Welfare implications of Outsourcing versus FDI in the host country

Abstract

Foreign direct investment may not necessarily be the most welfare enhancing form of international sourcing. The host country may avail options like – Joint venture, technology licensing, franchising, outsourcing etc. A host country's choice of organizational form should depend on its growth and welfare effects. This paper compares the welfare effects of FDI with that of outsourcing in the host country using Grossman-Helpman quality ladders framework. If the host country's absorptive capacity is above a threshold level, outsourcing is more welfare enhancing vis-à-vis FDI; while even with lower than threshold absorptive capacity, outsourcing being welfare improving over FDI is not ruled out.

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Section 1: The Background

Globalization, measured by any form – foreign direct investment (FDI), outsourcing, international mergers and acquisitions, and cross-border firm linkages via joint venture or license agreements have undoubtedly increased in the recent decades[1]. Global trade expands the economic pie and may let all the participating nations raise their welfare levels. Blomström et al. (1998), Balasubramanyam et al. (1996) and Borensztein et al. (1998) present evidence that inward direct investment has raised the growth rate of many developing countries. Increased competition, technology transfer, increased access to world markets due to spillovers to local firms, and worker training are some of the channels through which FDI can benefit the host economy.

Despite the increasing importance of FDI and outsourcing on economic prosperity of a nation, the relative impact of these two alternative forms of foreign sourcing on the host countries involved has received relatively little attention. A comparison of their effect on the welfare of the host country is an important policy issue. This paper compares the effect of FDI with that of outsourcing on factor prices and aggregate welfare in the host country. The foreign firm's organizational mode of fragmented production affects the relative demand for skilled and unskilled labor. The model shows that outsourcing may yield higher welfare than FDI under certain conditions. Specifically, it is found that outsourcing unambiguously leads to a higher welfare if the host country has high absorptive capacity. Such an unambiguous possibility does not exist for FDI. Welfare is different in the two alternative regimes of foreign sourcing, because the extent of relative demand for skilled and unskilled labor created by FDI and outsourcing are different, which in turn impacts their wage rates and hence aggregate GDP or welfare.

Two innovations are attempted in this paper. First, I formally distinguish between the two forms of foreign sourcing - FDI and outsourcing - in a unified framework and I embed it in a general equilibrium framework to highlight their differential impact on welfare in the host country. None of the existing models differentiate between FDI and outsourcing when they confer on welfare, see for example Antràs (2003, 2005), where they distinguish between FDI and outsourcing but do not talk about welfare implications, while Glass and Saggi (2001) do talk about the welfare impact of outsourcing in the source country but in their model outsourcing cannot be distinguished from fragmentation. Second, I choose to address the problem from the point of view of a host country with non-homogeneous labor[2]. Most of the literature on welfare impact of foreign sourcing focuses on the source country with few exceptions like Reis (2001) and Feenstra and Hanson (1996b). This model is different from Feenstra and Hanson (1996b) as international outsourcing and FDI are together knit as part of a product cycle framework in which multinationals are triggered by cost saving opportunities. I allow for substitutability between skilled and unskilled labor in manufacturing, a feature, which is missing in Glass and Saggi (2001). The model's framework shares similarity with Reis (2001), however, he focuses only on FDI. Since most of the literature available in this area focuses on the north or the source country, the internalization decision of the firm has been still better explored. See for example, Antràs (2003, 2005), Antràs and Helpman (2004), Grossman and Helpman (2003, 2004) which discuss about the source firm's profits in the two alternative regimes while Glass and Saggi (2001) discuss the source country's welfare and the multinational firm's profits, taking the host country as given. In this paper, I start off from where these papers have concluded. I take the source country and the source firm's internalization decision – the choice between FDI and outsourcing as given, and analyze the host country's perspective to the problem. This paper is about the preferred mode of organization of foreign sourcing in the host country taking the northern firm and the north as given.

The paper is organized in the following way. Section 2 is on related literature on FDI and outsourcing and builds an extension and a rationale for a key assumption of this paper. Section 3 describes the model; section 4 characterizes equilibrium in the host country and the conditions under which one form of foreign sourcing

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[1] Between 1980-98, the amount of net FDI received by developing countries has increased from 4.4 billion dollars to 170.9 billion dollars, almost a forty times increase. Feenstra (1998) compares several different measure of international outsourcing and argues that they have all increased. Gartner group estimated that the global market demand for outsourced business services would be over $300 billion by the end of 2004. McKinsey & Co projected that India would generate $17 billion in outsourcing revenues, employing 1.1 million by 2008. This is indeed a phenomenal contribution not only to Indian GDP, but also to global GDP.

[2] The issue of internalization decision by the multinationals or contract enforcement is not considered in this paper. Internalization specifically is an issue that is affected by profit considerations. Host countries can device incentives to influence the internalization decision of the SF if it believes a particular form of foreign sourcing is more suitable to its economic environment. For a discussion on internalization decision see Antràs (2003, 2005), Grossman and Helpman (2003, 2004) and Antràs and Helpman (2004).

scores over the other in terms of welfare. Section 5 demonstrates a comparative static exercise of the impact of investment in human capital in the south on welfare in the host country. Section 6 concludes the paper.

Section 2: Related Literature and Extension

The key difference between FDI and outsourcing is that of ownership and control. The sourcing firm maintains control over its subsidiary while it has little control over its outsourcing partner in the host country. In literature, different approaches, viz, factor endowment, contract theory and incentive system - have been used to model the choice between the internalization decision of a sourcing firm which have brought to fore the differences between FDI and outsourcing. Grossman and Helpman (2002, 2003) emphasize the importance of search and matching, customization cost, market thickness and protection of intellectual property rights in the host country for outsourcing vis-à-vis FDI to bring out how a subsidiary differs from an outsourcing partner. Ownership and control difference is also formally modeled in Grossman and Helpman (2004) where they assume monitoring a possibility under FDI while not so under outsourcing. Similarly ownership also implies in their model that the cost of inputs be borne by the MNC under FDI mode while it is paid by the supplier under outsourcing. Incompleteness of contracts is another feature that sets in when transaction happens between two independent entities as in case of Antràs (2003, 2005) and Antràs and Helpman (2004). With incomplete contracts, Antràs and Helpman (2004) show that the bargaining power of the MNC is higher under FDI vis-à-vis outsourcing. They emphasize that the organizational fixed cost of FDI and outsourcing are different and one can rank them in order of one's belief about the relative importance of managerial economies of scope relative to managerial overload. In an economy where managerial overload dominates, such that fixed cost for setting up a subsidiary is higher, it is the more productive firms that venture into FDI. Antràs (2003), on the other hand, does a commendable job in linking the capital intensity of an offshored intermediate to the organizational mode of foreign sourcing. He finds that the probability of FDI increases with capital intensity of a good. Antràs (2005) also capture the fact that a relatively new product is not sent offshore without FDI. However, with time, as the intensity of headquarter service falls it can be outsourced. This highlights that the degree of standardization of a good is also different perhaps for a product that is outsourced relative to a product that is made in a subsidiary. With these crucial differences between FDI and outsourcing already embedded in many theoretical models, I try to experiment with another difference between the two organizational forms. I assume that FDI subsidiary is less skill intensive relative to outsourcing production unit in the host country. The rationale[3] for this assumption is explained as follows.

First, as pointed by Teece (1977), FDI involves greater technology transfer relative to an arm's length transaction for the simple reason that a subsidiary is a part of the parent company. Assuming that skilled labor can substitute for technology, an outsourcing partner will have to engage more skilled labor to match up with a subsidiary's quality level[4,5]. *Second*, since greater technology is transferred to a subsidiary, the desire to protect their technology from leaking to other firms makes them hire less skilled workers because skilled workers can be potential carriers of the MNC industrial secrets. This also explains the lower skill intensity of subsidiary production vis-à-vis an outsourcing partner[6]. *Third*, a recent survey by Hewitt Quarterly Asia Pacific (2005) on outsourcing industries in the developing countries finds that IT operations and customer relations tops the most frequently globally outsourced functions (which are medium to high skill intensive jobs), whereas historically, FDI

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[3] The rationale is based on available literature on FDI and arm's length transaction or the theory of multinational firm and need not necessarily be a feature of the model discussed in the next section.

[4] The fact that I mention technology transfer is only to build a general rationale of the assumption. It does not mean that I shall explain the mechanism of how outsourcing will be relatively skill intensive when technology transfer occurs.

[5] Higher end technology is definitely a complement to skilled labor; however, the technology that is transferred by a foreign firm to a subsidiary or to an outsourcing partner is never a higher end technology. Mansfield and Romeo (1980) noted that the incentive to prevent the dissipation of knowledge based assets is reflected in the fact that multinationals transfer technologies of new vintage via direct investment, preferring to license or transfer their older technologies via joint ventures. Moreover, Teece (1977) finds that even with FDI, the technology that is transferred is on an average 9 years old. In such a situation it is possible to substitute technology for skilled labor.

[6] As noted in footnote 4, more recent technology is transferred in the subsidiary unit while little in the outsourcing unit in the host. The host is capable of producing a prototype of the multinational's model product for different reasons in outsourcing and FDI. When the process is outsourced, it can produce the prototype by employing skilled labor while it can do the same job in the subsidiary by using the technology transferred. Thus, there is inherent difference between outsourcing and FDI, even though they can produce the same product one does it with the help of skilled labor while the other via better technology, implying more risk of leakage in the latter mode.

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has been usually in the manufacturing sector. The survey further goes on to predict that three years down the line, outsourcing will also increase in finance and accounting and human resource, making outsourcing activity in the south still more skill intensive relative to a FDI subsidiary[7]. *Fourth*, empirical evidence by Feenstra and Hanson (1996a, 1996b), Sachs and Shatz (1994), slaughter and Swagel (1997), Slaughter (2000) also indicates that outsourcing leads to a greater divergence between the skilled and unskilled workers' wages, while FDI does not. Greater divergence in factor prices of skilled and unskilled labor reflects the differential demand for the two types of labor under the alternative forms of foreign sourcing. Thus, empirical evidence favors the assumption that outsourcing is a more skill intensive activity than FDI. *Fifth*, the above economic reasoning and empirical evidence regarding FDI and outsourcing is reflected in the formulation of eminent theoretical economic models[8]. For example, Grossman and Helpman (2005) and (2002) describe outsourcing as specialized or customized services by the input suppliers for the multinational companies (MNC), implying greater intensity of skilled labor in production by the outsourcing partner. Feenstra and Hanson (1996a) model also indicates that outsourcing is a skill intensive activity from the point of view of the host country (as well as the source country). Per contra, when it comes to describe FDI, Xu (2000) suggests that a relative increase in skilled biased demand shifts in all the sectors does not necessarily imply skill-biased demand shift in the country because *FDI may be unskilled labor-intensive activity in the host country.* This implies that FDI may not be skill-intensive relative to domestic activity while outsourcing according to Feenstra and Hanson is. Thus, we may conclude that outsourcing is perhaps more skill intensive than FDI[9].

While building the rationale for the assumption stated above, I have, at some points used evidence on licensing in order to address arm's length transaction in the form of an outsourcing relationship. Therefore, at this stage, perhaps it is worth mentioning that outsourcing may seem to share similarities with licensing but in essence is different. Licensing implies sale of technology to a host country entrepreneur while outsourcing is a contract to produce a part of total output. That is, outsourcing usually involves fragmentation of the production process while licensing does not. Outsourcing partners in the host country provide one of the inputs for the final good produced by the multinational company whereas, the licensee produces the entire product herself and directly sells it to the market. Second, even though licensing also involves finding a match between the licensor and the licensee but the nature of these search or matching process is very different from outsourcing. In literature, licensee search has been modeled more like an auction (Casson and Buckley, 1981 and Casson, 1979) while searching for outsourcing partners have been modeled using probability theory (Grossman and Helpman, 2002). Third, once the license is sold to the licensee he is usually free from any kind of inspection of production process. Per contra, outsourcing partner contributes to an input in the final good produced by the MNC, therefore, appraisal and quality check of the partner's product is inevitable. Thus, outsourcing is a much longer term and interactive relationship than simply licensing. Fourth, if a licensor makes effort to internalize, assimilate and further improve the technology, it is purely his gain, while if the outsourcing partner builds on the technology given by the multinational, both agents gain. Fifth, usually the licensing contract specifies ex-ante how much a licensor earns in the profit and also the royalty fee while under an outsourcing contract this decision is made ex-post production. Thus, to draw a simile, one always compares horizontal FDI with licensing while vertical FDI with outsourcing, due to the inherent difference of fragmentation of production under offshoring. Thus, the differences between horizontal FDI and vertical FDI could perhaps come close to the difference between licensing and outsourcing.

Keeping the basic premise of this paper in mind, that is, outsourcing partners use more skill intensive technique of production than their counterparts in a subsidiary, I move on to model the differential impact of FDI and outsourcing on welfare in the host country.

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[7] From the perspective of the north, these may not be highly skilled operations, however, from the host country perspective, if we were to divide the labor force into two cohorts, namely skilled and unskilled, IT operations, customer relations, finance and accounting certainly do not belong to the unskilled labor segment.

[8] Even though none of the authors compare FDI skill intensity with that of outsourcing, the modeling of the two activities with different set of assumptions on skill requirements perhaps is in-built with their perception about skill intensity in FDI and outsourcing.

[9] None of the authors have modeled outsourcing as an unskilled labor-intensive activity relative to the rest of the economic activity in the host country. However, some authors have not ruled out that FDI in the host country maybe unskilled labor intensive relative to the rest of the host country. So, this implies that putting the different authors' perception about FDI or outsourcing together, we may get that outsourcing is perhaps to more skill intensive relative to FDI.

Section 3: The Model

This section builds a North-South framework that specifically revolves around the events happening in the low wage south, which acts as the host country for offshored production. Each country is endowed with two types of inelastically supplied labor, the skilled and the unskilled labor, who are consumers of final goods. Consumers derive utility from consumption of two kinds of goods. One of the consumption goods is the homogeneous agricultural good, produced only in the south under perfect competition. The other good, is the vertically differentiated manufacturing good. By definition, within the manufacturing products, consumers derive more utility from higher quality manufacturing products and are willing to pay a premium for higher quality. This gives manufacturing firms an incentive to do expensive R&D and innovate to climb up the quality ladder. The technological capability of the firms in the south is assumed to be low and therefore, only the northern firms carry out innovation. Imitation is ruled out in the model.

A product cycle is generated in which shifts in production to the south may occur either through FDI or outsourcing. FDI and outsourcing are modeled as mutually exclusive forms of foreign sourcing. This is unlike Grossman and Helpman (2003) where FDI and outsourcing co-exist in the industry equilibrium. Even though the assumption is less realistic, it is essential to evaluate the independent impact of the two forms of foreign sourcing on host country welfare. Our approach is similar to Ottaviano and Turrini (2003), where they model exports, FDI and outsourcing as mutually exclusive ways of capturing the southern market. Even Antràs (2003, 2005) has this feature of all pervasive FDI or outsourcing for one product line, that is, both forms cannot co-exist for transacting one good.

In the model presented below, I ignore the problem of mode choice between FDI and outsourcing from the perspective of the sourcing firm, and focus on the preferred mode of foreign sourcing by the host country government[10]. To materialize this, I need to assume that the host country is a relatively small open economy to be able to affect any of the variables in the north. Therefore, variables like northern wages, innovation intensity, probability of standardization, search costs of finding an outsourcing partner or fixed cost of setting up a subsidiary etc. are exogenously given for southern steady state equilibrium. On the other hand, the multinationals or more accurately called the sourcing firms[11] (SF) in the host country are large enough to impinge their impact on the labor markets in the host country and hence affect its wages and welfare.

Section 3.1: Household Behavior

Section 3.1.1: Consumption

Consumers' problem is modeled in the spirit of Grossman and Helpman (1991) quality ladders model. Consumers live in one of the two countries, North or South, $h \in \{N, S\}$, belong to one of the two labor types, $l \in \{1, 2\}$, 1 for unskilled labor and 2 for skilled labor. Consumers take market variables as given and maximize a Cobb Douglas Utility function increasing in consumption of homogeneous good y and an aggregate X of the vertically differentiated manufacturing good whose price varies according to the stage of the product cycle.

The utility function of a representative consumer in country h and of labor type l is given by:

$$\bigcup_l = [X_l]^\gamma [y_l]^{1-\gamma} \qquad l \in \{1(\text{unskilled}), 2(\text{skilled})\} \tag{1}$$

y, which is the homogeneous perfectly competitive agricultural good is chosen to be the numeraire while X, the aggregate vertically differentiated manufacturing good is represented as:

$$X_l^h = \int_0^1 \sum_m \xi^m x_{l,m}^h(j) dj \tag{2}$$

Where ξ^m is the assessment of quality level m and $x_{l,m}^h(j)$ is the consumption of quality level m of product j by labor type l in country h.

For consumption of X, consumers choose from a continuum of manufacturing products indexed by $j \in$ [0, 1] available in discrete quality levels indexed by m. Quality level[12] m of product j provides quality $q_m(j) \equiv \xi^m$.

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[10] This kind of approach comes from the belief that profit maximization is the only motive that drives a firm to choose a particular form of foreign sourcing. Therefore, a host country government can always frame incentive schemes to attract that very mode of foreign sourcing that brings higher welfare for its economy.

[11] Antras (2005) point out that a sourcing firm is a multinational only if it vertically integrates with its input supplier not otherwise.

[12] Since this is a static model we look at one discrete level jump in quality that generates a product cycle.

All consumers value higher quality of manufacturing goods, that is, $\xi > 1$. Where ξ denotes the innovation size or magnitude of the quality jump.

A consumer utility maximization problem is broken in three stages. In stage one, they decide on the proportion of expenditure to be spent on manufacturing and agricultural goods. In stage two, they allocate the available expenditure for each product. Since the elasticity of substitution between various products of the manufacturing sector is assumed to be unity, the consumer evenly spreads spending across the unit measure of all products, $\gamma\ E_l^h(j) = \gamma\ E_l^h$. Aggregate Consumers demand $x_{\widetilde{m}}(j) = \gamma\ E / p_{\widetilde{m}}(j)$ units of quality level $\widetilde{m}(j)$ of product j and no other units of other quality level of that product. In the final stage, the consumer allocates spending for each product to the quality level $\widetilde{m}(j)$ offering the lowest quality adjusted price. Thus, in equilibrium, the consumers choose only one quality of a product that has lowest quality adjusted price. Same quality level is chosen irrespective of the country of residence or the type of labor because there is a unique quality of a product that has lowest adjusted price.

Consumers maximize utility as given by the utility function (1) subject to the budget constraint:

$$y_l^h + P\ X_l^h = E_l^h \tag{3}$$

Where E_l^h is the income of a representative labor type l residing in country h and P is the composite price of the manufacturing good. Maximizing (1) subject to (3), and aggregating over both countries and both types of labor we get the aggregate demands for y and X as:

$$y\ = (1-\gamma)E \tag{4}$$

$$P\ X = \gamma\ E \tag{5}$$

$$\text{Where}\quad E = E^N + E^S = E^N + w_1 L_1^S + w_2 L_2^S \tag{6}$$

Where L_l^S denote the stock of type l labor in south[13] and w_l the corresponding wage. Specifically, E includes the wage income of the southern laborers, wage income of the northern laborers and profits of the firms in the north[14]. As mentioned before, south being small country cannot influence E^N.

Section 3.2: Producers

Section 3.2.1: Production Structure

The consumers are willing to pay a premium of ξ for a single jump in the quality of the product, which motivates the firm to indulge in costly R&D of innovating higher quality levels. Assuming that the potential for quality improvement is unbounded, only a northern firm has the ability to drive forward the world quality frontier for the existing products through innovation. In figure 1, the northern firms are shown to be innovating with the followers targeting the leaders as well as the southern production units of sourcing firms. While R&D races in the north occur simultaneously for all products within the X sector, entrepreneurs in the south are inefficient at innovation or imitation. This is clear in figure 1 as there exists no link for southern firms on innovation or imitation. Once a higher quality product is developed, northern firms undertake its production and reap profits. As in Vernon (1966), I also assume that a product developed in the north is produced completely by the northern firms till its production gets standardized[15]. Once standardized, the northern firm has the opportunity to become a sourcing firm by shifting its basic stage of production to a low cost nation either through FDI or outsourcing. This is depicted in figure 1. Sourcing firms then in turn decide on internalization by choosing between FDI and outsourcing. We separate figure 1 in two parts by a dotted horizontal line. All entities lying above the line are assumed to be exogenous, while this model focuses on entities lying below the line, namely, the southern national firms and the subsidiary or the outsourcing partners.

Product cycle is generated because shifting a part of a sourcing firm production to the south whether through creating a subsidiary or through contracting out to outsourcing partner firm, lowers its cost of production and drives the northern firms out of the market. On the other hand, the SF may also be driven out of the market by further innovation by the northern firms, (See figure 1).

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[13] The model assumes full employment.

[14] As we will see later, the profits of firms in the south are always driven to zero.

[15] Also see Glass and Saggi (2001), Markusen and Venables (1998) for further reference.

The available literature differentiates between outsourcing and FDI in ways relating to contractual incompleteness, relative importance of fixed costs, degree of standardization, capital intensity or ease of monitoring. In this paper, I experiment modeling with yet another difference between FDI and outsourcing which is lesser known. The rationale for this distinction has been explained at the outset of this paper. This assumption implies that the regime shift in the host country from FDI equilibrium to outsourcing equilibrium (or vice-versa) entails only one exogenous change, that is, the change in the technology of production (via the exogenous change in skill intensity).

Section 3.2.2: Manufacturing Technology

Assume that the production under the sourcing firm is separated into two stages – the basic stage of production and the advanced stage. As in Glass and Saggi (2001), I assume that to produce one unit of final good, a sourcing firm must combine α units of output from basic stage of production with $(1-\alpha)$ units of output from advanced stage of production produced in the north. This can be envisioned as a fragmented production structure whereby advanced production[16] involves the manufacturing of sophisticated intermediate inputs and basic production involves the bundling of final goods by using these intermediate inputs. Unlike this model, Glass and Saggi (2001) assume that one unit of labor is required for producing one unit of output, which makes their production strategy very rigid as labor requirements do not respond to factor prices. Moreover, they do not distinguish between skilled and unskilled labor, and as a result their model does not allow for any substitutability across factors of production. I do away with these assumptions in our model.

We use a standard neoclassical production function. The production technology of a sourcing firm is represented as:

$$X^M = (1-\alpha)f^N(L_1^N, L_2^N) + \alpha\ f_i^B(L_1^S, L_2^S)$$

Out of the total manufacturing output produced by the sourcing firm $(1-\alpha)$ proportion is produced using the sourcing firm's technology in north and α proportion using the subsidiary or the outsourcing partner technology, $f_i^B(L_1^S, L_2^S)$ in south. It should be noted that the technology of production is different for FDI subsidiary and outsourcing partner and thus the subscript $i \in \{q(\text{FDI}), o(\text{Outsourcing})\}$.

The marginal cost (MC) of production of the sourcing firm is a weighted sum of basic stage MC incurred by the sourcing firm's production unit in the south, MC^B (by subsidiary or outsourcing partner) and advanced stage MC incurred by the sourcing firm's production unit in the north, MC_{MNC}^N

$$MC_i^M = (1-\alpha)\ MC_{MNC}^N + \alpha\ MC^B$$
$$\Rightarrow MC_i^M = (1-\alpha)\ MC_{MNC}^N + \alpha\left[a_{2,i}^B(w_i^S)w_{2,i}^S + a_{1,i}^B(w_i^S)w_{1,i}^S\right] \tag{7}$$

$a_{l,i}^k(w^h)$ is the unit/marginal requirement[17] of type l southern labor, under sourcing firm's offshoring mode i, by the firm type $k \in \{S(\text{Southern domestic firms}), B(\text{subsidiary or outsourcing partner in south})\}$[18].
Southern domestic firms produce the homogeneous good y under perfect competition with a CRS production function, $f^S(L_1^S, L_2^S)$. The marginal cost of producing good y in a southern firm is given by:

$$MC_i^S = a_{2,i}^S(w_i^S)w_{2,i}^S + a_{1,i}^S(w_i^S)w_{1,i}^S \tag{8}$$

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[16] Glass (2004) explains the fundamental assumption behind the reason for not transitioning the entire production process to the south. This follows as a direct implication of the assumption of inefficiency of south in handling the advanced stage of production.

[17] It is well known that for a neo-classical, constant returns to scale production function, the unit labor requirements is equal to the marginal labor requirement and that these coefficients of labor requirements can be expressed as a function of the relative wage. Let $w^k = \dfrac{w_2^k}{w_1^k}$ represent the relative wage of skilled labor for country h = N, S. To obtain the unit/marginal labor requirements, we consider the implied cost function and use Shephard's lemma along with homogenous of degree one property of the production function.

[18] For example, $a_{1,q}^S(w^S)$ is the unskilled labor requirement by the southern firms under FDI and similarly, $a_{1,o}^S(w^S)$ is the skilled labor requirement by the sourcing firm's production unit in the south under outsourcing.

Since northern wages are assumed to be given exogenously, marginal cost of the northern national firms is just equal to a constant, say, χ.

Section 3.2.3: Pricing Decisions of the firms

A sourcing firm, which splits production between north and south, compete with a northern firm. The quality level of the product of a sourcing firm is no better than that of the northern quality leader. Therefore, sourcing firms engage in limit pricing and charge a price equal to the marginal cost of production of northern firms, χ. On the other hand, price competition among southern firms drives down good y prices to marginal cost equal to one[19].

$$P^S = MC_i^S = AC_i^S = 1$$

Section 3.2.4: Industry Flows

Let n^N and n^M represent the measure of northern firms and sourcing firms respectively. In equilibrium, these measures are constant and determined by northern firms' innovation intensity, the probability of standardization and the probability of formation of subsidiary or outsourcing partner. In this model all these factors are exogenous, which implies that the measures of firms are also exogenous.

Section 3.2.5: Resource Constraints

The last building block of the model is the resource constraint of the south.
Southern skilled labor required by southern firms for good y production under i mode of foreign sourcing is $a_{2,i}^S(w_i^S)\left[(1-\gamma)E_i\right]$ and by sourcing firm's production unit in south for good X is $\alpha\, n^M a_{2,i}^B(w_i^S)\left(\dfrac{\gamma\, E_i}{\chi}\right)$

Thus, skilled labor market equilibrium in south is represented by an equality of supply with demand

$$L_2^S = a_{2,i}^S(w_i^S)\left[(1-\gamma)E_i\right] + \alpha\, n^M a_{2,i}^B(w_i^S)\left(\frac{\gamma\, E_i}{\chi}\right) \tag{9}$$

Similarly, in equilibrium, unskilled labor demand in south is equal to the given unskilled labor supply:

$$L_1^S = a_{1,i}^S(w_i^S)\left[(1-\gamma)E_i\right] + \alpha\, n^M a_{1,i}^B(w_i^S)\left(\frac{\gamma\, E_i}{\chi}\right) \tag{10}$$

This completes the formulation of the model. We can now turn to the next section that compares welfare under the two alternative regimes of international sourcing in south.

Section 4: Equilibrium in South and Welfare Comparison

In this section, I compare the welfare impact of a regime shift of foreign sourcing from say, FDI equilibrium to outsourcing equilibrium (or vice-versa) in the host country. We can model the welfare effect of a change in the mode of foreign sourcing in the host country as a comparative static exercise. To carry out this exercise, we need to specify one of the two modes of foreign sourcing as the initial equilibrium. Without loss of generality, we may assume that FDI constitutes the initial equilibrium[20] in the host country. This implies that, to begin with, the world economy being analyzed has all its international sourcing or fragmented production through foreign subsidiaries. Then we may ask whether a regime shift from FDI to outsourcing can increase the real GDP of the host country and if so, we qualify the conditions for it to hold true. We can also reverse our question and find conditions under which aggregate real wage earnings fall in the host representing a welfare loss after regime shift from FDI to outsourcing.

There are two different components of change in the skill requirements as we move from FDI equilibrium to outsourcing steady state. The first of this change is endogenous, which comes about due to changes in wages as we move from initial FDI equilibrium to the outsourcing steady state. Besides this endogenous change, there also exists an exogenous change in the relative demand for the two types of labor emanating from the change in technology of production used under outsourcing vis-à-vis FDI. As noted in the

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[19] Even though northern firm's prices depend on sourcing firm's MC and therefore on southern wages, however, by assuming the south to be a relatively small open economy, we can escape any effect on northern variables or even repercussion effect.

[20] There is nothing sacrosanct about choosing FDI as the initial equilibrium and we could also choose outsourcing to constitute the initial equilibrium. This will not change the nature of our results and conditions obtained.

introduction we use our assumption that outsourcing production by partners of a sourcing firm in the south use a higher skill intensive technique of production vis-à-vis FDI production in foreign subsidiaries.

We split the changes in marginal labor requirements that result from the regime shift of foreign sourcing into the exogenous and endogenous components. Let the exogenous rate of change (that corresponds to the change in technology of production) in marginal labor requirements with regime switch by the sourcing firm's production unit in the south for l type of labor be represented by

$$\hat{u}_l = \frac{da_l^B (exogenous)}{a_l^B} \qquad\qquad l = 1, 2$$

Similarly, the endogenous counterpart change is represented by

$$\hat{a}_l^k = \frac{da_l^k (w^S)}{a_l^k} \qquad\qquad l = 1, 2 \text{ and } k = S, B$$

Both exogenous and endogenous changes in marginal labor requirement entail a change in marginal cost of production with a shift from FDI equilibrium to outsourcing equilibrium. Totally differentiating MC^B to get the change in marginal cost of production of the southern unit of the sourcing firm (as we move from FDI equilibrium to outsourcing steady state):

$$\hat{MC}^B = \theta_2^B \, \hat{w}_2^S + \theta_1^B \, \hat{w}_1^S + \theta_2^B \, \hat{u}_2 + \theta_1^B \, \hat{u}_1 \qquad\qquad (11)$$

And totally differentiating equation (8), we get:

$$\hat{MC}^S = \theta_2^S \, \hat{w}_2^S + \theta_1^S \, \hat{w}_1^S = 0 \qquad \text{(Since } y \text{ is the numeraire good)} \qquad (12)$$

$$\Rightarrow \hat{w}_1^S = -\frac{\theta_2^S \, \hat{w}_2^S}{\theta_1^S}$$

In equation (11) and (12) $\theta_l^k = \frac{a_l^k \cdot w_l^k}{MC^k}$ represents the cost share of type l labor in production by k type firm in the host country.

Using the above expression we get that,

$$\hat{a}_1^k = -\theta_2^k \sigma_k (\hat{w}_1^S - \hat{w}_2^S) \quad \text{and} \quad \hat{a}_2^k = \theta_1^k \sigma_k (\hat{w}_1^S - \hat{w}_2^S) \qquad\qquad k = S, B \qquad (13)$$

Where σ_k is the elasticity of substitution between the two factors of production.

Totally differentiating the southern resource constraints, and substituting for $\hat{a}_l^k$ from (13) and using $\hat{E} = \hat{w}_1^S e_1 + \hat{w}_2^S e_2$

Where $e_l = \frac{w_l^S L_l^S}{E^S} \frac{E^S}{E} = \frac{w_l^S L_l^S}{E^S} \psi$ and ψ is the share of the host country GDP in global GDP, we get the following two equations in $\hat{w}_1^S$ and $\hat{w}_2^S$ [21]

The above system of equations may be represented in the following matrix form:

$$\begin{bmatrix} [A_1 - e_2 (\lambda_2^S + \lambda_2^B)] & -[A_1 + e_1 (\lambda_2^S + \lambda_2^B)] \\ -[A_2 + e_2] & [A_2 - e_1] \end{bmatrix} \begin{bmatrix} \hat{w}_2^S \\ \hat{w}_1^S \end{bmatrix} = \begin{bmatrix} \lambda_2^B & 0 \\ 0 & \lambda_1^B \end{bmatrix} \begin{bmatrix} \hat{u}_2 & \hat{u}_1 \end{bmatrix}$$

Where $\quad A_1 = \lambda_2^S \sigma_S \theta_1^S + \lambda_2^B \sigma_B \theta_1^B$

$\qquad\quad A_2 = \lambda_1^S \sigma_S \theta_2^S + \lambda_1^B \sigma_B \theta_2^B$

The set of two equations can be solved to get the change in wages due to exogenous increase in skill intensity that happens as a result of regime shift of foreign sourcing from FDI to outsourcing, that is, we can derive:

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[21] λ s are the proportional labor shares. For example, $\lambda_l^B = \alpha \dfrac{n^M a_l^B (w^S)}{L_l^S} \left(\dfrac{\gamma E}{\chi} \right)$ is the proportion of type l labor of south employed by SF

manufacturing production unit in the south.

$$\frac{dw_l^S}{d\left(\frac{u_2}{u_1}\right)} \frac{\left(\frac{u_2}{u_1}\right)}{w_l^S} = \frac{\hat{w}_l^S}{\hat{u}_2 - \hat{u}_1} \qquad \qquad \text{for } l=1, 2.$$

$$\frac{\hat{w}_2^S}{\hat{u}_2 - \hat{u}_1} = \frac{\left[A_1 + e_1 (\lambda_2^S + \lambda_2^B)\right]\left[A_2 - e_1\right]}{\Delta\left[(\lambda_2^B + (\lambda_2^S + \lambda_2^B)\lambda_1^B)e_1 + (A_1\lambda_1^B - A_2\lambda_2^B)\right]}\lambda_2^B \lambda_1^B$$

Where Δ is the determinant of the above 2x2 matrix on the LHS. Intuitively, when the skill intensity of production increases[22], we would expect the skill premium to increase and by equation (12), this implies that an increase in wages of skilled labor should necessarily be matched by a fall in wages of unskilled labor.

To make welfare comparisons across the two alternative regimes of foreign sourcing, we need to look at real wage effect. In the current setup, the southern domestic good is chosen as the numeraire while the price of the sourcing firm's good depends on the exogenously given marginal cost of northern firms, χ. The only difference that arises in price index under the alternative regimes of international sourcing is due to price of the northern firms' goods[23]. The price of northern firm's good is a quality mark up over the marginal cost of the sourcing firm's production unit in the south. Thus, a comparison of real wages in the two mutually exclusive forms of international sourcing must depend on the MC of production of the subsidiary and the outsourcing partner.

$$\hat{p} = \tau \ M\hat{C}^B$$

Where τ is the contribution of northern goods price to the price index. For algebraic convenience[24] we assume $\tau = 1$.

FDI leads to a higher welfare vis-à-vis outsourcing if the real GDP after the regime shift to outsourcing is lower, that is:

$$\frac{\hat{w}_2^S - \hat{p}}{\hat{u}_2 - \hat{u}_1} L_2^S + \frac{\hat{w}_1^S - \hat{p}}{\hat{u}_2 - \hat{u}_1} L_1^S \ < 0$$

or, $\qquad \frac{\hat{w}_2^S}{\hat{u}_2 - \hat{u}_1} \frac{L_1^S}{\theta_1^S}\left(\zeta\ \theta_1^B - \theta_2^B\right) + \ \hat{K} < 0$

Where, $\zeta = \dfrac{L_2^S}{L_1^S}$ and $\hat{K} = -\dfrac{\theta_2^B \hat{u}_2 + \theta_1^B \hat{u}_1}{\hat{u}_2 - \hat{u}_1} > 0$ is exogenous.

If, we restrict $\dfrac{\hat{w}_2^S}{\hat{u}_2 - \hat{u}_1} \ > \ 0$, given by the conditions in the appendix, then a <u>necessary condition</u> for FDI to generate higher welfare vis-à-vis outsourcing is

$$\zeta < \frac{\theta_2^B}{\theta_1^B} \tag{14.1}$$

Thus, FDI *may* lead to a higher welfare relative to outsourcing if the host country has a lower absorptive capacity relative to foreign sector absorption of skilled labor. On the other hand, the above result also indicates that a <u>sufficient condition</u> for outsourcing to generate higher welfare is:

$$\zeta > \frac{\theta_2^B}{\theta_1^B} \tag{14.2}$$

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[22] See Appendix for conditions under which $\dfrac{\hat{w}_2^S}{\hat{u}_2 - \hat{u}_1} \ > \ 0$

[23] Since the host is small by assumption a change in marginal cost of SF production unit in south which changes the prices of northern goods is a very small component of price index of the north.

[24] This assumption does not alter the qualitative nature of our results. It only simplifies algebra and removes a not so necessary parameter and gets more crisp results.

This implies that if the absorptive capacity of the host country is above the foreign sector absorption given by the relative cost share of skilled labor to unskilled labor in the foreign sector, then outsourcing definitely leads to higher welfare. This result is intuitive because of the fact that outsourcing values skilled labor more than FDI implying that a higher proportion of skilled labor in the population leads to lower skill premium and therefore higher demand for skills only under outsourcing. Now, with a larger set of labor receiving the skilled labor wages and also higher relative unskilled labor wages, the aggregate GDP and hence welfare is bound to rise. On the other hand, with FDI, the demand for skilled labor is not high. If high skill availability in the host country is matched with FDI, the low demand for skills pushes the wages of skilled labor to lower levels and hence reduces welfare since a greater proportion of labor earns this lower level of skill premium. Moreover, outsourcing may still lead to higher welfare vis-à-vis FDI even if it is matched with lower skill abundance in the host country provided the rise in skill premium is not too high to crash the unskilled labor wages.

This result indicates some lesson for the developing countries that compete blindly for FDI offering subsidies and attractive package incentives to the sourcing firms. It makes sense for the host country to attract FDI only if they have low level of skills relative to foreign sector absorption in the host country. However, the results also indicate that even if the domestic absorptive capacity, ζ, is low, FDI may still not lead to higher welfare. On the other hand, if the domestic absorptive capacity is above the threshold defined, then, the host country certainly gains from outsourcing contracts rather than FDI.

Section 5: Comparative Static: The Effect of Investment in Human Capital

Suppose we allow for investment in human capital formation in south. With an investment in education that leads to higher relative supply of skilled labor over the long run period, the welfare of the economy is impacted due to changes in wages in steady state. Does this necessarily imply a higher level of welfare for the host country and whether this impact is higher under FDI or outsourcing? We carry out a comparative static exercise within each regime of foreign sourcing – FDI and outsourcing – and we ask the question that under what condition does the real GDP increase with investment in human capital. In the current set up of the model, we cannot directly compare the differential effects of increase in the relative supply of skilled labor on FDI with that of outsourcing. However, we may do so indirectly by comparing conditions under which they generate similar result.

Section 5.1: Effect of Human Capital Formation under FDI and outsourcing

Investment in human capital formation is such that unskilled workers upgrade their skills and move to the skilled labor category of workers, keeping the total labor force constant. Therefore, $dL_2^S = -dL_1^S$

$$\Rightarrow L_2^S \frac{dL_2^S}{L_2^S} = -L_1^S \frac{dL_1^S}{L_1^S} \qquad \Rightarrow \hat{L}_1^S = -\zeta \, \hat{L}_2^S \tag{15}$$

Totally differentiating the resource constraints, that is, equations (9) and (10) and substituting equations (14), (15) and (20), we get the following two total differential equations:

$$\begin{bmatrix} e_{2,i} - A_{1,i} & e_{1,i} + A_{1,i} \\ e_{2,i} + A_{2,i} & e_{1,i} - A_{2,i} \end{bmatrix} \begin{bmatrix} \hat{w}_2^S \\ \hat{w}_1^S \end{bmatrix} = \begin{bmatrix} 1 \\ -\zeta \end{bmatrix} \begin{bmatrix} \hat{L}_2^S \end{bmatrix}$$

$$\frac{\hat{w}_2^S}{\hat{L}_2^S} = \frac{\left[e_{1,i} - A_{2,i} \right] + \zeta \left[e_{1,i} + A_{1,i} \right]}{\Omega_i}, \qquad \frac{\hat{w}_1^S}{\hat{L}_2^S} = -\frac{\left[\zeta \left(e_{2,i} - A_{1,i} \right) + \left(e_{2,i} + A_{2,i} \right) \right]}{\Omega_i}$$

Where Ω_i is the determinant of the above 2x2 matrix on the LHS. Since the wages of the two types of labor move in opposite direction by virtue of equation (12), it is therefore likely that with investment in human capital, which increases the relative supply of skilled labor, the skill premium goes down[25].

Section 5.2: FDI Vs Outsourcing: The Effect of Human Capital Investment

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[25] Sufficient condition for $\frac{\hat{w}_2^S}{\hat{L}_2^S} < 0$ is: $\frac{A_{2,i}}{e_{1,i}} < \zeta$, while the sufficient condition for $\frac{\hat{w}_1^S}{\hat{L}_2^S} > 0$ is: $\zeta < \frac{e_{2,i}}{A_{1,i}}$. Combining the two

conditions we get $\frac{A_{2,i}}{e_{1,i}} < \zeta < \frac{e_{2,i}}{A_{1,i}}$

Welfare rises under FDI or outsourcing after investment in skill if the following condition holds:

$$\frac{\hat{w}_2^S - \hat{p}_{sf}}{\hat{L}_2^S}\left(L_2^S + \hat{L}_2^S\right) + \frac{\hat{w}_1^S - \hat{p}_{sf}}{\hat{L}_2^S}\left(L_1^S + \hat{L}_1^S\right) > 0$$

Using equation (7) we get, $\hat{p}_{sf} = M\hat{C}^M = \theta_2^B \, \hat{w}_2^S + \theta_1^B \, \hat{w}_1^S$. Substituting equation (15), we get

$$\hat{p}_{sf} = \hat{w}_2^S\left(\theta_2^B - \theta_1^B \frac{\theta_2^S}{\theta_1^S}\right)$$

Substituting equation (15), and the price change after skill formation, $\hat{p}_{sf}$ into the above expression, we get:

$$\Rightarrow \frac{\hat{w}_2^S}{\hat{L}_2^S} L_1^S\left[\left(\frac{\theta_1^B \zeta - \theta_2^B}{\theta_1^S}\right) + \frac{\hat{L}_2^S}{L_1^S}\left(\frac{\theta_1^B + \theta_2^B \zeta}{\theta_1^S}\right)\right] > 0 \qquad (19)$$

Thus, condition (19), needs to be satisfied in any regime of foreign sourcing for investment in skill formation to be welfare enhancing. Thus, a <u>necessary condition</u> for real GDP to rise with investment in skill formation, given that skill premium falls with increase in skilled labor is: $\zeta < \frac{\theta_2^B}{\theta_1^B}$.

Now, to compare the impact of skill investment under FDI with that of outsourcing, we note that, at given relative wages in the south, higher skill intensity of outsourcing partner vis-à-vis foreign subsidiary implies that $\theta_2^B\big|_q < \theta_2^B\big|_o$ and $\theta_1^B\big|_q > \theta_1^B\big|_o$. This implies that $\frac{\theta_2^B}{\theta_1^B}\bigg|_o > \frac{\theta_2^B}{\theta_1^B}\bigg|_q$ Thus, there is a greater chance that the domestic absorptive capacity, ζ , is lower (than actual absorption by the sourcing firm's production unit in the host country) for outsourcing rather than FDI. In other words, if $\zeta < \frac{\theta_2^B}{\theta_1^B}$ is satisfied by FDI regime, then it necessarily is satisfied under outsourcing but not vice-versa. Hence, it may pay more to have investment in human capital under outsourcing rather than FDI because outsourcing values skilled labor more than FDI. Therefore, it is more probable for investment in skills under outsourcing to be welfare improving vis-à-vis FDI. Thus, to begin with, if a host country has low absorptive capacity, it may prefer FDI, however, as this capacity grows (say through investment in human capital), the preferred mode of foreign sourcing by the host country may switch to outsourcing. Once outsourcing enters the host country, further investment in skills leads to self-reinforcing higher levels of welfare with each discrete jump in investment on human capital.

Section 6: Conclusions

In this paper foreign sourcing in the form of either FDI or outsourcing is taken as an exogenous event and the focus of interest lies on analyzing their affect on welfare in the host country. The approach that I choose runs as follows. I developed a product life-cycle model in this paper that focuses specifically on the events in the host country. The empirical and theoretical differences between FDI and outsourcing leads to the conclusion that FDI subsidiary activity is relatively less skill intensive vis-à-vis outsourcing partner's production technique in the host country. This conclusion drives a number of results[26] in this paper. It is found that under certain conditions, depending on the absorptive capacity of the host country, elasticity of substitution in production and the relative demands generated by FDI and outsourcing for the two factors of production, outsourcing may lead to a higher level of real GDP. Specifically, a very interesting result comes about through our formal treatment of the model. It is found that, if the absorptive capacity of the host is higher than the foreign absorption (given by the ratio of costs shares of the skilled and unskilled labor in the foreign sector), then, outsourcing certainly leads to higher

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[26] It is also possible accommodate the differential impact of FDI and outsourcing on skill formation in the host country by endogenizing the skill acquisition decision of workers as in Sayek and Sener (2001) and Beaulieu et al. (2004). In such a setting, FDI induces skill formation by getting the unskilled labor in close contact with the new technology of the north, while under outsourcing, individuals respond to increased skill premium by undertaking training and becoming skilled.

welfare. However, if the absorptive capacity of the host country is below this derived threshold, then, FDI *may* lead to higher welfare. Even in this case, outsourcing being welfare enhancing is not ruled out. This result should raise alarm for countries blindly trying to attract FDI by giving incentives especially in the form of subsidies and tax relaxation. The second crucial result of this paper concerns the relative importance of investment in skill formation in the two alternative modes of foreign sourcing. It is found that efforts to increase skills in the host country is more likely to payoff under outsourcing relative to FDI, since outsourcing values skilled labor more than FDI.

Appendix

The two alternative conditions under which skill premium to increases with outsourcing are:

<u>*Case a.1*</u>: If $A_2 < e_1$, then a sufficient condition for skill premium to increase with outsourcing is: $A_2 \lambda_2^B < A_1 \lambda_1^B \Rightarrow \theta_2^B < \theta_1^B$. Thus, if a weighted measure of elasticity of substitution between the two types of labor is lower (than the expenditure share of the unskilled labor), then, a sufficient condition for skill premium to rise with outsourcing is that the cost share of unskilled labor must be greater than the share of skilled labor in the foreign sector. The intuition for this result is simple. With high unskilled labor share in the foreign sector, a shift to outsourcing (from FDI) dramatically increases the demand for skilled labor that tends to raise skill premium. On the other hand, a low degree of substitutability between the factors does not allow easy substitution of unskilled with skilled labor. Therefore the wages of skilled labor definitely rise.

<u>*Case a.2*</u>: If $A_2 > e_1$, then a necessary condition for skill premium to increase with outsourcing is: $A_2 \lambda_2^B > A_1 \lambda_1^B \Rightarrow \theta_2^B > \theta_1^B$. That is, if a weighted measure of elasticity of substitution is higher (than the expenditure share of the unskilled labor), then, a *necessary* condition for skill premium to rise with outsourcing is that the cost share of skilled labor in the foreign sector of must be greater than that of the unskilled labor.

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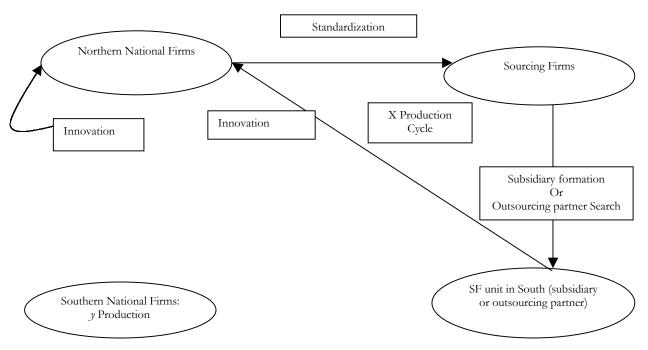
Figure 1: Production Structure of the World Economy