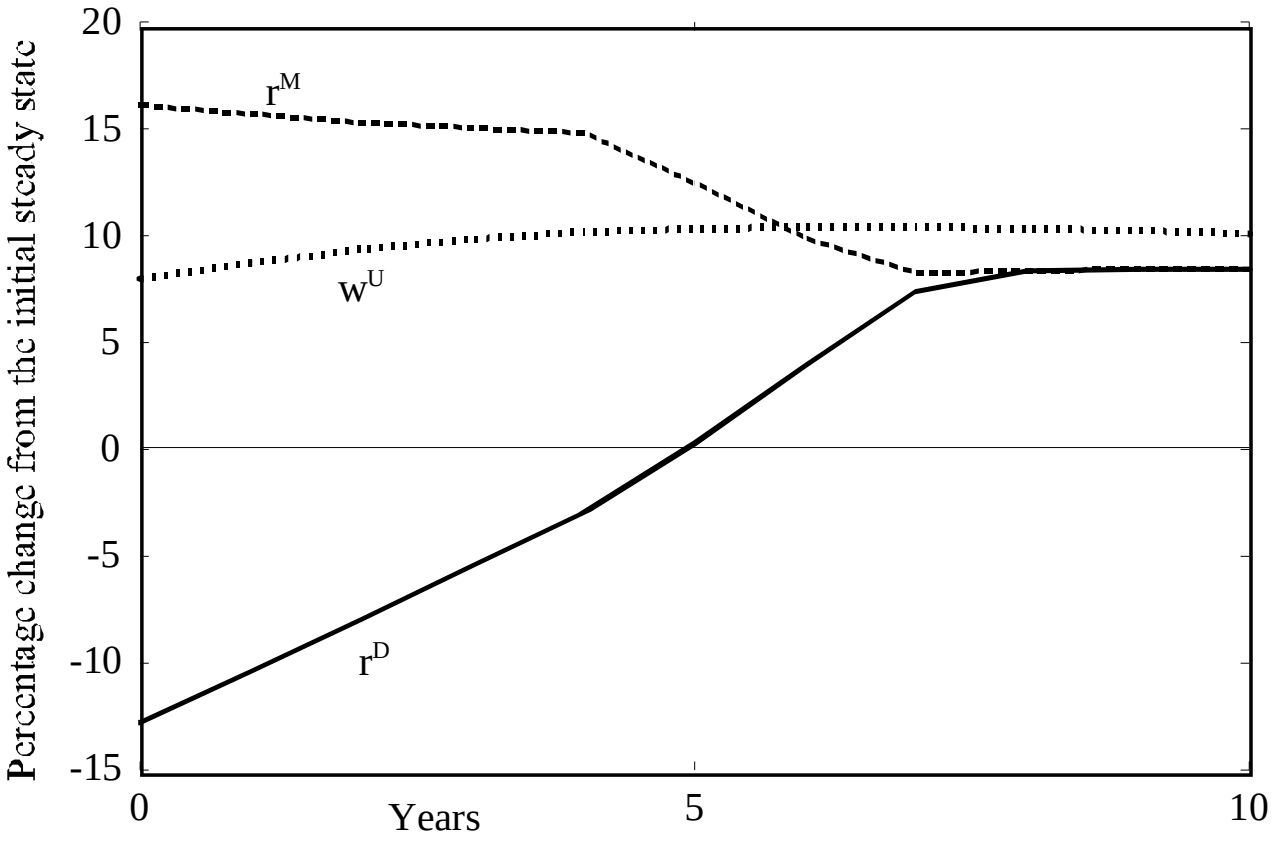
Figure 2: Dynamic Path of Stocks and Flows of Labor



After liberalization of FDI barriers, all new skilled workers choose to work in the multinational sector for almost seven years, $s^M=1$; $s^D=0$. The steady state is approached after about eight years, with a higher share of skilled workers employed in the multinational sector, i.e., $S^M=.62$; $S^D=.38$.

Legend: s^M (s^D) share of new skilled workers taking jobs in the multinational (domestic) services sector. S^M (S^D) share of alll skilled workers working in the multinational (domestic) serivices sector.

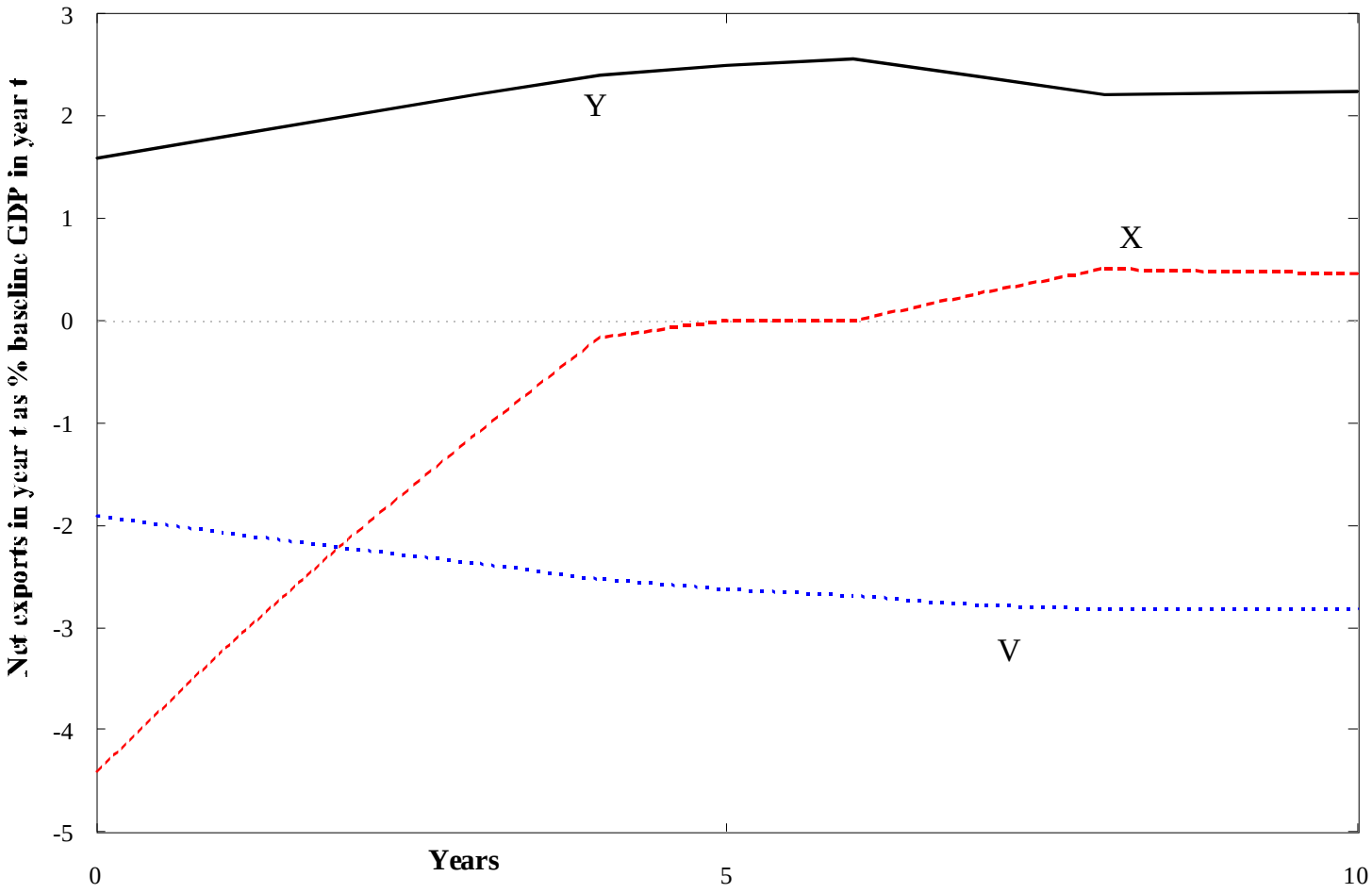
Figure 3: Wages in Transition



Imperfect mobility of skilled workers and an increase in demand for skilled workers in the multinational services sector, results in the wage rate of skilled workers in the multinational services sector initially exceeding the wage rate of skilled workers in the domestic services sector, i.e., $r^M > r^D$. After about eight years, the these wage rates converge to an increase in skilled worker wages of about eight percent relative to the steady state. The wage rate of unskilled labor also increases by about 10 percent due to the expansion of varieties and the externality that conveys on factor productivity.

Legend: r^M (r^D) = wage rate of skilled workers in the multinational (domestic) services sector. w^U = wage rate of unskilled labor.

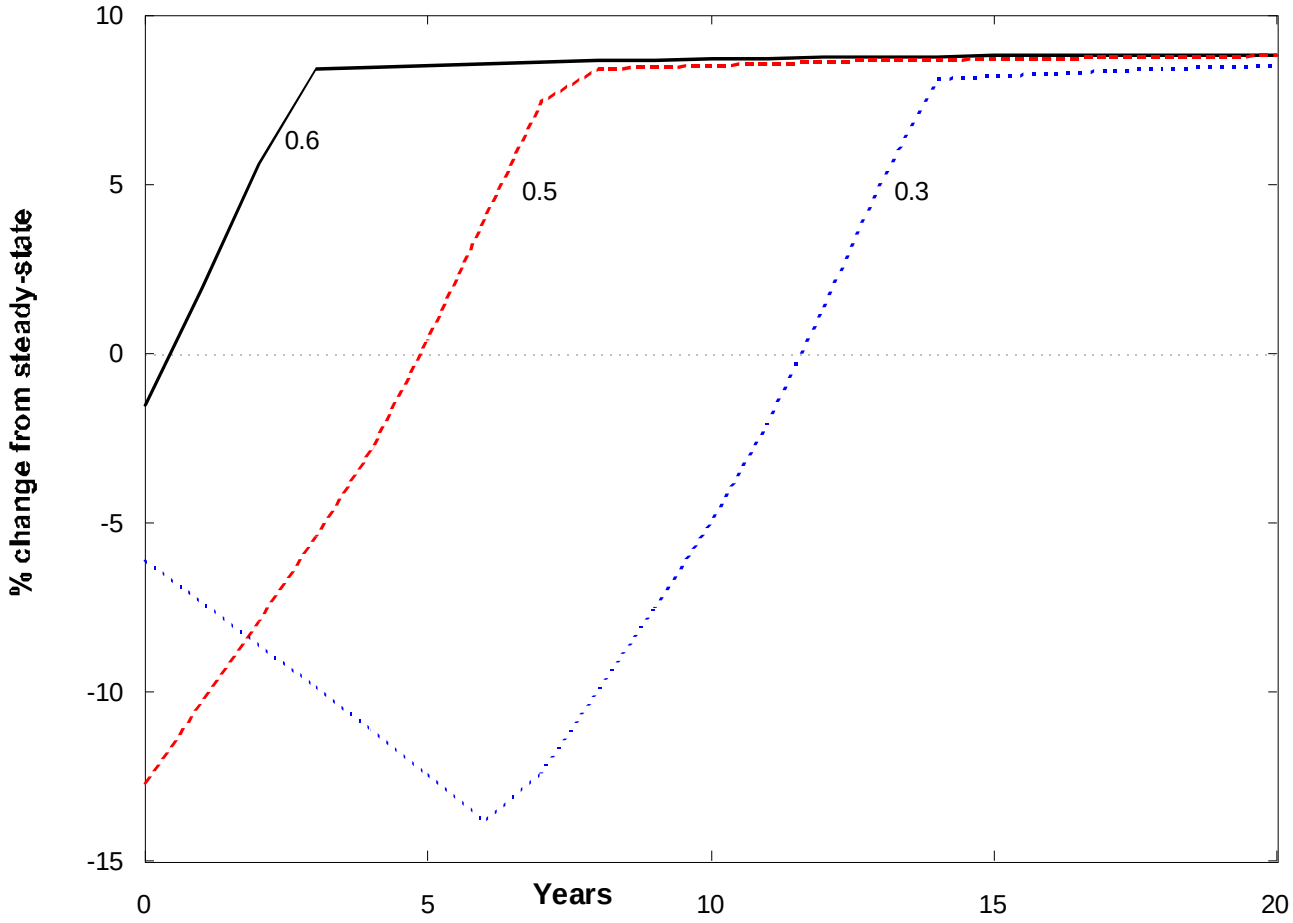
Figure 4: Net Exports



After liberalization, the country exports Y, and imports X and V in the early years. As service varieties grow, exports of X expand, so that after five year, the country exports X and Y and imports only the input V.

Legend: Y (X) value of exports minus imports of Y (X) in year t divided by GDP in the baseline steady-state in year t. V equal the value of imported specialized inputs into multinational service production.

Figure 5: Impact of the Share of Skilled Mobile Workers on the Dynamic Path of Wages of Immobile Skilled Workers



If 60% of skilled workers are mobile, the wage rate of immobile workers rises in one yearand approaches the wage rate increase of skilled mobile workers in less than five years. With only 30% of skilled workers mobile, the wage rate of immobile skilled workers falls relative to the steady state and remains below steady state levels for about 12 years; after 15 years though it approaches the increase of the wage rate of skilled mobile workers.