

Part III

MULTINATIONAL FIRMS,
LINKAGES AND
SPILLOVERS EFFECTS



LINKAGES, MULTINATIONALS, AND INDUSTRIAL DEVELOPMENT

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7.1. Introduction

It has been frequently noted that flows of foreign direct investment (FDI) have increased rapidly during the past decade. While much of the global stock of FDI exists within developed countries, recent evidence indicates that flows to developing countries have increased substantially: in 1997, developing countries received 37.2 per cent of the global flows of FDI (UNCTAD 1998). Furthermore, given the relatively small economic size of these economies, even a small amount of foreign investment can account for a large percentage of their total investment and therefore generate a significant impact. For example, in 1996, the total stock of inward FDI as a percentage of the gross domestic product in developing countries equaled 48.6 per cent (UNCTAD 1998).

Multiple market forces are behind the observed growth in FDI: reduction in costs of communication has eased the constraints on global rationalization of production and the information technology revolution has created markets for many new products and services. Increased world trade in services has further contributed to global FDI flows since services often require suppliers to have a physical presence in a market. However, changes in the market environment do not capture the whole story.

Policy initiatives have also played a central role: many countries have gone further than simply removing barriers to inward FDI and have taken a more pro-active approach toward attracting FDI through the use of fiscal and financial incentives. This new, more favorable, policy environment in many developing and formerly communist countries contrasts sharply with historical attitudes toward multinational firms in these countries.

The spread of multinational firms was often viewed with suspicion and mistrust in such countries, particularly in those that pursued a strategy of import substitution. An important aim of import substitution policies was to encourage indigenous

industrial development. Hostility toward multinationals was based on the perception that the entry of such firms was detrimental to domestic industrialization. The infant industry argument, or some derivation of it, often served as an intellectual justification for such policies.

However, a parallel tradition in development (at least among academic discussions) took a more optimistic view. In this tradition, multinationals were (and are) seen as agents that increase competition in the host economy, transfer modern technology, and help achieve a more efficient allocation of resources. The recent wave of liberalization of trade and FDI policies suggests that the optimistic view of FDI seems to be gaining the upper hand. One manifestation of this trend of liberalization is the proliferation of bilateral investment treaties across countries: there now exist 1,513 bilateral investment treaties among countries, compared with fewer than 400 at the beginning of 1990 (UNCTAD 1998). Of course, the failure of import substitution as a strategy for development is a crucial reason behind this remarkable turnaround in policies in many developing countries.

Within the more optimistic view of FDI, a frequently cited benefit of inward FDI is that it pushes forward the process of industrial development by creating *linkages* with the rest of the economy. In this paper, we explore the argument that FDI encourages industrial development through linkages. First, we discuss the relevant economics literature that has attempted to formalize the concept of linkages. Second, we discuss the existing empirical evidence regarding linkages. In our first task, we begin by tracing the intellectual development of the idea of linkages by noting the debt owed to Hirschman (1958) who provided a concrete definition of the fundamental concepts. Next, we provide a discussion of some of the more recent theoretical analyses of the concept of linkages. Then, we discuss empirical evidence on linkages in light of the insights yielded by theory. Finally, we comment on the findings of both types of literature and note the policy implications of these findings.

7.2. Fundamental concepts

In a classic work, Hirschman (1958) developed the concepts of backward and forward linkages and analyzed their importance for economic growth. In his own words:

The setting up of an industry brings with it the *availability of a new expanding market for its inputs* whether or not these inputs are supplied initially from abroad.

This enhanced market exerts a backward pressure for establishing industries that supply the new entrants. He calls this process *backward linkage* effects:

Every non-primary activity will induce attempts to supply through domestic production the inputs needed in that activity.

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Similarly, *forward linkage effects* are created when one industry uses another industry's outputs as its inputs:

Every activity that does not by its nature cater exclusively to final demands will induce attempts to utilize its outputs as inputs in some industries.

The sum of the backward linkage effect and the forward linkage effect gives the total linkage effect, which can be seen as the growth in new industries induced from establishing an industry. Hirschman was careful on the issue of backward linkages: he noted that linkages between parent and satellite industries are unlikely to be as important as those formed with larger industries that have a lower probability of forming.¹

Another important point made by Hirschman was that multiple industries are likely to have a greater linkage effect when taken together, compared to simply adding up the individual effects. The presence of two or more industries may create enough demand to surpass the threshold required for establishing new industries, whereas the presence of only one of them would not.² Taking all of these industries together may provide enough incentive to create yet others. This cumulative effect may explain much of the acceleration of industrial growth seen early on in the development process.

Regarding empirical implementation, Hirschman suggested that the importance of linkages in an economy could be approximated by the percentage of inputs purchased from other industries for backward linkages and the percentage of output sold to other industries for forward linkages. Industries with strong linkages in both directions (such as petroleum products and chemicals) can be distinguished from those with predominately forward linkages (such as metal mining and agriculture) and those with predominately backward linkages (such as grain mill products and leather products). In this sense, Hirschman's scheme for development planning preceded and foresaw the recent debate regarding industrial targeting.³

Hirschman argued that part of the difficulty for underdeveloped economies is a lack of interdependence and linkages. Consequently, the development process must commence with industries that cater to final demand. This requirement leaves two possibilities: transformation of either primary goods or semi-manufactures into final products. Since the latter may provide stronger possibilities for linkages, Hirschman suggests that governments in such countries should assist industries involved in intermediate activities since these have strong potential for creating both backward and forward linkages.

Clearly, an accurate accounting of expected linkage effects is crucial for any plan to encourage investment in industries with the strongest linkages. Hirschman's suggested method for proceeding on this front was to use input-output data from more advanced countries with already existent industries to represent the linkages expected to form in some lesser-developed country. However, any extrapolation across countries runs the risk of error. For example, technologies adopted in lesser-developed countries might use a different mix of inputs, especially if other

parameters (such as factor endowment ratios and trade policies) are not the same across countries. Many of the failures of development prescriptions stem from failing to account for idiosyncrasies across countries.

The entry of firms, especially large multinational firms in developing countries, may expand the total output of an industry through increased scale, enhanced competition, technology diffusion to local rivals, or general training of workers. This expansion in output of an industry may play a crucial role in bringing the scale of existing industries up to levels sufficient to generate backward and forward linkages needed for industrial development. As we shall see next, the theoretical economics literature on multinationals has indeed advanced this argument.

7.3. Multinationals and linkages: theory

The recent surge in the literature on industry linkages and international trade provides several concrete models of concepts originating in the development literature. In a recent paper, Rodríguez-Clare (1996a) takes up Hirschman's concept of linkages and develops a formal model to analyze the effects of multinationals on economic development. He relies on three premises to develop a model of the linkage concept. First, a greater variety of inputs leads to higher production efficiency, as captured by assuming a love of variety for inputs in the production of final goods (a weaker form of Hirschman's assumption that certain inputs were necessary for production). Second, market size limits the available variety of specialized inputs due to inputs being produced with increasing returns to scale (related to Hirschman's specification of a minimum economic size). Third, proximity of supplier and user is required, since domestic firms must buy all of their inputs locally (to ensure that domestically produced inputs are essential to developing an industry in final goods). Under such circumstances, an economy will exhibit multiple equilibria: a good equilibrium with high wages (which coincides with the production of complex final goods and a wide variety of inputs) and a bad equilibrium with low wages (which coincides with the production of simple final goods and a small variety of inputs). If the number of varieties of the intermediate good exceeds a threshold, then a country specializes in producing the more complex good. Since profits are zero due to the assumption of free entry, the higher wages in the good equilibrium imply that it Pareto dominates the bad equilibrium.

To give multinationals a role in the process of industrial development, Rodríguez-Clare supposes that two economies exist with one in the bad equilibrium (a developing country) and the other in the good equilibrium (a developed country).⁴ Under this scenario, firms in the high-wage economy may wish to take advantage of the cheap labor overseas by establishing a plant in the host country, while maintaining headquarters at home to enjoy access to the wide variety of specialized inputs available there.⁵ The crucial assumption is that specialized inputs cannot be exchanged internationally through arm's-length transactions and thus cannot be used by a firm unless it operates in the country where the inputs are produced. Consequently, only multinationals can combine the wide variety

of specialized inputs from the developed country with the cheap labor from the developing country.⁶

Rodríguez-Clare develops a statistic called the *linkage coefficient* to address the effect of multinationals on the host economy. The linkage coefficient measures the ratio of employment generated in upstream industries by a firm to the labor hired directly by that firm. A *positive linkage effect* arises if the multinational has a higher linkage coefficient than domestic firms. A positive linkage coefficient implies that an increase in the number of multinationals results in a greater variety of intermediate goods produced locally, which in turn increases the productivity of domestic firms and the domestic wage.⁷

Positive linkages are most likely to result when the good that multinationals produce is more complex, the communication costs between the headquarters and the factory are higher, and the source and host countries are more similar in terms of the variety of intermediates produced. The cost of communication is modeled as an iceberg-type transportation cost: a fraction of the composite input (produced from specialized source inputs) melts *en route* from the source headquarters to the host factory. An increase in the cost of communication between the factory and headquarters causes a firm to purchase more goods locally, and hence raises its linkage coefficient. In addition, since the multinational is only able to purchase more inputs locally if they are produced, the linkage coefficient is increasing in the variety of intermediate goods produced in the host economy. Since firms using a greater variety of inputs tend to establish plants in countries with a smaller variety of intermediates, an implication of this analysis is that developing countries may not enjoy substantial linkages because multinational firms import their inputs from the source country.

This model operates under the principle of full employment, and the idea that foreign firms compete directly with domestic firms (hence creating a negative relationship between the number of firms in one country and another). In truth, underdeveloped countries do not possess full employment. A multinational may hire labor from the ranks of the unemployed, or from other industries that then replace their departed workers by drawing from the previously unemployed. In such a setting, not only the wage but the total wage bill (the wage times employment) should contribute to domestic welfare.⁸ A multinational's presence could generate large benefits by increasing employment, even if wages increase only slightly.

Furthermore, the existence of multiple final goods industries would further complicate the scenario, since one would have to know from which industry the labor is being displaced. Consider three industries, A, B, C, which have linkage coefficients in descending magnitude. If a multinational enters in industry B, then it may have a negative impact on the host economy if it draws labor from industry A. However, the converse will hold if the addition of this firm draws labor from industry C. Which scenario is more likely?

What happens if we allow multinationals to pay a higher wage than local firms do?⁹ This query is not merely of theoretical concern: multinationals are indeed

often observed paying higher wages than local firms, especially in developing countries (see Aitken *et al.* 1996). Can the added labor income be enough to offset a mild negative linkage effect? While such questions are beyond the scope of Rodríguez-Clare's model, their importance can hardly be overstated.

In another interesting paper, Markusen and Venables (1999) construct a model with linkages to address the potential for cumulative causation in industrial development – the ability of the formation of an upstream industry to generate the later formation of a downstream industry. The entry of multinationals affects the host economy in two potentially opposing directions. On one hand, multinationals replace domestic firms through a *competition effect*: the entry of multinationals lowers the price index for the final good, which causes the exit of domestic producers of final goods to restore equilibrium. On the other hand, multinationals may create conditions beneficial to local industries through a *linkage effect*: the entry of multinationals may raise the demand for intermediates, which causes the domestic production of intermediate goods to expand.¹⁰

An important variable for assessing the linkage effect is the *input–output coefficient*, which measures the ratio of the intermediate required relative to the per unit total input requirement of the downstream industry.¹¹ Whether this ratio for the multinational firms exceeds the ratio for the domestic firms influences whether the linkage effect is positive. The two ratios may differ due to differences in technology (the multinational firms may use more intermediates relative to primary factors than do domestic firms) or differences in sourcing (multinationals may source from abroad). If this ratio is greater for multinational firms than for domestic firms, then the multinational uses local intermediate goods more intensively than the domestic industry. Thus, this ratio is the analogue to Rodríguez-Clare's employment-based measurement.

The Markusen–Venables model also exhibits multiple equilibria. Starting from the good equilibrium where the domestic economy already supports its own upstream and downstream producers, multinational activity can generate various consequences depending on the relative strengths of the competition and linkage effects. In general, the competition effect decreases the number of domestic firms (both upstream and downstream), while the linkage effect may increase both if multinationals use intermediates more intensively than domestic firms do. The various consequences are most easily understood by considering a few special cases. These cases are chosen to illustrate how the characteristics of the multinational investment project and of the domestic industry influence the magnitude and direction of the effects.

First, suppose multinationals source no intermediates locally. Then, the linkage effect must reduce the number of domestic firms (both upstream and downstream), which reinforces the competition effect. Second, alternatively assume that multinational production merely displaces foreign firms serving the domestic market through exports. Such a scenario arises if foreign firms decide to switch to being multinationals, a common occurrence (and hence not merely a theoretical exercise). Then, the competition effect is zero, and provided the multinationals source some

intermediates locally, the linkage effect increases the number of domestic firms (both upstream and downstream).

Third, instead of assuming intermediate goods are near perfect substitutes so that the forward linkages, whereby additional upstream firms (through enhanced variety) induce entry of downstream firms, are shut down. Then, multinational firms purely displace domestic downstream firms, so the number of domestic downstream firms falls although the number of domestic upstream firms may rise. This last case illustrates the role of the love of variety for intermediates in inducing forward linkages and hence cumulative causation in industrial development.

Even starting with no initial domestic production (the bad equilibrium), backward linkages generated by multinational firms may be strong enough to induce the development of a domestic upstream industry. The domestic economy would be observed having its own upstream industry but not yet its own downstream industry (only multinational production). Forward linkages may then induce the development of a domestic downstream industry. Ultimately, the multinational presence serves as a catalyst to the development of the entire domestic industry. The expansion of domestic production may be so strong that it eventually drives the multinational out of the host country, as occurred in the bicycle and personal computer industries in Taiwan.

Matouschek and Venables (1999) takes a deeper look at the interaction between competition effects and backward linkages created by the entry of a multinational firm into the local market. They analyze the effects of investments in the downstream and then the upstream industry. They break the overall effect of multinational entry into two parts: an initial production effect and a feedback effect. The *initial production effect* is the immediate change in local production: the multinational production alters the output levels of domestic firms (through crowding out) in that industry as well as in upstream production. The number of downstream firms adjusts to restore zero profits, but the number of upstream firms is held constant in determining this piece of the overall effect. Next, the *feedback effect* occurs once changes in the upstream industry impact the downstream sector through changes in the price of upstream varieties (which are felt as cost changes to those downstream). Here, entry and exit of upstream firms affect both the variety of intermediates available as well as the intensity of competition.

The initial production effect in the downstream industry depends on two important parameters: relative local supply and the measure of local substitutes. The *relative local supply* is the ratio of the additional local supply generated by the foreign investment project relative to the local supply generated by a local firm. It depends on the export orientation (of the project and the local firms) and the extent that the project is import replacing. Relative local supply is decreasing in the export orientation of the multinational relative to local firms. If the project sells less of its output locally than do local firms (and the project is not import replacing), then the relative local supply is less than unity because the project is more export oriented than local firms.

Relative local supply is also decreasing in the extent that multinational output merely replaces imports of the downstream good from foreign countries. If the multinational has the same export orientation as local firms, then relative local supply is unity if the multinational's output does not displace any imports from abroad but zero if it fully displaces them (sells the same amount locally through FDI as it did before through trade). The initial production effect can be negative; as if the project sells all its output locally while local firms export some of their output and the project displaces no imports.

The *local substitutes* index states the number of units of local sales by local firms that are displaced by one unit of local sales by the foreign investment project. A value of zero means that local firms compete in completely different markets, while a value of one means local firms compete in the same market segment. Intermediate values between zero and one indicate the degree of competition.

Consider different possible values for these two parameters to illustrate their impact. When local substitutes take a value of one (compete in same market) and relative local supply is zero (multinational sales merely displace imports, or no multinational production is sold locally, for example), then the initial production effect is simply the foreign investment project's own production: no crowding out of local firms occurs in the downstream market. On the other hand, if relative local supply is one (such as if the project sells the same amount locally as one local firm but does not displace any imports), then no initial production effect results: multinational production fully crowds out local production so local production in the downstream market is unchanged. Hence, the initial production effect is decreasing in the relative local supply. Similarly, the initial production effect is also decreasing in the local substitutes index.

The initial production effect in the upstream industry depends on the level of *relative local sourcing*, which is the project's usage of local inputs per unit of output relative to the usage by local firms. A value of one means the project uses local inputs to the same degree as local firms, while a value of zero means the project buys all of its inputs from abroad (or uses none). The initial production effect in the upstream industry is increasing in relative local sourcing but decreasing in relative local supply. Putting the initial production effects in the upstream and downstream industries together, the initial production effect of the project is larger, the larger the export orientation or import replacement of the project, the lesser the degree that the project competes directly with local firms, and the larger the usage of local intermediate goods by the project.

In the next round, the feedback effect captures inter-industry effects generated by the project. Positive feedback effects are possible because increases in the demand for upstream goods induce the entry of upstream firms (which in turn causes entry of downstream firms due to reduced costs). Characteristics of each industry also affect the magnitude of the feedback effect. The feedback is greater if the upstream industry has a greater degree of imperfect competition. Backward linkages result in forward linkages, like the cumulative causation described in Markusen and Venables (1999) and initially seen in Rodríguez-Clare (1996a).

If the initial production effect is zero and relative local sourcing is unity, the project generates no feedback effect.

Feedback effects strengthen welfare gains: the reduced input costs lead to a reduced price for the final good and hence welfare benefits through consumer surplus. A relatively export-oriented project generates even greater welfare gains, which may help explain the export performance requirements that multinationals often face in developing countries. A welfare reduction will occur if the project has a relative local sourcing coefficient less than one and is export oriented. The more the output expansion and welfare gain, the higher the elasticity of demand, the greater the potential for expansion of sales at the expense of imports, and the greater the potential for expanding exports in the downstream industry.

Next, consider investing in a project in the upstream industry. Such an investment will lower the price of inputs for the downstream industry, increasing the demand for upstream production. There is also a substitution effect, where the lower price for one intermediate may reduce demand for others. However, more downstream firms enter due to higher profits (the feedback effect), which may offset the substitution effect. Additionally, if local industry supply is perfectly elastic, then there is no net result. Forward linkages require an initial production effect upstream in order to affect the downstream industry.

Furthermore, forward linkages are decreasing in both local substitution and export orientation. If the former equals one, or if all output is exported, then there are no forward linkages. Finally, larger welfare gains result if the downstream industry is more open to international trade and competition or if the upstream industry is more imperfectly competitive.

So far, three different models have proposed three different linkage measurements. To recapitulate, Rodríguez-Clare's statistic depends on the relative local job creating capabilities of multinational and domestic firms. Markusen and Venables use the competition effect to determine whether multinationals crowd out local firms and the input-output coefficient to compare the use of locally produced intermediate goods across multinational and local firms. Finally, Matschusek and Venables use two similar measures, relative local supply and relative local sourcing, to capture the crowding out of local production or imports and the demand resulting for locally produced intermediate goods. Rodríguez-Clare examines linkages in a general equilibrium setting where the emphasis is on wage effects, while the other two conduct their analyses in partial equilibrium where the emphasis is on price effects.

The last approach is somewhat more appealing as it provides a more complete view of how linkages affect the local economy. For empirical purposes, the relative local sourcing and Markusen-Venables indices are the easiest to quantify. The others involve job or demand creation, which can be analyzed theoretically using a *ceteris paribus* assumption, but would be difficult to implement empirically. The competition or crowding out effects may be apparent *ex post* (for assessing existing projects), but would be hard to determine *ex ante* (for assessing planned projects, such as for host country approval).

Other theoretical papers consider the role linkages play in trade liberalization (such as Krugman and Venables 1995, 1996, Venables 1996; Puga and Venables 1996, 1997; Baldwin 1999). None of these models contains FDI: instead of foreign firms becoming multinational, these models have concurrent exit of foreign firms and entry of domestic firms to shift production into the domestic economy.

In Krugman and Venables (1995), if transportation costs are sufficiently low, the presence of backwards and forwards linkages leads to agglomeration and a core–periphery dichotomy with its resultant wage gap. As costs fall to zero, the two economies again see production in both sectors and a convergence of wages. The other papers build off these results. Puga and Venables (1996) show that when cost linkages outweigh demand linkages, the upstream industries will be the first to flee the domestic economy, and the industries with weaker linkages will lead the exodus.¹² Extending these models to allow for FDI would seem to be productive avenues for future research.

7.4. Empirical evidence on linkages

Schive (1990) provides some empirical work on linkages from FDI in Taiwan. Since his work precedes the theoretical models discussed above, he does not use the above-mentioned measures. Nevertheless, his study shows that FDI in Taiwan tended to concentrate in industries with strong backward linkages. Initially, enterprises controlled by non-Chinese investors tended to import more and form enclaves, with little interaction with the rest of the economy. Over time, however, these firms tended to increase the percentage of inputs that they bought domestically. He postulates that perhaps these firms need time to determine which local suppliers could provide for their needs and points to evidence showing that those firms which set up shop later tended to import a lesser percentage from the start. Perhaps this shift occurred because later entrants had time to observe and learn from the behavior of earlier entrants. However, this learning effect may tell only part of the story. It is also likely that foreign firms begin to buy more local inputs due to a domestic learning effect: domestic suppliers may also need time to determine the needs of foreign firms and to learn to supply those needs at competitive prices. Thus, the later entrants enjoyed a better selection of locally produced inputs from which to choose.

Furthermore, Schive's observation that foreign-based non-Chinese firms tended to import a higher percentage of their inputs than domestic firms may not capture the full picture. Foreign firms could also use a higher level of inputs per unit of output, so that the resulting linkages effect may be stronger than the corresponding effect for Chinese foreign firms. Borrowing from Rodríguez-Clare's linkage coefficient concept, foreign firms might also create more jobs depending on the types of inputs they buy, despite their higher tendency to import. For example, if inputs demanded by multinationals require more labor per unit of output than those demanded by local firms, then the multinational's demand may actually create more jobs upstream than local firms.

Three other case studies precede the recent theoretical papers on linkages and FDI. Stewart (1976) studies linkages in a random sample of manufacturing firms located in the Limerick Mid-West Region of the Republic of Ireland. Stewart measures linkages in several different ways: backwards national linkages (BNL) are defined as the sum across firms of total inputs minus imports plus wages paid to employees at the plant (pre-tax). Similarly, backward regional linkages (BRL) are defined as the sum of inputs bought in the region plus the local wage. Finally, the difference between sales and exports is called forward national linkages (FNL) while forward regional linkages (FRL) equal regional sales across firms. The author notes that there are indeed several flaws with these measurements. First, the effect of wages in BRL may be overstated due to taxes. Second, redistribution of resources (labor and capital) results when a foreign firm replaces a domestic one. In this case, since there was high unemployment in this region during the survey period, this redistribution may not prove a significant issue in terms of labor. Furthermore, these measures also ignore secondary effects, which are captured by the cumulative causation analysis developed in Markusen and Venables (1999) and advanced by Matouschek and Venables (1999). The new theory and the linkage measurements developed take some of these effects into account, showing immediately how older empirical studies may benefit from the new theory. His analysis concludes that foreign firms fail to develop either backwards or forward linkages. Irish firms generate larger linkages as a percentage of output compared to foreign firms, but fewer of them are regional. He proposes that fiscal incentives and the region's characteristics attract firms that are less likely to develop linkages. In 1964, regional linkages as a percentage of output were as follows: 39.3 per cent for US firms, 22.1 per cent for British firms, and 27.4 per cent for Irish firms. In 1970, the figure for US firms had fallen to 28.7 per cent, comparable to the 29.5 per cent for Irish firms, both of which were paltry, compared to the 44.9 per cent witnessed with British firms.

British firms provide an excellent example of the general trend that multinationals tend to buy more locally as time goes on, while the behavior of US firms runs counter to it.¹³ The British firms also illustrate the benefits of proximity to the host country, despite the claim by Rodríguez-Clare that proximity lowers communication costs and hence decreases the level of local purchasing. This counter result may well be due to some of the dynamics referred to in the Taiwanese example. Irish suppliers, by having a closer connection with the British than the US firms, both in terms of geography and the cultural spillover that results, may find it easier to determine the needs of British suppliers as opposed to US firms. British firms may likewise find it easier than US firms to purchase from Irish suppliers due to proximity. In addition, US firms may have a better selection of intermediates to choose from in their own domestic market owing to the larger size of the US market.

The Irish experience has also been studied by Barry and Bradley (1997) who find that foreign factories are much more likely to import their inputs than are local factories.¹⁴ This result again casts doubt on the proposition that multinationals generate significant local linkages. However, Barry and Bradley also find that

foreign firms have a higher productivity than domestic plants.¹⁵ Furthermore, those industries with high levels of FDI tend to have higher wages.

Lim and Fong (1982) examine Singapore, starting in the early 1960s when there were few linkages because US tariffs (placed only on the value added) created the incentive for intra-firm trade. They conducted three case studies of long-established, export-oriented, multinational firms in Singapore's electronics industry.¹⁶ Their conclusion was that, with limited government interference (as in Singapore), export-oriented multinationals can indeed create linkages. In a recent book, Moran (1998) provides anecdotal evidence strongly suggestive of extensive backward linkages from FDI in the Mexican auto industry. Within five years of the initial investment, there were 300 domestic producers of parts and accessories, of which 110 had annual sales of more than one million dollars.¹⁷

These case studies present some evidence that FDI results in linkages, especially backward linkages, since multinationals often locate simple manufacturing operations in developing countries to take advantage of low local wages. However, none of these studies provides a rigorous econometric study to help determine whether any of these trends or results is statistically significant. Certainly much more rigorous work, taking advantage of the new measurements developed in recent research, would add significant value to the empirical literature analyzing linkages and multinationals.

7.5. Conclusions

In this paper, we have provided a selective survey of the theoretical and empirical literature on linkages from FDI. At present, there does not exist a strong connection between theory and empirical evidence. Part of the problem may simply be that it is difficult to empirically implement the theoretical models. However, much of the advances in the theoretical modeling of linkages are relatively recent, so most empirical work pre-dates the formal theory.

In general, there is strong theoretical support for the idea that FDI can play a crucial role in industrial development by generating backward and forward linkages in the host economy. On the empirical side, the evidence is mixed. While some studies support the linkage effects of FDI, others fail to find such effects. However, much of the existing empirical evidence does not correspond directly to the theory and therefore should not be viewed as a direct test of existing theories. A fresh attack on the problem of measurement of linkages needs to be undertaken using the issues identified by modern theory.

Finally, linkages are but only one of the potential channels through which FDI impacts a host economy. Any policy formulation based primarily on the notion of linkages would be misguided. Increased competition, technology transfer, increased access to world markets due to spillovers to local firms, and worker training are some of the other channels through which FDI can benefit the host economy, and such benefits can be realized despite the absence of linkages. Hence, policy formulation should be based on a more holistic view of FDI.

Notes

- 1 Satellite industries are characterized by a strong locational advantage (established close to the parent industry), having as their predominant input the output of the parent industry, and possessing a smaller minimum economic size than the parent industry.
- 2 Thus, an economy may be subject to coordination problems, leading to the possibility of multiple equilibria: only if agents can successfully coordinate their investments will industrialization result in the economy. Such coordination problems have often been argued to lie behind development traps. See Rodríguez-Clare (1996b) for a formal model of such traps.
- 3 The main question in this debate is whether, through clever use of various policy instruments, a government can increase domestic welfare by biasing investments in an economy toward industries that generate stronger spillovers (or linkages) for the rest of the economy.
- 4 The two countries are assumed too small to affect international prices (or alternatively, the two final goods are perfect substitutes so that their relative price remains fixed).
- 5 The analysis should also apply to shifting production within countries, from an advanced to a backward region, provided labor supplies are immobile across regions.
- 6 The justification for this assumption is that relying on suppliers from abroad involves excessive coordination costs. Producer services such as banking and consulting are clear examples.
- 7 Hence, an increase in any parameter that increases the multinational's linkage coefficient benefits the host economy. Furthermore, positive linkage effects could push the number of varieties above the threshold, and shift the host economy from the bad to the good equilibrium. In this case, the backward linkages are strong enough to induce forwards linkages, creating a new downstream industry.
- 8 Alternatively, the wage minus the reservation wage times employment to account for the value of leisure.
- 9 See Glass and Saggi (1999) for a model in which a multinational's strategy of paying higher wages than domestic competitors has important welfare implications.
- 10 Again, intermediate goods are non-tradable, although their results should persist provided intermediate goods are not perfectly tradable.
- 11 The supply of primary factors is infinitely elastic, released from a perfectly competitive rest of the economy.
- 12 In a subsequent paper, Puga and Venables (1997) introduce the hub-and-spoke scenario of trade, where the hub has trading agreements with each of the spokes but the spokes have no such relationship with each other. Because the hub has lower costs and a larger demand (again linkages are the primary forces), trade liberalization results in a shift of production to the hub.
- 13 In a detailed study of Puerto Rico's experience between 1948 and 1963, Weisskoff and Wolff (1977) found evidence that linkages do grow over time.
- 14 O'Malley (1995) discovers that while foreign firms in Ireland have a lower backward linkage per unit of output, they possess a higher backwards linkage per employee, which is the statistic proposed by Rodríguez-Clare (1996a).
- 15 Incidentally, the fact that foreign-owned plants are more productive than domestic ones is perhaps the most robust finding of the empirical literature on FDI. For example, see Haddad and Harrison (1993) and Aitken and Harrison (1997).
- 16 The authors propose that linkage creation is determined by a three-step process. The first step involves determining whether there would be foreign or local sourcing of inputs. Next, the issue is whether to produce them in house or to purchase them locally. The final step determines the form of the direct relationship between buyer and independent seller.

17 Most interestingly, investments by foreign car manufactures were followed by investments by foreign firms who made automobile parts. Foreign producers also transferred technology to such domestic suppliers: industry best practices, zero defect procedures, and production audits were introduced to domestic suppliers thereby improving their productivity and the quality of their products. See also Lall (1985) for similar evidence regarding India's trucking industry.

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