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PRODUCTION SHARING AND SINGAPORE'S GLOBAL COMPETITIVENESS *

Sven W. Arndt

Abstract

This chapter investigates the contribution of cross-border production networks to the international competitiveness of a nation's producers. Cross-border sourcing of components has effects on productivity and efficiency that are very similar to those of technical progress. When a country's comparative advantage varies across the components of a product, the ability of that product to compete in world markets is improved when components are sourced from lowest-cost suppliers. Parts, components, and accessories play an important role in Singapore's trade with both less and more advanced countries. This opens opportunities as well as risks.

1. Introduction

Singapore has made spectacular progress in recent decades in pushing its economy into the world's top ranks. One important pay-off has been a substantial rise in living standards. Among the main drivers behind this accomplishment have been entrepot trade, which exploits an important natural comparative advantage, and enlightened education, social, and economic policies, which have built up man-made comparative advantage based on human capital.

The Singapore economy is open, dependent on trade, and very dependent on entrepot trade. The role of entrepot trade is dramatically evident in Figure 1, where the values of exports and imports each exceed gross domestic product (GDP) by a significant margin, and in Figure 2, which shows the importance of re-exports in total merchandise exports. While entrepot trade

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is likely to be an important part of the Singapore economy for some time to come, well-positioned competitors in the region are gearing up to challenge the country's dominance.

It is important for Singapore not only to remain competitive in shipping and transportation, but to ensure competitiveness in other sectors. In this effort, cross-border production networks can play a key role. Singapore has already experimented with the concept in its "growth triangle" and "industrial park" projects.

Singapore faces competition in world markets from both less advanced and more advanced countries. The dominance of entrepot trade has allowed labor costs in Singapore to rise toward levels occupied by advanced countries, while labor productivity and the quality of human capital may not always have kept pace. In the absence of such a dominant sector, wage growth would have been more constrained by international competition faced by firms in manufacturing and services. This situation contains some of the elements of the Dutch disease phenomenon.

When it comes to enhancing competitiveness in other sectors, the combination of relatively high wage costs and size and space limitations creates special problems for Singapore. Advanced countries in North America and Europe try to overcome the scarcity of unskilled labor through immigration and guest-worker programs, but space and congestion constraints make this an unattractive option for Singapore. One way to deal with this problem is to jump up the value chain to products and services in the production of which unskilled labor is unimportant. Another is to "import" low-cost labor via cross-border production sharing.

The aim of this chapter is to explore the contribution cross-border production sharing can make to productivity and competitiveness in Singapore. The remainder of the chapter is organized as follows. Section 2 examines several popular measures of competitiveness and compares them to the idea of comparative advantage in order to assess Singapore's competitiveness at the sectoral level. Section 3 discusses the effects of cross-border

production sharing on competitiveness and derives implications for Singapore. Section 4 offers a summary and some closing comments. An annex on the economics of production sharing follows the main text.

2. Competitiveness versus Comparative Advantage

Although the terms “comparative advantage” and “competitiveness” are often used synonymously as determinants of a country’s trade profile, they are conceptually quite different and imply quite different policy outcomes.

To be competitive means to be able to sell goods at a profit in world markets. Unless a country’s firms have price-setting powers in home or foreign markets, competitiveness is essentially a matter of controlling cost. Hence, an indicator of relative costs would be a useful measure of a country’s competitiveness. Inasmuch as such measures are unavailable at industry or sector levels, analysts use trade performance as a rather imperfect substitute. They examine exports and imports in order to see what may be “revealed” about competitiveness. The fact that a country exports a product may be taken as a good preliminary indicator of competitiveness. If, in addition, the share of exports of the product in the country’s total exports exceeds the share of exports of that commodity in world exports, then the country must have a competitive edge. Symmetric considerations apply to the products a country imports.

Figures 3 and 4 display Singapore’s top three export and import sectors in terms of their respective shares in total exports and imports. They are electrical equipment, computers and machinery, and lubricants fuel and oil, and together accounted for roughly two thirds of exports and of imports in 2000. Among the less dominant sectors, organic chemicals and optical and medical instruments provide less than 5 % of exports each, while instruments and plastics capture less than 5 % of Singapore’s goods imports each.

It is striking, though not completely unusual, that the same sectors dominate exports and imports. Such symmetry is typical, for example, of countries whose trade is predominantly intra-

industry in nature. Specialization according to product variety has long been recognized as an important feature of intra-industry trade among advanced countries. Intra-industry trade is also consistent with the Linder hypothesis, according to which trade between advanced and developing countries may display such a pattern in which the former export goods at the high end of the quality spectrum of a sector and import goods at the low end of the spectrum.

Cross-border production sharing takes specialization beyond intra-*industry* trade to intra-*product* trade. Intra-product trade occurs when production is “fragmented” and spread across borders, so that the parts, components and accessories (PCAs) contained in a product are manufactured in several countries.

If the varieties model were the dominant explanation for Singapore’s trade profile, we would expect imports and exports in a given sector or industry to consist of products of largely identical quality, but of different variety. If the Linder hypothesis dominated, we would expect Singapore’s imports from emerging economies in a given sector to be of lower quality than its exports to those economies. At the same time, Singapore’s exports in that sector to advanced countries like the United States (US) and Japan would be expected to be less technologically sophisticated than imports from those countries. Where intra-product trade is important in a sector, Singapore would tend to be an importer of labor-intensive and high-tech-intensive components and an exporter of middle-range components, in addition to trade in final products.

Thus, if countries like Malaysia, Thailand and the Philippines are “emerging” market economies and the US, Japan, and other advanced countries have “emerged,” then we may think of economies like Singapore and Hong Kong as “emergent.” The composition of an emergent economy’s trade will be more complex as a result of its position in the middle of the continuum. In trade with countries at the emerging end of the continuum, imports will be more labor-intensive and less technology- and skill-intensive than exports, while trade with countries at the emerged end will show exports to be more labor-intensive and less technology- and skill-intensive than imports.

As noted, the products exported by a country are often taken as indicative of competitiveness or comparative advantage, while those imported are interpreted as representing sectors in which the country “lacks” competitiveness. In its assessment of competitiveness, the World Economic Forum (2002) constructs two types of trade-performance indexes. The first index (Cu) measures current trade performance and is based on share in world exports, value of net exports, per capita exports, and product and market diversification. The second (Ch) is a measure of performance change in the recent past and includes changes in world market share, product diversification, market diversification, sectoral trade surplus, and specialization in the rapidly growing areas of a sector¹. In Table 1, measures of Singapore’s current standing appear in the first column, and those representing recent changes in the second.

According to the first measure, Singapore’s current competitiveness ranges from chemicals, information technology (IT) and consumer electronics, where it is strongest, to clothing, textiles, processed food, and basic manufacturing, where it is weakest. In between, are sectors like minerals, transport equipment, electronic components, non-electric machinery, miscellaneous manufacturing, and a variety of other activities.

The International Trade Centre of UNCTAD/WTO (UNITC, 2002) produces rankings based on revealed comparative advantage, as shown in the first column of Table 2. The Centre’s “revealed comparative advantage” (RCA) indexes relate the share of a product in a country’s exports to the share of that commodity in world exports. Values in excess of unity indicate country specialization and hence “reveal” comparative advantage².

The common characteristic of these measures is that they make *ex post* inferences about competitiveness. While they are unquestionably “revealing” about competitiveness, they do not say anything directly about cost effectiveness or resource productivity. They are, moreover, sensitive to trade restrictions, subsidies and competitiveness policies, which help create trade patterns which have little to do with comparative advantage. Hence, the fact that a

commodity receives a “low” rating in these exercises does not necessarily mean that a country is not cost-competitive. Indeed, countries will often be net importers of products in which they are cost-competitive.

In thinking about competitiveness and comparative advantage, it is useful as a first step to recall the distinction in the trade literature between “absolute” and “comparative” advantage, where the former compares costs of production at home and abroad. A country whose costs fall below those of another would clearly be judged to be competitive by conventional definitions of that measure. Indeed, it would be judged to be competitive if its costs matched those of other country suppliers. However, it would not necessarily export the product. Absolute advantage is neither a necessary nor a sufficient condition for exporting a product.

It is not a country’s raw ability to compete, but its relative or “comparative” ability that matters. The number of products in which a country has comparative advantage will thus always be smaller than those in which it is competitive. A country’s ability to compete in the world market for a commodity does not imply that it should export that commodity. In fact, it will be economically efficient to import some products in which the country is competitive, in order to free up productive resources for use in products in which it is relatively more competitive. If productive resources are allocated across sectors in ways that equalize returns at the margin, there will typically be products in which the country is competitive, but which it nevertheless produces in limited quantities or not at all and imports instead. Thus, the fact that Singapore has a relatively low share of exports or even imports certain products is not necessarily evidence that the country is not competitive in those areas.

3. Production Sharing and Competitiveness

3.1 Fragmenting the Production Process

Cross-border production sharing, also known as cross-border production fragmentation and intra-product specialization, has received a major boost from recent innovations in

communications and transportation technologies and from market-opening changes in trade and regulatory policies. As a result, the cost of coordinating economic activities across national frontiers has declined precipitously in recent years and manufacturers have responded by breaking up the production process and moving its constituent activities abroad, producing components and locating assembly in accordance with the dictates of comparative advantage.

In this framework, a capital-rich, labor-poor country will have an edge in producing components that are capital- and skill-intensive, while labor-rich countries will produce the labor-intensive components and undertake labor-intensive assembly. This principle, which is well-known in commodity trade, is now being applied to trade in PACs. Airliners, automobiles, consumer electronics, apparel, and many other products are made up of components that come from every corner of the world³.

Many companies utilize cross-border sourcing of components in order to increase competitiveness in markets for the final product. If a component can be obtained at lower cost from a foreign source, then the cost-savings can either be passed on in lower end-product prices, hence garnering larger market share, or be collected in higher profits at given prices.

However, a country does not have to be the producer of an end product in order to reap benefits from cross-border production sharing. Indeed, one of the attractive features of production sharing is that it facilitates a finer division of labor and thereby enables more countries to benefit from participation in global production networks. This can be especially valuable for economies trying to move up the value chain in international trade.

High-wage countries tend to be at a competitive disadvantage in labor-intensive aspects of production. To engage in such activities is to undermine overall competitiveness. Modern technology enables firms to maintain competitiveness by dispersing labor-intensive activities to labor-rich, low-wage locations. In the absence of cross-border fragmentation, rising wage costs would cause domestic firms to lose market share at home and abroad, as imports of competing products rise and exports of the home product fall. Cross-border sourcing enables firms to slow,

if not reverse, that process.

This advantage of cross-border sourcing is well understood in the North American automobile industry, for example, where US carmakers seek to enhance competitiveness by relocating labor-intensive assembly to northern Mexico. Production sharing of this type enables both countries to raise average productivity and thus to increase employment and wages⁴. From Mexico's perspective, the lack of competitiveness in capital- and skill-intensive activities makes production of the entire automobile uneconomic at present. By importing skill- and capital-intensive components from the US, Mexico enjoys cost advantages which enables its auto industry to compete in the US producers US market. Over time, importation of technology, together with accumulation of skills, should enable Mexican producers to move up the value chain away from labor-intensive assembly.

3.2 Trade Balance and Exchange Rate Effects

The rise of components trade has important implications for how we measure and interpret the balance of trade. In the presence of cross-border production sharing, imports and exports of final products may embody significant amounts of exported and imported components, respectively. The aforementioned automobiles entering the US from Mexico are so full of US-made parts and components, that the US value-added exceeds the value that was added in Mexico. Analogously, US exports, say, of airliners, contain significant amounts of imported components, so that the value of the exported product is larger than the US-made value embedded in that product.

These developments require new ways of thinking, not only about competitiveness, but also about the trade balance. Since goods entering a country contain homemade components and goods leaving contain imported components, what does the conventional measure of the trade balance tell us? If the value of a country's imports exceeds its exports, the traditional measure asserts that the country was a net importer of value. However, if the share of

homemade components in imports exceeds the foreign components in exports by enough, there will actually have been a net export of value.

While cross-border production sharing alters the way we view the trade balance and current account, it also alters the effects of exchange rate changes on the trade balance and current account. Depreciation of the home currency, for example, raises the domestic-currency price of imported final products and thus makes domestic suppliers of such products more competitive. However, if those domestic products contain imported components, then the depreciation raises costs, thereby diluting the competitive edge created by the depreciation.

Analogous considerations hold for the country's exports, the competitiveness of which rises with a currency depreciation. This advantage is diluted, however, to the extent that exports contain imported components, the prices of which rise with the depreciation. Further, if the imported products contain components which were imported by the country of origin, whose currency has appreciated, then the lower cost of components allows foreign firms to reduce the prices of their exports, thereby mitigating the anti-competitive effects of the appreciation of their currency. The net effect of an exchange rate change depends on a variety of factors, including methods of transfer pricing by multinationals, but the basic point remains, which is that cross-border sourcing and production sharing reduce the impact of exchange-rate movements on competitiveness. Hence, traditional ways of thinking about the effects of exchange rate changes give the wrong answer in a world in which offshore sourcing and cross-border production sharing are important (see Chapter 11 in this volume by Ramkishan Rajan and Reza Siregar for a detailed discussion of Singapore's exchange rate policy).

Production sharing may affect the choice of trading partner in the formation of preferential trade agreements. Traditionally, an important criterion in the choice of partners has been to provide markets for exporters, while the emergence of cross-border production sharing makes access to imports of low-cost components a key element. The traditional approach was mainly an exercise in trade liberalization, whereas cross-border production shifts the weight

toward deeper economic integration.

3.3 Components in the Trade of Singapore

Components play an important role in Singapore's overall trade. Figures 5a and 5b illustrate the case with reference to imports of automatic data processing equipment, parts and accessories. It is clear that imports of components make up a substantial share of total imports in that industry. Indeed, in its trade with the US, the value of component imports has exceeded imports of equipment in recent years. Figures 6a and 6b repeat the exercise on the export side.

Comparison of Figures 5b and 6a raises a question to which we do not have an answer, but which is important nevertheless: what is the portion of components imported into Singapore in Figure 5b that ends up in equipment exported in Figure 6a? Still more interesting, and related to automobile trade between the US and Mexico, is the (unknown) portion of components imported from the US that is incorporated into equipment which is then exported to the US. Questions arise as well about the shares of components from Japan, Malaysia and Thailand that may be embodied in equipment that is exported to the US. We do not have precise answers to these questions, but the fact, for example, that a downturn in equipment exports to the US is matched by a downturn in component imports suggests the possibility of a connection.

Finally, Figures 7a and 7b compare Singapore's exports and imports of transistors, microcircuits and related parts. As before, the two sides of the trade balance trace out very similar patterns, probably as a reflection of the global business cycle in the industry.

An important question from the perspective of competitiveness is what determines whether a microcircuit is exported or imported? The preceding discussion suggests that an item should be imported if producing it requires inputs that are relatively scarce and expensive in Singapore and exported if the opposite condition holds. Another way of expressing the "rule" is that the item should be imported if producing it at home uses up more productive resources than the resources needed to make the exports that pay for the imported item. This expression links

the rule directly to the discussion above of competitiveness and comparative advantage. What matters is the difference between the resource cost of domestic production and the resource cost of the exports involved in the exchange.

Singapore's position as an "emergent" economy, however, means that trade patterns depend on their direction along the continuum. Hence, in trade with Malaysia, Thailand and other emerging economies, we expect imported microcircuits to be relatively standardized and labor-intensive and exported microcircuits to be relatively more customized and skill-, capital- and technology-intensive. The exported items should, however, be less skill-, capital- and technology-intensive than those imported from the US and Japan.

Singapore is well positioned to be a leading producer and exporter of components whose place along the technology and skill continuum lies somewhere between the two component types involved in the first two points above. Taken together, these two points suggest that multi-component end products from Singapore may contain significant shares of foreign value-added. This can be a potential problem if Singapore allows itself to be squeezed by competition from both ends of the continuum in the direction of assembler of products which contain labor-intensive components imported from emerging economies and skill, capital-; and technology-intensive components imported from emerged economies. At given world product prices, rising shares of imported components reduce the space for domestic value-added.

3.4 Production Sharing and Factor Flows

While offshore sourcing enables firms to defend their competitiveness, it has broader implications for society at large. It may, for example, provide an alternative to cross-border labor migration. As unskilled and semi-skilled labor has become scarce and expensive in industrialized countries, immigration has often provided a solution. In Europe, large-scale guest-worker migrations have played an important role over the years and in Canada and the United States immigration continues to supply labor.

Offshore sourcing and cross-border production offer an alternative, especially where labor immigration is not a viable option for reasons of crowding and congestion. In such cases, relocation of labor-intensive production to labor-abundant countries provides a way of importing the services of workers without worker migration. This option applies not only to manufacturing, but to services, such as airline reservation centers, which do not depend on the physical presence of workers in the country that uses their services. There exist many other types of services, however, including domestic, hotel and sanitation services, which do require the physical presence of the laborer.

While production sharing with a labor-abundant country reduces the need for inflows of labor, it often gives rise to outflows of capital to finance construction of production facilities. Additional host-country investment is often needed in order to provide essential infrastructure. While private foreign direct investment plays a key role in setting up productive capacity and host governments may provide infrastructure and tax and other incentives, the role, if any, of the investing country's government is more problematic. Ireland is an interesting case in which government provided significant incentives and European Union funds helped upgrade the infrastructure.

The basic issue is whether investing-country governments should play a role beyond ensuring appropriate trade, competition, and related policies? If the government becomes an investment partner in the enterprise, for example, does it expose public resources to undue risk? Such questions are particularly relevant to the situation in Singapore, where public and quasi-public entities play more prominent roles than in many other countries. These and related issues are taken up in Chapter 5 in this volume by Christopher Findlay and Alexander Sidorenko.

4. Concluding Remarks

As an "emergent" economy, Singapore finds itself challenged by emerging economies,

on the one hand, and by emerged economies, on the other. Even its prized position as an entrepot trader is not exempt from challenges, as neighboring countries upgrade their ability to compete.

Among the new elements in international competition are production fragmentation and cross-border production sharing, made possible by trade liberalization and by cost-cutting innovations in communication and transportation technologies. Cross-border production sharing enables countries to participate in the making of a product, without having to produce all of it. If each country focuses on what it does best, all participants benefit. In this environment, countries need to think not only about improved access to markets in which to sell goods, but to markets in which to obtain inputs.

Components trade is already an important activity in Singapore, with significant shares in both exports and imports. As an “emergent” economy, Singapore faces competition from both emerging and advanced economies. In trade with emerging countries, Singapore has an edge in exporting relatively skill, technology-, and capital-intensive parts, accessories and components (PACs), while importing the more labor-intensive varieties. In trade with advanced countries, the ordering is reversed, with imported components relatively skill, technology-, and capital-intensive.

Emergent economies like Singapore face competition from both sides of the spectrum of trading partners and thus risk being squeezed in terms of value-added shares in exported end products. When products become internationalized through cross-border production networks, a country’s share of the value-added contained in such products is an indicator of sectoral or industry-specific competitiveness. As Singapore is forced to cede production of labor-intensive components to emerging economies, it must strive to wrest production of skill, technology- and capital-intensive components from advanced economies. In other words, it must move up the value-chain of component production. Failure to do so will cause Singapore’s value-added share to decline and that will be an indicator of declining competitiveness.

Annex: The Economics of Production Sharing

If a product must be produced in its entirety in a single location, then a company's or an industry's competitiveness is a weighted average of competitiveness in the various component activities. Companies learned long ago that outsourcing of parts and components can play an important role in controlling costs and safeguarding competitiveness. Until recently, however, the cost of outsourcing increased substantially when national frontiers had to be crossed. As trade barriers have come down and satellite communications and other technological innovations have reduced coordination costs, it has become easier to spread the constituent activities of production across countries. If a company, wishing to compete in a given product market is better than anybody at making every part of the product, then it should make the product in its entirety. However, if the company's cost competitiveness varies across constituent activities, then the company can improve its overall competitiveness by outsourcing activities in which competitiveness is weak.

Analytically, the effect of outsourcing is similar to that of technical progress. Technical progress lowers cost by raising the productivity of capital or labor or both. As a result, the production possibility curve shifts out, in all directions if technical progress occurs everywhere in the economy, or only in the direction marking the industry or sector in which it takes place. For small countries, facing given world commodity prices, this implies a rise in the output of that industry and an increase of employment there.

When a country ceases to produce a component in which it has a comparative disadvantage, the quantity of resources it must give up by importing the component declines relative to the quantity of resources needed to produce the component at home. This is equivalent to the resource-cost-reducing effect of technical progress. Here, too, the production possibility curve shifts out, in just one dimension if just one sector resorts to outsourcing or in multiple dimensions if many sectors engage in cross-border sourcing. And, as before, in the

small, price-taking country output and employment rise in the relevant sector(s).

This result is important, because it undercuts a key claim of the protectionist, which is that outsourcing causes industry output and employment to shrink. The intuition behind this outcome is simple: if outsourcing reduces costs and makes an industry's product more competitive in home and foreign markets, then domestic firms will be able to sell more of that product than before. Hence, although jobs making the abandoned component are lost, jobs are opened up in making the other components and in assembling the larger quantity of the final product.

The specifics of the adjustment depend on a variety of factors and conditions, but the basic intuition stands. It is the element that makes production sharing a win-win arrangement for the countries that participate in it. Under production sharing, labor-rich countries specialize in labor-intensive components and assembly, while skill, technology-, and capital-intensive countries specialize in a complementary fashion. The shift toward production sharing has effects in the relevant industries on both sides analogous to technical progress, raising output and employment. Factor rewards also rise, although the effect on factor-price ratios depends on the factor intensity of the sectors involved in cross-border production sharing.

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Endnotes

¹ See World Economic Forum (2002) pp. 126-127 for details. For a critical assessment of the methodological approach involved, see chapter 3 in this volume by Sanjaya Lall.

² Tamamura (2002) provides a detailed assessment of industrial structure, competitiveness and revealed comparative advantage (RCA) in the Asian region.

³ See the appendix for additional comments. For detailed analyses, see Arndt (1997, 1998, 2001), Deardorff (2001), and Jones and Kierzkowski (2001). For an application to economic development, see Arndt (1999).

⁴ See the appendix and Arndt (1998). For an application to U.S.-Mexico trade, see Arndt and Huemer (2001, 2002).