

Organizations and Trade

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Abstract

We survey an emerging literature at the intersection of organizational economics and international trade. We argue that a proper modeling of the organizational aspects of production provides valuable insights on the aggregate workings of the world economy. In reviewing the literature, we describe certain predictions of standard models that are affected or even overturned when organizational decisions are brought into the analysis. We also suggest potentially fruitful areas for future research.

1. INTRODUCTION

As in standard general equilibrium theory, the three central primitives of traditional and new trade theory are consumer preferences, factor endowments, and the production technologies that allow firms to transform factors of production into consumer goods. As parsimonious as these frameworks are, they have generated some particularly sharp theorems in economics. However, a limitation of these theories is that the specification of technology treats the mapping between factors of production and final goods as a black box. In practice, this mapping is determined by the decisions of agents in organizations.

The growing field of organizational economics is devoted to the study of how these organizational decisions shape the mapping between factors of production and consumer goods. An understanding of these microeconomic decisions may be intellectually interesting in its own right: For instance, there is a vast literature trying to understand why certain transactions are carried out within firms and others across firms. In this article, we attempt to convey the notion that studying these organizational decisions also provides valuable insights for the aggregate workings of the world economy, and thus the importance of organizational economics transcends the narrow nature of some of the questions it seeks to answer. Only by microfounding the origin and properties of production functions can one fully understand how changes in the economic environment, such as falling trade or communication costs or improvements in contract enforcement, will affect economic outcomes. The classical, reduced-form approach to production technologies will naturally miss the endogenous response of organizations to these changes in the economic environment. We illustrate the importance of this omission by describing a few predictions of standard models that are dramatically affected or even overturned when organizational decisions are brought into the analysis. As an example, the slicing of the value chain across countries can radically alter the predicted effects of trade integration on relative factor rewards in both developed and developing economies. Also, we show how the internalization decision of firms can significantly affect the overall pattern of multinational enterprise (MNE) activity around the world.

Although our survey avoids dwelling into many technical details, it is worth providing a brief formalization of the common theme in the literature we review. Consider a standard definition of a production function in a country c given by $F_c(L)$, where L denotes a vector of traditional inputs (different types of labor and capital, land, etc.).¹ The main characteristic of these inputs is that their supply is determined outside the production process. For example, aggregate labor supply decisions are made by agents in response to the wages prevailing in the economy, not as part of the production process of a firm. $F_c(L)$ then denotes the output that can be produced using a set of inputs L in a certain location c . The assumption that the specification and parameters of $F_c(\cdot)$ are given by technology and are independent of the economic environment assumes away the organizational problem. Now suppose that firms can decide which inputs to use and how to combine them. For example, they can decide to buy some intermediate inputs and produce only part of the production process themselves: an outsourcing decision. The optimal decision on how to produce will determine the characteristics of the function $F_c(\cdot)$ and will make those characteristics a function of, potentially, all prices and properties of the economy.

¹For simplicity, we abstract here from intermediate inputs. Of course, the use and form of production of certain intermediate goods or services are part of the organizational problem. However, these intermediate goods and services are produced by traditional inputs.

Summarize these prices and properties by E . Then the problem of organization becomes one in which the traditional notion of technology is modified to a reduced-form specification given by $O_c(L, E)$. Understanding how this production function depends on the characteristics of the economy, namely how the function $O_c(\cdot)$ relates to the function $F_c(\cdot)$, is the goal of organizational theories.²

The key distinction we make in this survey between the “general” production problem and the organizational problem is that the organizational problem includes only the decisions that shape how a product is produced. The general production problem encompasses both the decisions of what to produce and how to produce it. We therefore think of an organization as all the agents (a firm, a group of firms, or one or several individuals) that participate in a particular production process, given the product and its characteristics. As such, the organizational problem includes the decisions of where to locate the different parts of the production process, what type of agents and capital to employ, and whether to produce things in one single firm or outsource part of the production process. These dimensions guide the ordering of the literature that we propose below.³

Trade and organizations are related in so far as the ability to produce part of the production process in different locations determines the characteristics of the organizational problem and the function $O_c(\cdot)$. The ability to trade has traditionally been understood, from a country’s perspective, as an expansion in the production possibility frontier because trade can be viewed as an alternative technology to produce the imported goods. In the same way, the ability to organize the production process using foreign factors, technology, institutions, etc., determines the organization of the production process and therefore the implied productivity of this process. This link between the organization of production and the ability to incorporate foreign factors and foreign characteristics in the production process via trade has important consequences for welfare. Many of the papers we review discuss the particular welfare and factor-price implications of this link.

Combining trade theories with organizational theories yields many new predictions in both fields. By incorporating organizational theories into general equilibrium trade models, researchers have obtained a variety of aggregate predictions from these particular ways of understanding the production process. For example, the ability to organize the production process across countries can change the pattern of comparative advantage and therefore the pattern of trade. Not only are trade models richer and more flexible by incorporating organizational decisions, but organizational theories also gain in richness of predictions and testable implications. For instance, by moving away from the traditional partial equilibrium, firm-level approaches in organizational economics, some papers we discuss unveil interesting complementarities in the organizational decisions of firms.

Also important in explaining the success and impact of this recent literature is the fact that data on international transactions are particularly accessible: More data on foreign

²Note that the specification of the function $O_c(L, E)$ is, in general, endogenous in organizational theories. However, it is still the case that theories impose many restrictions on the way this function can depend on the characteristics of the economy.

³The decision of the number and type of products to produce is, according to our definition, not an organizational decision. In general, this decision has been studied in frameworks that emphasize firm heterogeneity, so we abstain from discussing it. The interested reader should go to Bernard et al. (2006) and Nocke & Yeaple (2008).

direct investment (FDI), MNEs, related party trade, etc., are becoming available every day. This makes the international dimension of the organization decisions of firms a good candidate to explore empirically the predictions of organizational theories, and gain insights into their aggregate importance in the economy.

The remainder of the paper is divided into four sections plus a final section with concluding remarks. By dividing the literature into four sections, we try to follow a logic that, we hope, helps the reader. In particular, we move progressively from theories that remove certain traditional frictions from classical theories (such as the ability to fragment production or trade tasks), to theories that introduce nontraditional frictions (such as contractual frictions) in order to pin down firm boundaries. As a result, the first two sections discuss only the international organization of production and are rich in aggregate predictions, but they say nothing about the breakdown of this international organization of production into firms. In contrast, the last two sections introduce contractual frictions to provide a rich set of predictions on the way the organization of production is broken down into national and MNEs. Inevitably, these models sacrifice on the richness of the type of organizations considered and on their general equilibrium implications. Nonetheless, these two sets of literature are complementary and have been developed, to a large extent, in parallel.

In Section 2, we review a body of work that models the international fragmentation of production across borders in otherwise neoclassical models. Despite the fact that these theories, in general, share the frictionless environment with traditional theories, we argue that the organizational choices inherent in the international slicing of the value chain can have dramatic consequences for the workings of general equilibrium models.

In Section 3, we discuss a literature that further departs from traditional models by relaxing the assumptions that the set of tasks involved in production is fixed and that factors of production of the same type (e.g., unskilled or skilled workers) are perfect substitutes (in efficiency units) from each other. This leads to a nontrivial matching problem between factors of production, which can be interpreted as the organizational design of the production process.

In Section 4, we focus on the internalization decision of firms, an organizational decision that has received a lot of attention in recent research (for alternative reviews of this literature, see Helpman 2006 and Spencer 2005). As we discuss below, trade statistics have unveiled certain systematic patterns regarding the way that production is being fragmented across borders within and across firms. Because a rationalization of these stylized facts requires a formal model of why some tasks are done within firms, it cannot be provided by complete-contracting frameworks of the type used in traditional theories of international trade. Hence, a recent literature has developed general equilibrium models of multinational production that draw firm boundaries through incomplete contracting.

Finally, in Section 5, we briefly comment on a few other studies that focus on the effect of contractual frictions for organizational decisions other than the internalization decision. Section 6 concludes by offering some suggestions for future research in this field.

2. FRAGMENTATION IN OTHERWISE NEOCLASSICAL MODELS

Production of a good involves the performance of a set of activities. These different parts of the production process have been labeled tasks, intermediate goods, or vertical production stages. All the papers reviewed in this section focus on the idea that the production

process used by firms can be decomposed into these smaller units. None of these studies has anything meaningful to say about the boundaries of the firm; they focus only on the organization of the international production process.

Explicitly recognizing the multistaged nature of production in models of international trade has been important because the economic environment (e.g., trade costs, information and communication technology, factor prices) can shape where and how these different tasks or stages of production are performed. In this sense, the possibility of performing these stages in different countries affects the organization of production. That is, it affects the reduced-form production function (i.e., the way in which factors of production are transformed into goods) used by firms in different countries. The possibility of trading these tasks or performing the stages in a different location can have important effects on the measured productivity of firms (as pointed out initially by Jones & Kierkowski 2001), on the identity of the industries in which countries have comparative advantage (Dixit & Grossman 1982, Baldwin & Robert-Nicoud 2007, Grossman & Rossi-Hansberg 2008b), and on the implications of trade liberalization or reductions of trade costs on factor prices (Grossman & Rossi-Hansberg 2008b, Rodríguez-Clare 2007). By affecting the location in which each part of the production process is done, trade determines organization. By determining the way in which the production of these stages affects the reduced-form production function, organization determines trade flows. Dixit & Grossman (1982) provide the first study of this organizational decision in a trade model with a continuum of tasks that differ in their capital-labor ratios.

The unbundling of the production process has also been a constant object of study in international trade because of the ubiquitousness of intermediate-good trade and offshoring. Many empirical papers have documented pieces of evidence that point to the unbundling of the production process (see Baldwin & Robert-Nicoud 2007 for a good discussion of the literature; Hummels et al. 2001 and Hanson et al. 2005 offer nice attempts to measure this phenomenon).⁴ More of these production stages are being done in distinct countries, so the share of value added of any given country in a particular product has been declining in the past 30 years. Economists have pointed to the role of improvements in communication and transportation technology in explaining these phenomena. As these technologies improve, it becomes more economical to fragment the production process to take advantage of cross-country differences in the cost of performing the necessary tasks or of producing the required intermediate goods. As Grossman & Rossi-Hansberg (2008b) argue, reductions in communication and trade costs imply that by “trading tasks” or “unbundling” the production process, firms or organizations can enjoy the productivity benefits of worker specialization without sacrificing the gains of placing production in the most economical location.

The effect of unbundling the production process (Baldwin 2006) has been compared with the effect of improvements in technology. Jones & Kierkowski (1990, 2001) studied a standard factor abundance Hecksher-Ohlin framework with two industries and two factors in which production initially has to be completed in only one stage. At some point, it becomes feasible to fragment the production process into two intermediate goods with

⁴Many problems exist in measuring the fragmentation of production. Three of the most salient ones are that (a) trade statistics are collected in terms of total value instead of value added, (b) they tend to insert both final goods and intermediate inputs in the same (finely disaggregated) industry categories, and (c) some traded tasks (e.g., managerial tasks) may not be accurately measured.

different factor intensities within an industry. These stages can be done in distinct countries. Firms will take advantage of this possibility if the two stages have factor intensities that vary sufficiently. The possibility of trading these intermediate stages in an industry is similar to an improvement in total factor productivity in that same industry. The analogy is helpful because much is known about the effect of Hicks-neutral technological change in Heckscher-Ohlin models (for early contributions, see Findlay & Grubert 1959, Jones 1965). All the standard results apply, so fragmentation leads to overall gains from trade but, in most cases, generates distributional conflict. This is similar to the effect of reductions in trade barriers in the standard Heckscher-Ohlin model. When trading with a poor country with abundant unskilled labor, the ability to fragment production can lead to decreases in the wages of low-skilled workers and to increases in the wages of high-skilled workers. Arndt (1997), Egger & Falkinger (2003), and Kohler (2004a,b) extend this analysis in several directions. In particular, they add the possibility of fragmenting production in both industries (see also Deardoff 2001a,b).

Yi (2003) introduced a technology with three sequential stages of production. The emphasis here, relative to Jones & Kierkowski (1990), is the assumption that the stages of production have to be done sequentially (see Hummels et al. 1998 for evidence of this assumption). The first two stages can be produced offshore, but the third needs to be completed close to the firm's headquarters. Yi showed the importance of multistage production in accounting for the large increase in trade flows relative to GDP in the second half of the twentieth century: As tariffs and other forms of transport costs of intermediate goods decrease, firms choose to complete more stages abroad, which increases trade. Tariffs have an amplified effect on trade because they apply to the gross value of the product, not to the value that was added abroad. So, a firm that decides to complete the second stage abroad (e.g., importing it from a subsidiary or an independent supplier) may also need to pay tariffs on the value it added in the first stage, even when the first stage was completed in the home country. This is a clear example of how an endogenous response by an international organization of production to trade policy can have an important effect on the volume of trade. In a follow-up paper, Yi (2008) used the same idea to estimate trade costs. Multistage production implies that smaller trade costs are needed to explain the lack of international trade relative to national trade (sometimes referred to as the border effect). Because measured trade costs are too small to account for the volume of trade, this finding highlights the importance of accounting for this element of the organization of production.

One of the drawbacks of this literature is that the possibilities to fragment production, and the characteristics of each fragment (e.g., factor intensities), are exogenous. These exogenous characteristics of the different stages drive most of the implications. As a result, the literature has produced a taxonomy of examples in which a whole variety of outcomes is possible depending on the precise way in which fragmentation is introduced. Grossman & Rossi-Hansberg (2008b) provide sharper implications by assuming that production requires a continuum of tasks from each factor of production. Thus, low- and high-skilled workers each perform a continuum of distinct tasks. All tasks are required to produce the good and each task can be completed domestically or abroad. Performing the task offshore (in a location separate from the firm's headquarters) requires paying a cost that differs by task. Some tasks can be produced offshore easily (e.g., basic manufacturing tasks), whereas others are difficult or impossible to produce offshore (e.g., local transportation). Which tasks are offshored is part of the production decisions of the firm. The result is a production

process that can be embedded in standard trade models to study the impact of the costs of offshoring parts of the production process.

In a Heckscher-Ohlin context, Grossman & Rossi-Hansberg (2008b) showed that reductions in the average cost to offshore tasks performed by a given factor have analogous effects to factor-augmenting technological change in that factor. Because these tasks are produced with one factor, reductions in the cost of offshoring lead to factor-augmenting technological change instead of Hicks-neutral technological change in that industry. This implies that reductions in the cost of offshoring low-skilled tasks can lead to gains for all factors of production. Low-skilled workers become more productive in the skill-abundant country because they combine their output with the cheaper tasks produced by foreigners. This effect (called the productivity effect) benefits low-skill workers in the skill-abundant country. Nonetheless, the standard Stolper-Samuelson effects identified in traditional trade models are still present, so the final impact on low-skill workers is uncertain.⁵

All the studies mentioned above focus on the organization of production between countries that have either different technologies or different factor endowments. Tasks are performed offshore because they can be done cheaper or more productively in another country and the costs of producing them abroad are not too large. Baldwin & Robert-Nicoud (2007) discussed the case in which countries have different technologies to produce particular tasks but similar overall levels of technology. Those countries can have similar aggregate total factor productivity and still trade tasks. As in standard Ricardian trade models, Baldwin & Robert-Nicoud (2007) showed that such countries specialize in the production of particular tasks. Otherwise, they argued that the basic insights of Grossman & Rossi-Hansberg (2008b) survive this generalization. Grossman & Rossi-Hansberg (2008a) studied the pattern of specialization across tasks between countries that are identical except, perhaps, for their size. They introduced external increasing returns at the task level as the source of agglomeration and showed that, in general, the larger country (in terms of output) will have higher wages and specialize in the tasks that are relatively more costly to offshore.

All these theories are static and focus on the organizational problem as related to the international organization of production and trade. None of them focuses on the dynamics of technology or factor accumulation and how they change as the international organization of production changes. These areas require more investigation. It is easy to argue that, as the international organization of production involves more locations, technology transfers to these countries change either the production possibilities of these countries in the future or the incentives people have to acquire a better education or particular practical skills. Rodríguez-Clare (2007) presents a first effort to address these issues. It uses the setup by Eaton & Kortum (2002) embedded in a quality-ladder growth model. It then introduces offshoring and analyzes the impact that reductions in offshoring costs may have on growth. Rodríguez-Clare shows that although the rich country always gains from a reduction in offshoring costs in the long run, the poor country may reduce research effort and therefore suffer in the long run. These insights depend crucially on the particular assumptions used to model the research sector and the potential technological transfers

⁵Feenstra & Hanson (1996, 1997) and Verhoogen (2008) studied quality upgrading as a result of the fragmentation of production and analyzed empirically the impact on foreign factor prices. Although important, these empirical studies do not discuss the formation and behavior of organizations, but instead they focus on product selection.

across countries. Hence, although the analysis is intriguing, few final results have been advanced.⁶

3. MATCHING AND FACTOR HETEROGENEITY

In Section 2, we discuss theories of organization and trade that allow firms to trade the tasks performed in production. However, the set of required tasks was fixed by assumption. The literature reviewed in this section endogenizes the decision of how to produce as well as of what exact factors to use in production. In the above-mentioned papers, the number of factors was small, normally two. Therefore, factor heterogeneity was not an element. As theories delve into the decision of how to produce, choosing among heterogeneous factors becomes important. A firm can decide to produce using a few talented individuals and many less-talented assistants or it can hire workers with similar talents. Which option dominates will depend on whether technology is sub- or supermodular (as explained by Grossman & Maggi 2000) and on the distribution of talent in the population. Keeping constant the mean of the distribution, a dispersed distribution of talent with many highly skilled and unskilled individuals will favor the first type of organization, as agents with intermediate talent will be relatively expensive.

The key technological requirements for the distribution of skills in the population to matter for the organization of production are as follows: It must exhibit skill complementarity, imperfect substitutability among workers' skills, and differential sensitivity to the skill of different workers (as discussed in Kremer & Maskin 1996).⁷ A production technology exhibits skill complementarity if better teammates increase the marginal product of a worker. Imperfect substitutability implies that workers with different skills perform different roles in production. In contrast to the theories reviewed in the previous section, it is not the number of units of skill, but how they are distributed across agents within the production team, that determines output. Finally, marginal increases in worker skill have to lead to differential marginal increases in output. This is consistent with the notion that different workers perform different roles in production, so the marginal value of their skills, conditional on their teammates, differs. Any technology that satisfies these three basic requirements will lead to a nontrivial organizational problem in which firms must decide whom to hire and how to produce.

Lucas (1978) introduces what may be the most basic organizational problem. Lucas (1978) assumes that all agents in the economy are heterogeneous in their ability to manage, but that all are identical as workers. He assumes a production function of the form $AF(n)$, where A is the ability of the one manager employed by the firm (or the entrepreneur) and n is the chosen number of workers. $F(\cdot)$ is assumed to be increasing and concave in the number of workers (other factors could be added as well so long as the function still exhibits diminishing returns to all factors). Because everyone is homogeneous as a worker,

⁶Recently, Monge-Naranjo (2008) studied the effect of multinational production on growth via knowledge transfers to local agents that may be internal or external to the firm. His paper is a nice attempt at understanding this important problem, but more empirical and theoretical research is needed to understand both how MNE and individual worker characteristics shape the transmission of knowledge in source countries and what the aggregate implications are of this diffusion of knowledge.

⁷See Legros & Newman (2002) for a nice discussion of the theory of one-to-one matching in equilibrium models and Sattinger (1993) for a review of the use of matching to study labor markets and how to incorporate matching into simple general equilibrium models.

the ability of workers does not enter the production function directly, but the ability of the manager does. Of course, one could think of the ability of workers as determining the level of $F(\cdot)$, which is assumed constant across firms. Lucas (1978) studied the equilibrium occupational decisions that result from an exogenous distribution of managerial skill in the population. His technology does not exhibit skill complementarity: The ability of the individual managers does affect the productivity of workers, but the managerial ability of workers is irrelevant for the productivity of managers. The lack of complementarity implies that there is no well-determined matching problem; thus the characteristics of the workers that sort into each team is indeterminate (and irrelevant). As such, the organizational problem reduces to an occupational-choice problem. Burstein & Monge-Naranjo (2008) embedded this model into a Ricardian international-trade model in which home managers can produce abroad. In their case, the productivity of a firm is determined multiplicatively by the manager's ability, and the characteristics of the country in which the workers are hired. Burstein & Monge-Naranjo (2008) used the model to explore quantitatively the role of this type of cross-country team formation and found significant negative welfare effects from eliminating this form of offshoring. Particularly interesting is the fact that they can control for local productivity using their theoretical model.

Grossman & Maggi (2000) studied a world with two countries and two industries. One of the industries combines the two tasks required for production with a supermodular technology (essentially equivalent to a positive cross-derivative of the production function with respect to the level of the two tasks), and the other with a submodular one (essentially a negative cross-derivative). In the sector with a supermodular technology, firms want individuals of the same type. That is, in equilibrium, workers match with others like themselves. In contrast, in the submodular industry, firms want (given equilibrium factor prices) to combine low- and high-skilled individuals to achieve maximal cross-matching. The result is an allocation in which, in each country, the extreme types (the most and least skilled) are matched with each other and the intermediate types self-match. Grossman & Maggi (2000) showed that if the variance of the skill distribution differs across countries, but the distributions are symmetric with a common mean, the country with higher variance will have a comparative advantage in the submodular sector. Their paper provides a good example of how the organization of production can affect comparative advantage through the distribution of skills. In this theory, the organization of production interacts with a rich set of factor markets to lead to the discussed outcome.

Although insightful and novel, this analysis has some limitations. Notably, Grossman & Maggi (2000) assume that matching is one to one, i.e., a production process matches only two individuals, one of each type. Hence, the organization of production involves only the talent-allocation problem and assumes away the organizational design problem. In particular, it is hard to interpret one of the workers as a manager with several subordinates. The analysis is also limited by the fact that the skill distributions across countries have to be symmetric and differ only in their variance (or diversity as defined in their paper).

Kremer & Maskin (2006) were the first to introduce the formation of international teams [in Grossman and Maggi (2000), all teams are national and economies trade final goods]. They presented a model in which two agents with different skills can match and produce in a team. Their model uses a Cobb-Douglas production function with coefficients that sum to more than one and are different for the two skills. This technology satisfies the three requirements of matching. They studied international matches that can form in a world with workers of several skills, and they characterized the wages that

workers will command depending on the characteristics of technology and the supply of the different workers. The paper provides a useful taxonomy of the possible cases (self-matching, cross-matching, etc.) but does little to discriminate among them. As in Grossman & Maggi (2000), it considers only teams with two agents (one-to-one matching). Particularly useful is the discussion about the properties a technology must possess to have nontrivial matching.

Antràs et al. (2006) used the hierarchical technology introduced in Garicano (2000)—and developed in general equilibrium with heterogeneous agents in Garicano & Rossi-Hansberg (2004, 2006)—to study the impact of the formation of cross-country teams on the organization of production and wages. A continuum of heterogeneous agents in two countries forms production teams with one manager and several workers. The production function differs from the technology discussed by Lucas (1978) (see above) in that the span of control (i.e., the number of workers per manager) depends on the workers' abilities.⁸ This implies that the technology exhibits complementarity among worker's skills, which leads to positive assortative matching (in Lucas's model there is no matching as workers' skills are irrelevant). More generally, the production function exhibits all the properties discussed in Kremer & Maskin (1996), but it adds team production where one manager is matched to many workers. Hence, in equilibrium, there is a skill level below which all agents are workers and above which all agents are managers. Furthermore, complementarity implies positive assortative matching, so the best managers form teams with the best workers. To the extent that countries have different skill distributions, if managers can form teams with foreign workers, some will. Whether the best or worst managers form these teams depends on the characteristics of the skill distributions in both countries. If the North is much more skilled than the South, the worst managers in the North will form these international teams. Independent of the skill overlap (the range of skills available in both countries when the distributions are assumed uniform), globalization (i.e., the formation of these international teams) implies a reduction in the measure of managers in the relatively skill-scarce country. Antràs et al. (2006) also showed that this reorganization of international production will increase wage inequality in the South, as observed in the data⁹ and will have an ambiguous effect on wage inequality in the North (see Feenstra & Hanson 1999 for evidence consistent with this prediction). Essentially, good workers in the South benefit from the possibility of being matched with better managers in the North. Northern wage inequality can increase if the North is much more skilled and communication technology is particularly good, so the span of control of managers is large.

Antràs et al. (2006) provided the first international trade model to introduce hierarchical one-to-many matching (rather than one-to-one matching) where a manager is endogenously matched with a potentially large number of workers and the identity of managers and workers is endogenous. Furthermore, the actual team production function results from a microfounded model of worker specialization in production and knowledge, where the relation between the skill of the manager and that of the worker is mediated by communication technology. An important limitation of the analysis is that most of it is restricted to uniform skill distributions in both countries. Some of this analysis can be

⁸In the theory, workers with more knowledge can solve more problems on their own and therefore use less managerial time as they request help less often.

⁹See Goldberg & Pavcnik (2007) for a survey of the empirical literature on the effect of globalization on wage inequality in developing countries.

extended easily to more flexible distributions, but more research is needed to determine whether these results may be generalized.¹⁰

In a follow-up paper, Antràs et al. (2008) expanded this framework by analyzing the possibility of multilayered production teams, namely teams with multiple layers of management. They focused on international teams with up to three managerial layers. The exercise allows firms to change the number of layers as a response to the economic circumstances and to organize abroad part of the production process. The paper shows that firms with workers abroad may want to add a layer of managers in the foreign country to deal with simple locally generated problems, thereby economizing on international communication costs. Whether firms introduce this extra layer depends on the difference between local and international communication technologies and the opportunities of managers in foreign countries to start their own firms.

Understanding the process of introducing and eliminating layers is, we believe, an important topic for future research. Much has been said about the role of information and communication technology in flattening organizations, understood as a reduction in the number of management layers within organizations (see, for example, Rajan & Wulf 2006, Caroli & Van Reenen 2001). The process of introducing new layers to deal with the international organization of production has been less studied empirically. As this form of reorganization of production is relatively easy to observe and may have large effects on organizational structure, understanding it is important to determine the costs and benefits of international production.

Finally, Nocke & Yeaple (2008) presented an assignment model of FDI, but they focused on the matching between brands of different quality and entrepreneurs of heterogeneous ability. Their study is the first to analyze, in a matching context, the decision of firms to set up or buy the plants they use to produce abroad. Because production overseas implies fixed costs, but the value of existing plants is proportional to their productivity and output (and therefore the marginal cost of production), the more productive firms (the ones that ultimately have a larger scale) are the ones that do greenfield FDI; namely, these firms will build new plants.

4. CONTRACTUAL FRICTIONS AND MULTINATIONAL FIRM BOUNDARIES

The theoretical models reviewed above enhance our understanding of trade and FDI flows, but they do not properly draw the boundaries of multinational firms. Some models identify a potential gain to fragment production across borders or to use managerial know-how in a foreign country, but they are not designed to explain why these activities occur within firm's boundaries (thus involving foreign insourcing or FDI), rather than through arm's-length subcontracting, licensing, or outsourcing. As such, they are not theories of the MNE, but theories of the international organization of production.

A vast literature in economics has focused on studying firm-level decisions related to the mode of servicing a foreign market or the (firm-level) division of production across countries. Markusen (1984) introduced the so-called proximity-concentration trade-off between exporting and multinational activity. Relative to exporting, servicing a foreign

¹⁰Ohnsorge & Trefler (2007), Costinot (2008), and Costinot & Vogel (2008) also introduced worker heterogeneity in standard trade models, but they focused on the sorting of workers into industries rather than the matching between different types of workers. Hence, they abstract from the organizational problem.

market through a local affiliate that replicates the home production process abroad may be appealing because it saves on transportation costs (due to proximity to demand). With increasing returns to scale, however, exporting may prove to be more profitable because it provides the benefits associated with concentrating production in a single location.¹¹ Helpman (1984) developed a complementary approach by showing that, in the presence of factor price differences across countries and increasing returns to scale in the production of headquarter services (e.g., management know-how, distribution, product-specific R&D), a producer may find it optimal to fragment the production process and undertake headquarter services and certain manufacturing processes in different countries. Helpman's (1984) model predicts that measures of the extent of MNE activity should increase in relative factor endowment differences across countries.¹²

These technological theories of the MNE have provided valuable insights for how MNE activity affects the structure of trade flows, factor price differences, and the diffusion of technology across countries.¹³ Nevertheless, they continue to assume that when fragmentation or replication across borders is profitable, it will be undertaken within firm boundaries. In practice, one of the key organizational decisions of firms is the so-called internalization decision, which is the classical make-or-buy decision in industrial organization, but it also applies in an international context. For example, in 1997, Intel Corporation decided to offshore part of its production of microprocessors to a \$300-million manufacturing plant in Costa Rica. It also decided to keep full control over that facility, which it wholly owns. Conversely, while Nike also relies on offshore manufacturing, it subcontracts the production of its products to independent producers in Thailand, Indonesia, Cambodia, Vietnam, and other low-wage countries, keeping within firm boundaries only the design and marketing stages of production.

As we illustrate below, there are many instances in which the internalization decision, as with other organizational decisions, affects the mapping between factors of production and final goods. A growing body of empirical work documents that the internalization decision of MNEs is far from random, in the sense that the relative prevalence of foreign insourcing versus foreign outsourcing is systematically related to certain firm, industry, and country characteristics. This warrants some explanation. Data on the ownership structure of firms are generally hard to obtain, which partly explains why the most satisfactory empirical tests of alternative theories of the firm have relied on data on specific industries. Fortunately for international trade economists, any exchange of goods or services that crosses a political border is automatically recorded in government statistics. These statistical records also often include information on whether the parties transacting the good or service are related or not, thereby providing an example of intrafirm or interfirm (i.e., arm's-length) trade, respectively. Worldwide, intrafirm trade composes one third of all transactions: For the United States, it represents close to 50% of imports and more than one third of exports.

¹¹This horizontal approach to MNEs has been extended and empirically tested by Brainard (1997), Markusen & Venables (1998, 2000), Helpman et al. (2004), and Ramondo (2007).

¹²Yeaple (2003b) and Hanson et al. (2005) empirically tested this vertical view of MNEs. In the real world, we observe firms undertaking multinational activity owing to a combination of horizontal and vertical forces. Yeaple (2003a), Grossman et al. (2006), and Ekholm et al. (2007) studied rich theoretical frameworks that unveil interesting complementarities between these two forms of MNE expansion.

¹³See Helpman (1984) and Markusen & Venables (2000) for particularly lucid discussions of the effects on the pattern of trade and factor prices. Ramondo (2007) or Garetto (2008) provide quantitative exercises attempting to measure the welfare consequences of MNE-induced technology diffusion.

In terms of the systematic patterns mentioned above, the share of intrafirm trade in total trade varies substantially across industries and countries, and a significant share of this variation can be explained by certain key characteristics. For instance, Antràs (2003) reported that simple measures of R&D and capital intensity can explain a large fraction (almost 75%) of the cross-industry variation in the share of intrafirm imports of total U.S. imports. Using more detailed data sets, Yeaple (2006), Nunn & Teffler (2008), and Bernard et al. (2008) reported similar results and unveiled further stylized facts.

Such findings have motivated a recent wave of theoretical work attempting to shed light on the internalization decision of MNEs. The main unifying theme of this literature is the departure from the classical assumption of complete contracting. As is well-known (at least since Coase 1937), firm boundaries are indeterminate in a world in which transactions are governed by comprehensive contracts that specify (in an enforceable way) the course of action to be taken in any possible contingency that the contracting parties may encounter. To shed light on the internalization decision, this new literature on MNEs and outsourcing has borrowed from the theoretical literature on firm boundaries and incomplete contracts (c.f., Williamson 1975, 1985; Grossman & Hart 1986), and it has developed ways to incorporate these contracting frameworks into general equilibrium models. These developments have proved fruitful in explaining the observed systematic patterns in the intrafirm component of trade and have been influential in the study of how contractual frictions generally affect the workings of general equilibrium models (see Section 5).¹⁴

The first applications of incomplete contracting to open-economy setups adopted the so-called transaction-cost approach of Coase (1937) and Williamson (1975, 1985). This approach describes certain contractual frictions that naturally emerge in arm's-length transactions when contracts are incomplete. Williamson, in particular, formalized how these contractual gaps (and the associated renegotiation or fine-tuning of contracts) create inefficiencies in situations in which the parties involved in a transaction undertake relationship-specific investments or use relationship-specific assets. Essentially, specificity implies that, at the renegotiation stage, parties cannot costlessly switch to alternative trading partners and are partially locked into a bilateral relationship. The combination of bilateral bargaining and sunk costs may generate ex-post inefficiencies (e.g., inefficient termination or execution of the contract) as well as ex-ante or hold-up inefficiencies (e.g., suboptimal provision of relationship-specific investments). An important limitation of the transaction-cost approach is that it says little about the costs of intrafirm transactions. If the market system is so imperfect, why is there not one big firm in the world integrating the production of all goods? The transaction-cost approach simply posits the existence of an exogenous governance cost of running an integrated structure.

Ethier (1986) offers an early application of the transaction-cost approach to international economics. In Ethier's view, the main difference between transacting within the boundaries of MNEs and transacting at arm's length is that, in the latter case, headquarters cannot offer quality-contingent contracts to downstream producers or distributors. As a result, headquarters cannot always devise a contract that ensures ex-post efficiency and extracts all surplus from their contracting partners. Under these circumstances, the headquarters may be better off integrating the downstream producer. Interestingly, when

Relationship-specific asset: an asset or investment whose value is higher inside than it is outside of that particular relationship

¹⁴To some extent, the stylized facts on intrafirm trade provide *prima facie* evidence of the importance of incomplete contracting in the real world, which has fostered a burgeoning literature studying organizational choices of firms that transcend the internalization decision (see Section 5).

solving for the general equilibrium of the model, Ethier (1986) found that integration is more attractive when differences in relative factor endowments between countries are small. This result contrasts with that obtained by Helpman (1984) and nicely illustrates how a microfounded model of the integration decision can radically affect the predictions emanating from models of the international organization of production.

McLaren (2000) and Grossman & Helpman (2002) offer alternative general-equilibrium formalizations of the transaction-cost approach that instead emphasize ex-ante or hold-up inefficiencies. In their frameworks, suppliers undertake relationship-specific investments that enhance the value of a good sold by a final-good producer. The key transaction-cost assumption in these models is that the final-good producer can contractually commit to trade with the supplier at a stipulated price only when it vertically integrates it. In the case of outsourcing, the final-good producer will have every incentive to hold up the supplier at the ex-post bargaining stage by offering him a relatively low remuneration for the already-sunk investment. Anticipating this ex-post hold up, the supplier will ex-ante choose to provide an inefficient level of investment. Although vertical integration entails an exogenous cost, it may be optimal when the hold-up inefficiencies are large enough. In any case, the organizational decision of whether to integrate suppliers or outsource to them affects the equilibrium mapping between inputs and final goods.

The most interesting results in McLaren (2000) and Grossman & Helpman (2002) arise when solving for their models' industry equilibrium, where they show that a firm's decision to vertically integrate its supplier potentially exerts a negative externality on the remaining nonintegrated bilateral relationships by thinning the market for inputs.¹⁵ As a result of these external effects, their models can feature multiple equilibria with a pervasiveness of different organizational forms (or industry systems) in ex-ante identical countries or industries. They can also explain why trade opening, by thickening the market for inputs, may lead to a worldwide move toward more disintegrated industrial systems, thus increasing world welfare and leading to gains from trade quite different from those emphasized in traditional trade theory.¹⁶ In other words, the endogenous organizational choices of firms can have a significant effect on the characteristics of an economy's response to a trade liberalization process.¹⁷

As mentioned above, the transaction-cost approach to the theory of the firm is silent on the sources of vertical-integration costs. In their seminal paper on the property-rights theory of the firm, Grossman & Hart (1986) argued that it is not satisfactory to assume that the contractual frictions that plague the relationship between two nonintegrated firms disappear when these firms integrate. Within firms, contracts are incomplete, agents are opportunistic, and why integration would change the relationship-specificity of investments is unclear. What defines then the boundaries of the firm? The property-rights approach posits that

¹⁵The mechanism in the two papers is, however, different: In McLaren (2000), a thinner market for inputs reduces the ex-post payoff of suppliers and exacerbates the hold-up problem. The effect in Grossman & Helpman (2002) is mediated by a search friction (which only appears under outsourcing): A thinner market for inputs reduces the probability of finding a match (when the matching function features increasing returns to scale), which reduces the attractiveness of outsourcing for the remaining nonintegrated pairs.

¹⁶This result is explicitly derived by McLaren (2000). Grossman & Helpman (2002) extended their setup in subsequent work (Grossman and Helpman 2003, 2005). Helpman (2006) offers an overview of these papers.

¹⁷Another organizational decision of firms discussed in papers by McLaren (2000) and Grossman & Helpman (2002) is the choice by which suppliers determine the degree to which they customize their intermediate products to their intended buyers. See also Qiu & Spencer (2002) and Chen & Feenstra (2008) for related work.

ownership is a source of power when contracts are incomplete. More specifically, when parties encounter contingencies that were not foreseen in the initial contract, the owner of physical assets (e.g., machines, buildings, inventories, patents, copyrights) has these residual rights of control and can decide on the use of these assets to maximize his payoff at the possible expense of the integrated party. Grossman & Hart (1986) then showed that, in the presence of relationship-specific investments, these considerations lead to a theory of the boundaries of the firm in which both the benefits and the costs of integration are endogenous. In particular, vertical integration entails endogenous costs because it reduces the incentives of the integrated firm to make investments that are partially specific to the integrating firm, thereby lowering the overall surplus of the relationship.

The property-rights approach has been applied to international trade environments by Antràs (2003) and Antràs & Helpman (2004, 2008). These papers envision an incomplete-contracting world in which both final-good producers and suppliers (who may be located in a different country) undertake noncontractible, relationship-specific investments that enhance value. The situation is thus one of double-sided holdup and leads to suboptimal investments by both types of producers. As in Grossman & Hart (1986), vertical integration does not affect the space of contracts: It simply entails a stronger bargaining power for the final-good producer in its negotiations with the supplying division. The key partial equilibrium result in these papers is that vertical integration is optimal only when the elasticity of output (or sales) with respect to the final-good producer's noncontractible investments is large relative to the elasticity of output (or sales) with respect to the supplier's noncontractible investments. In other words, integration dominates outsourcing in headquarter-intensive industries, but the converse is true in industries with low-headquarter intensity (or component-intensive industries, to use the terminology in Antràs & Helpman 2004).

Antràs (2003) embedded this structure in a general equilibrium model of international trade featuring increasing returns, product differentiation and monopolistic competition (c.f., Helpman & Krugman 1985). He argued that, in practice, noncontractible investments carried out by final-good producers are likely to be more capital-intensive than those undertaken by supplying firms (see his paper for evidence). As a result, the model delivers a positive association between capital intensity and the attractiveness of integration. In the open-economy model, this produces a positive correlation, at the industry level, between capital intensity and the share of intrafirm trade in world trade, which is one of the stylized facts mentioned above.¹⁸ Furthermore, when solving for the general equilibrium, the model also predicts a positive correlation between a country's relative capital abundance and the share of intrafirm exports in its total exports to any country (a prediction for which Antràs 2003 found strong support).

Antràs & Helpman (2004) developed a property-rights theory of the MNE that allows for intraindustry heterogeneity in productivity and for differential fixed costs across various organizational models (as in Melitz 2003 or Helpman et al. 2004). As a result, their model delivers equilibria featuring multiple organizational forms within an industry. Independent of the assumptions on fixed costs, the framework continues to predict a relative prevalence of foreign insourcing (or FDI) over outsourcing in headquarter-intensive industries. Furthermore, under the natural assumption that fixed costs are larger when sourcing

¹⁸The fact that the share of intrafirm imports in total U.S. imports is also significantly positively correlated with R&D intensity can be explained by the property-rights approach, as R&D intensity is another natural proxy for headquarter intensity.

in foreign countries than when doing so within firm boundaries, the model predicts that only the most productive firms in an industry should be expected to vertically integrate their foreign suppliers. Antràs & Helpman (2004) studied the relative prevalence of different organizational forms and derived predictions that extend beyond those derived in Antràs (2003) and that open the door for more complete empirical studies of the characteristics of the international organization of production. Antràs & Helpman (2008) further extended the framework to allow for partial contractibility of investments and showed that, contrary to what would have been predicted by a transaction-cost theory of the MNE, improvements in contractibility in a country can lead to increases in the prevalence of FDI (over outsourcing) in this country.

We have so far focused on an overview of the key theoretical contributions to the literature on contractual frictions and MNE boundaries. Recent efforts have been directed toward the development of empirical tests of the property-rights model of the MNE, as exemplified by Feenstra & Hanson (2005), Yeaple (2006), Defever & Toubal (2007), Tomiura (2007), Bernard et al. (2008), and Nunn & Trefler (2008). All these papers, however, focus on testing particular predictions of particular variants of the property-rights model, rather than offer a structural test of the model. Furthermore, as of now, there has been no satisfactory attempt to deal properly with a set of econometric biases (identified by the same model) that will arise when attempting to test the model.¹⁹ In our view, future research efforts should be aimed in that direction.

Another potentially fruitful area for future research relates to the study of the effects of the nonappropriable nature of knowledge on the internalization decision. Past research has arguably focused too much on hold-up inefficiencies as the main drivers of the internalization decision. Our example of Intel's choice to internalize fully their operations in Costa Rica may be better explained in terms of a fear of technological expropriation than in terms of a double-sided hold-up problem. An early attempt to incorporate a notion of nonappropriable knowledge into a general equilibrium model of the MNE was developed by Ethier & Markusen (1996), who adopted a transaction-cost approach in which FDI avoided any type of knowledge dissipation. A more satisfactory approach would entail the application of the property-rights approach and of the notion of access developed by Rajan & Zingales (2001).

5. CONTRACTUAL FRICTIONS AND OTHER ORGANIZATIONAL DECISIONS

The papers surveyed in the previous section focus on the internalization decision as the main organizational choice of firms. The systematic patterns observed in the outsourcing decisions of firms suggest that we live in a world of incomplete contracting. Two natural questions to ask are then, How do contractual frictions affect the other organizational choices of firms, and how do these choices interact with international trade? The available literature has provided only tentative answers to these questions.

Soon after the development of the complete theories of MNE boundaries described above, researchers acknowledged that imperfect contracting could affect not only the

¹⁹For example, the property-rights model predicts that capital intensity and R&D intensity will be higher in integrated firms relative to nonintegrated firms. Thus, the observed positive correlation between the share of intrafirm trade and capital and R&D intensity at the industry level could be partly explained by these forces, rather than by the selection of firms into integration or outsourcing.

ownership structure of firms, but also their geographical location. This understanding creates a link with the literature on fragmentation reviewed in Section 2. Antràs (2005) argued that the incomplete nature of contracts governing international transactions limits the extent to which the production process can be fragmented across borders. In a dynamic, general-equilibrium Ricardian model of North-South trade, he showed that the incompleteness of international contracts naturally leads to the emergence of Vernon-type product cycles: New goods are initially manufactured in the North (where product development takes place), and only later (when the goods are mature) is manufacturing carried out in the South.²⁰

Acemoglu et al. (2007), Costinot (2007), Levchenko (2007), and Nunn (2007) argue that contractual frictions can shape the location of production and thus the structure of trade flows even in models without any fragmentation of production. In particular, to the extent that contractual frictions lead to organizational choices by firms that affect the mapping between inputs and outputs differentially across sectors, imperfect contracting will be a source of comparative advantage: Countries with well-functioning contractual institutions will be net exporters of contract-intensive goods. These papers differ in their proposed measure of contract dependence. Acemoglu et al. (2007) built a microfounded model of technology adoption (another organizational decision of firms) in the presence of incomplete contracting and showed that greater contractual incompleteness leads to the adoption of less-advanced technologies. Furthermore, they demonstrated that the effect is more pronounced when there is greater complementarity among intermediate inputs. Costinot (2007) developed a model in which productivity is determined by the division of labor and the extent of the latter is affected by the contractual environment and by the complexity of production. He then derived the result that countries with better contracting institutions have comparative advantage in more complex sectors (for which he finds support in the data). Levchenko (2007) and Nunn (2007) also provided empirical evidence that a country's comparative advantage is partly determined by contracting institutions and suggested measures of contract dependence related to the costs of contracting between upstream and downstream producers.²¹

Another important organizational decision of firms concerns the allocation of decision rights among employees. In the presence of noncontractible effort decisions by workers, managers face a trade-off between granting decision rights to workers and keeping these rights to themselves. The former option has the benefit of providing workers with initiative, which may lead to higher effort, but delegation may result in decisions that are not necessarily optimal from the point of view of the manager. Avoiding delegation (i.e., exerting authority) tends to inhibit the initiative of workers but entails more control over the course of production. As a result of these forces, the reduced-form mapping between factors of production and goods is affected by the allocation of decision rights among agents. Aghion & Tirole (1997) first formalized this trade-off, and Puga & Trefler (2002) and Marin & Verdier (2008a,b) have applied it to general equilibrium frameworks.

In certain situations, managers may have access to simpler ways to provide incentives to workers. For instance, the remuneration of a worker can be made conditional on an

²⁰Antràs (2005) also drew the boundaries of MNEs and showed that the model gives rise to a new version of the product cycle in which manufacturing is shifted to the South first within firm boundaries and only at a later stage to independent firms in the South. See Puga & Trefler (2007) for another theoretical exploration of the links between contractual incompleteness and product cycles.

²¹Levchenko (2007) also developed an interesting theoretical model that illustrates how contractual incompleteness can significantly impact the workings of a general equilibrium model. For instance, in his model, the institutionally weak country may not gain from trade, and factor prices may actually diverge as a result of trade.

observable (and verifiable) variable that is, in turn, affected by the worker's effort decision. Holmstrom (1982) and Holmstrom & Milgrom (1994) have emphasized the role of contingent rewards in influencing workers' incentives. Less understood are the issues of how trade liberalization affects the slope of this incentive scheme and how this endogenous change affects the economy's response to trade opening. Grossman & Helpman (2004) and Vogel (2007) provide preliminary answers to these questions but more work is required in this area.

A final potentially fruitful avenue of research concerns the role of trade policy in a world where firms make organizational decisions under incomplete contracts. Antràs & Staiger (2008) have studied the implications of the fact that, in transactions involving significant ex-ante customization of goods, any renegotiation of the contract will lead to a price that is determined by bilateral bargaining and not by market clearing conditions, as in traditional theory. As a result, they showed that trade policy changes in local prices can have spillover effects in other countries, even when international (untaxed) prices are held constant, thus leading to predictions distinct from those of the traditional terms-of-trade theory of trade agreements. Conconi et al. (2009) have studied additional implications of incomplete contracting for the design of optimal trade policy.

6. CONCLUDING REMARKS

In our review of the literature on organizations and trade, we have disregarded many related papers and topics in order to give the reader a summary of what we believe are the main recent advances in our understanding of the role of organizations in trade. We have divided the literature into four sections, but we could have added several more. In particular, we could have included a discussion of the literature on heterogeneous firms that emanated from the seminal work of Melitz (2003) (see Helpman 2008, whose survey does cover this literature). We could have also reviewed the recent literature on multiproduct firms (e.g., Bernard et al. 2006; see also the survey in Bernard et al. 2007). As explained in the Introduction, our guiding principle was that these topics, although important, do not deal with the way production is organized, but rather focus on what is produced and who produces it. These are important questions, but we had to draw the line somewhere and we are undoubtedly biased toward our own idiosyncratic interests.

The discussion of the different strands of the literature has allowed us to outline some possible ideas for future research and what we view as gaps in the current understanding of this topic. More generally, there are four large areas in which we would particularly welcome more research.

First, most of the literature on organizations and trade is static. Only a few papers study the dynamic impact of the international organization of production on the evolution of knowledge, the distribution of skills, and other country-specific characteristics. Could the fragmentation of production lead to skill upgrading in developing countries? How will the pattern of specialization evolve given this type of learning? Will global production chains imply convergence in income levels? All these questions have been relegated to a few lines in the discussion of static frameworks. Theoretical work in this area is much needed.

Second, although the literature has incorporated many organizational theories into trade frameworks, many alternative theories of organizations await a general equilibrium implementation. These alternative approaches could also yield important insights into the way the international organization of production affects aggregate outcomes. Even more important may be an effort to synthesize what are the robust economic predictions and

effects of all these different organizational theories that we need to incorporate into trade frameworks. We may believe that the efficient use of information drives organizational structure or that authority and delegation are the key elements, but can we obtain common robust aggregate predictions from these theories for trade?

Third, even though some suggestive evidence is available to contrast current theories, most empirical work takes a reduced-form approach in which only the predictions of the theory on the sign of some correlations are contrasted with the data. In this review, we have made an effort to discuss the instances in which the theories we outlined in this survey are consistent with particular empirical facts or are motivated by them. Nonetheless, little work has been devoted to estimate structurally the models we have discussed in this survey. This is partly due to the stylized nature of some of these theories and to the underutilization of these types of empirical techniques in the international trade field. The literature on heterogenous firms has taken more advantage of this type of methodology with interesting, and much more robust, results. We hope to see the evolution of similar empirical work on the questions we have discussed in this survey.

Finally, although the literature on organizations and trade has been largely concerned with matching positive features of reality (e.g., the share of intrafirm trade, the volume of trade, the evolution of wage inequality), much less attention has been given to the normative and policy implications of changes in the international organization of production. More work is needed to assess quantitatively the magnitude of the observed changes, their welfare impact, and, if necessary, the possible policy responses.

DISCLOSURE STATEMENT

The authors are not aware of any biases that might be perceived as affecting the objectivity of this review.

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Errata

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