Trade Integration and Production Networks in Asia: The Role of China

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Abstract

This paper examines the implications of cross-border component sourcing and production networks for trade competitiveness and welfare. Offshore sourcing of components in which it has comparative disadvantage, enables a country to enhance its comparative advantage in the final product. This option provides emerging countries with an important alternative to capital accumulation and technical change as paths to economic development.

In addition, production sharing changes the nature of trade-balance accounting and tends to reduce the sensitivity of trade flows to movements in exchange rates. This has important implications for trade policy and for the choice of exchange-rate regime. In the context of regional trade areas, for example, deeper integration allowing for production sharing has welfare effects superior to those of standard preferential trade liberalization.

Keywords: cross-border sourcing; trade integration; production sharing; exchange rate elasticities.
JEL Codes: F11, F15, F32

1. Introduction

Globalization and the increasing openness of most economies has given rise to new and more complex trade patterns. Among these has been trade associated with cross-border production networks. While a large part of international trade still involves products made more or less entirely within countries, the proliferation of production networks is gradually internationalizing many commodities and services. With respect to domestic production, China's comparative advantage continues to lie in labor-intensive products. Over time, as the Chinese economy develops and accumulates physical and human capital and technological knowledge, the export mix will gradually change away from the labor-intensive end of the product spectrum in the direction of more knowledge- and capital-intensive activities, while the quality of imports will move in the opposite direction. In this process, most countries - China included - rely on inflows of foreign capital and transfers of technology to at least some extent.

In recent years, trade and investment liberalization and cost-saving breakthroughs in communication and transportation technologies have encouraged a worldwide trend away from integrated domestic production toward offshore sourcing and cross-border production sharing. This burgeoning phenomenon has received attention in the literature[1] and has come under increasing political scrutiny in the U.S. and other advanced countries, where the fear of "offshoring" has begun to encompass services as well as goods.

Cross-border production sharing offers a country like China new opportunities to compete in world markets. Instead of having to become proficient in the manufacture of entire products, Chinese firms may focus on selective parts and components for export to advanced countries for inclusion in finished products. The laws of comparative advantage continue to work here, suggesting that China should specialize in the making of relatively labor-intensive components.

When assembly is labor-intensive, cross-border production sharing and offshore sourcing enable Chinese firms to reduce costs by acquiring capital- and skill-intensive components abroad. This suggests that Chinese firms can improve their competitiveness in world markets for

final products through offshore sourcing of components in which they have efficiency disadvantages. Since a country's comparative advantage in a final product is a weighted average of its relative efficiency across constituent activities, the country can improve its overall competitive edge by obtaining the components in which it is least efficient abroad.

The availability of production networks among countries - and particularly between advanced and emerging economies - has vastly increased the opportunities for cost-efficient specialization and welfare-enhancing trade. In the presence of cross-border production networks, we would expect the emergence of trade patterns in which China imports capital- and skill-intensive components for inclusion in products to be exported to the U.S. and other countries. Hence, China's competitiveness no longer depends solely on technological skill development at home, but on the creation of network linkages to other countries.

As cross-border production linkages spread, they affect the sensitivity of trade balances to exchange-rate changes. If China exports goods made with imported components, then a revaluation of its currency raises the foreign-currency price of its exports, but it also reduces the home-currency prices of its component imports and thus the home-currency cost of its exports. The latter's effect on the foreign-currency price of its exports runs counter to the effect of the appreciation, reducing the overall effect and thus the sensitivity of both exports and imports to exchange-rate changes.

The rest of the paper develops as follows. Section 2 examines the essential features of cross-border production sharing, especially as it relates to economic development in emerging countries. Section 3 develops a three-country, partial-equilibrium model designed to illustrate the effects of cross-border component sourcing on prices and market shares. Section 4 assesses the implications of cross-border sourcing for trade-balance accounting and for the sensitivity of trade flows to movements in exchange rates. Section 5 employs a general equilibrium framework to compare the welfare effects of conventional trade liberalization and deeper economic integration including cross-border production sharing. Section 6 concludes.

2. Key Features of Production Sharing

Developing countries selling exports in the United States compete for market share not only with domestic U.S. producers, but with products from other developing countries. Thus, when the composition of one developing country's exports shifts toward more skill- and capital-intensive and away from labor-intensive products, it threatens the market position not only of certain domestic producers, but of other emerging economies.

A developing country wishing to change the composition of its exports in such a direction may attempt to do so directly by upgrading domestic capabilities or by participating in cross-border production sharing. The first option has been the dominant approach in the past. It typically relies on foreign direct investment inflows and technology transfers and on multinational enterprises to help in the transition to higher value-added products. A key feature of this approach is that it takes time.

Offshore sourcing of components in which the country suffers from significant comparative disadvantage offers an alternative. Rather than wait until the country has mastered all of the constituent activities of the production process, it focuses on mastery of a sub-set while relying on offshore sources for the rest.

If the sourcing comes from the advanced country to which the final good will be exported, makers of capital- and skill-intensive components in that country will feel two effects. To the extent that imports of the final product from the emerging economy reduce their market share, they will lose. On the other hand, they will benefit from the additional demand for exports of components. The makers of labor-intensive components and assembly will lose. An analogous situation will result if the sourcing comes from other (more advanced) emerging economies which have hitherto been exporting the product to the advanced country. Hence, if Chinese entry competes away Singapore's share in the U.S. market for a particular product, the net welfare effect experienced by Singapore will depend on the extent to which China resorts to sourcing components for that product in Singapore.

The cost-saving effects of outsourcing are illustrated in Figure 1, where the DD-curve represents domestic demand and the curve $S_o(x_1 + x_2)$ represents supply when product X is produced at home in its entirety. The product is assumed to be made up of two components, x_1 and x_2, with the former assumed to be the relatively labor-intensive component. The contribution to production costs of the first component is given by the supply curve marked $S_1(x_1)$. In the initial equilibrium, the country produces ac units, of which ab units are consumed at home and bc units are exported at the exogenous world price P_w.

Suppose that the country decides to replace domestically produced units of the second component with lower-cost imports. The result is to shift the supply curve to $S_2(x_1 + x_2^*)$, where x_2^* represents imports of the second, relatively capital- and skill-intensive component. Domestic production increases to point d, with all of the additional output going into exports.

The total value of X-production (adq"O) now consists of two types of value-added, one domestic and one foreign. The value of domestic production is heq"O, while the level of imported value-added is equal to adeh.. The change in the value of domestic production is thus equal to the difference between areas feq"q' and acfh. It is clear that the net change can be positive or negative. Thus, the values of final output and of exports may both rise, while domestic value added falls.

The employment effects may be similarly ambiguous. The area feq"q' represents additional domestic production (of the first component) and assembly and thus creates employment, while area acfh is implicit of jobs lost in the production of the second component. To the extent that production of the first component and assembly are relatively labor-intensive than production of the second component, there will be net job creation.

These are the results for a country which takes the world price as given. A large country, on the other hand, will cause the world price to fall when it supplies additional quantities of the product on world markets. A decline in the world price will move the output equilibrium down along supply curve S_1, reducing both the quantity and value of X-output. Furthermore, a large

country is likely to drive up the world price of the imported component, x_2*, causing supply curve S_2 to shift to the left. This, too, reduces the level and value of X-output.

As noted above, offshore sourcing of components is an alternative to the more traditional approach to moving up the value chain by mastering production of entire products. In the traditional case, the process is to shift the S_1 down and out by means of technological improvements and accumulation of physical and human capital. In general, countries will want to achieve an optimal mix of the two strategies. In recent years, reductions in protectionism and improvements in transportation and communication technologies have shifted the balance in favor of offshore sourcing and production sharing.

3. A Three-Country Perspective on Competition with Outsourcing

In Figure 2, domestic demand and supply conditions in two emerging economies (countries A and B) are depicted in the second and third panels, respectively. It is assumed that country A (say, a relatively advanced emerging economy) holds a competitive edge in world markets for good X over country B. Indeed, at the initial world price of X, P_w, country B neither exports nor imports the commodity.

The left panel of the figure represents net export supply and net import demand in the "world" market. The world price is established at the intersection of the two curves. Initially, net export supply (ES_A) is simply the difference between domestic demand and supply in country A. Net import demand (ID_{ROW}) is the difference between domestic demand and supply summed across all importing countries.

Now suppose that country B (say, China) succeeds in reducing domestic production costs, which shifts the domestic supply curve to S_B'. As we saw above, cost savings may be obtained either through technological improvements at home or through cross-border sourcing of capital-, skill-, and technology-intensive components of good X. We suppose here that the cost savings are achieved through offshore procurement of the second component. Country B is now

able to enter the world market for X. A small country would be able to sell its exports at the original world price. When a large country like China enters the market, the world price falls.

China's entry generates a new world export supply curve (ES_{A+B}), made up of the excess supplies of countries A and B. The new world price, P_w', is established at the intersection of this new world supply curve and the world import demand curve.

The reduction in the world price causes country B to offer a smaller quantity of exports than it would have at the original price. In country A, the fall in price forces a reduction in both production and exports of X. In the rest of the world, made up of consuming countries, imports of X rise. Producers in B and consumers in all parts of the world benefit from the entry of country B into the world market. Producers in country A and in the rest of the world lose.

Producers in country B (and in the rest of the world) may defend themselves against this new competition by implementing cost-reducing methods and/or by resorting to cross-border sourcing of the labor-intensive component, x_1. Suppose that such efforts generate a new supply curve in country A, namely, $S_A(x_1^* + x_2)$, where the first term in parentheses denotes imported components. This results in an outward shift of the world export supply curve to ES_{A+B}', the intersection of which with the unchanged world import demand curve generates the new world price of P_w".

This change enables country A to recapture some of the market share lost earlier to country B. Following this latest change, country B's exports clearly decline. The reduction in the world price brings further welfare gains to consumers in all three regions, but imposes welfare losses on producers in the importing countries.

It is worth noting that countries A and B outsource different components, with the former importing the labor-intensive component, while the latter imports the capital-intensive component. They may even exchange those components with each other. This type of trading network may become increasingly important in Asia, with latecomers among emerging economies importing relatively more sophisticated components from more advanced emerging

countries (and still more sophisticated, skill- and technology-intensive components from advanced countries), while exporting relatively labor-intensive components.

In the example at hand, assembly of product X takes place in both countries A and B. It is possible, however, for assembly to become the "outsourced" activity. When assembly is strongly labor-intensive, country A may be better off by "outsourcing" assembly to country B. In that case, country A will produce only the skill-intensive component, x_2, of product X. The entire domestic production of this component will be exported to country B, where it will be combined with the second component into the final product, which will then be exported to country A and the rest of the world.

For goods which require more skill-intensive assembly, country A would possess the competitive edge, so that country B would cease to produce the final product at home. It would limit its role to producing the labor-intensive component, exporting it to country A for assembly, and then importing the final product.

In both of these examples, imported final products can contain significant amounts of domestic value-added. This has important implications for measuring trade balances and for assessing the sensitivity of imports and exports to exchange-rate changes. We examine these issues below.

4. Cross-border Sourcing and Trade Balance Accounting

In the presence of offshore procurement of components, it is important to know the ultimate use of components. If they go into products destined for domestic use, standard procedures of balance-of-payments accounting continue to apply fully. But when imported components end up inside exported products or when exported components return inside imports of final or higher-stage goods, standard accounting may be misleading.

A ready example is the popular concern with import surges, which often leads policy makers to invoke protection based on safeguard provisions. Without information on the underlying causes of such surges, their implications cannot be properly assessed. There is a

difference between a surge in imports of the traditional kind and a surge in imports which contain large amounts of previously exported domestic value-added or a surge in imports destined to go into exported final products. The first type is easily recognized as conforming with the traditional notion of competitive threats that displace domestic output and employment. The second and third are beneficial to the extent that they are accompanied by surges in exports. These nuances will require increased sophistication on the part of officials and politicians in the formulation of trade policies.

As production sharing becomes more common and widespread, it is necessary to examine both gross and net changes in exports in order to identify the role and extent of imported foreign value added. Similarly, the growing tendency for imported end products to contain exported components, drives a wedge between the gross and net values of imports. The need to distinguish between imports and imported value-added and exports and exported value-added becomes more important. U.S. imports of motor vehicles from Mexico, for example, embody significant shares of components made in the U.S. Similarly, airplanes exported by Boeing and Airbus contain significant shares of components made abroad.

These considerations are relevant to the contemporary debate over valuation of the Chinese currency and over the likely effects of a revaluation of the yuan. Many U.S. advocates of revaluation against the dollar make the assumption that a higher value of the Chinese currency would raise China's demand for U.S. exports and reduce U.S. demand for Chinese imports. All this, because it is expected to raise the dollar prices of Chinese goods and reduce the yuan prices of U.S. goods.

There is a well-developed literature, including the literature on pass-through, which explores the conditions under which this expectation will be satisfied in the absence of production sharing.[2] Cross-border production sharing adds a further criterion that needs to be kept in mind. Whether the dollar prices of Chinese exports rise when the dollar price of the Chinese currency rises depends on whether and on the extent to which the Chinese currency

appreciates against the currencies of countries from which China obtains components for inclusion into end products exported to the U.S.

In the example of Figure 2, China is assumed to be country B and prices along all three vertical axes are measured in dollars. Suppose that curve S'_B represents an initial situation in which China produces good X in its entirety. In that case, a yuan revaluation will shift the curve up and to the left, causing the relevant net export supply curve to shift back in the left panel and raising the world price of good X. This would clearly result in reducing world imports of X.

If China engages in cross-border sourcing of component x_2 from country A and if the Chinese currency appreciates against country A's currency, as well as the dollar, then there will be two effects working in opposite directions. The revaluation against the dollar will, as before, raise the dollar price of product X and thus shift curve S_B' up and to the left, while the revaluation against country A's currency will reduce the yuan price of imported component (x_2) and thus shift the curve down and to the right. The more important is component x_2 in product X, the smaller the increase in the dollar price of the product as a result of the revaluation.[3]

It is interesting to recall that, traditionally, revaluation of the yuan would be expected by China's competitors in Asia and elsewhere to confer a competitive advantage upon them. In the presence of offshore component sourcing, on the other hand, that edge will be weaker.

An analogous argument applies to the predicted surge in U.S. exports to China following a yuan revaluation. If China imports cotton and textiles from the United States for use in apparel exports to the U.S., then the reduced materials cost due to revaluation may serve to reduce the yuan price of exported apparel, thereby mitigating the tendency for the revaluation to increase the dollar price of Chinese apparel.[4]

Production Sharing and Trade Elasticities

The discussion of the preceding section suggests that the sensitivity of trade flows to movements in exchange rates will tend to decline as the share of trade related to production sharing rises. It is empirically not always easy to identify the various elements contained in any

given trade series, but such evidence has been found for trade between the United States and Mexico in the automobile sector.[5] Specifically, the discussion of the last section suggests the following hypothesis, namely, that U.S. imports of motor vehicles from Mexico and U.S. exports of vehicle parts to Mexico should be less sensitive to movements in the bilateral exchange rate than exports and imports of manufactures generally and of non-manufactures such as agricultural products.

The declining sensitivity of trade flows to exchange-rate changes has important implications for the choice of exchange-rate regime. To the extent that the supposedly damaging effects of exchange-rate volatility on trade have been used as an argument against floating rates, any decline in the sensitivity of trade flows to the exchange rate reduces the importance of that criticism and constitutes an argument for floating rates.

On the other hand, to the extent that exchange-rate adjustments have been touted as an important part of the adjustment mechanism (buffer), any decline in the system's responsiveness to exchange rates reduces the potency of that claim, weakening the case for floating and strengthening the case for fixed rates.

5. Regional Trade Integration and Production Sharing

The foregoing has examined certain effects of component sourcing in a trade environment that was essentially undistorted by trade policies. It has been shown that production sharing raises welfare under such conditions, because it allows the laws of comparative advantage to be extended to trade in components. It has also been shown that the welfare consequences are ambiguous in an environment characterized by MFN tariffs.[6]

It is possible, however, for the spread of production networks to take place in the context of preferential trade liberalization. In what follows we consider two types of preferential trade liberalization. The first is the standard preferential trade area (PTA) of the literature in which liberalization is confined to the reduction or elimination of border restrictions like tariffs and quotas. The second is a deeper, more advanced form of integration which lifts restrictions on

foreign direct investment, right of establishment, and movement of persons and thus provides the environment for production sharing. We call this more advanced type of liberalization an integrated economic area (IEA).

Although preferential trade liberalization has been proceeding at an increasing pace in recent years, such agreements are not necessarily net trade-creating in their effects. Such a judgment would apply to many of the recent bilaterals, especially if they discriminate heavily against third countries. Preferential arrangements are, however, more likely to lead to trade creation if they embrace the deeper and more extensive liberalization of the integrated economic area (IEA).

The differences between the welfare effects of the two types can be illustrated with the aid of Figure 3. In the figure, the initial equilibrium is found at points Q_o and C_o. The situation depicted is one in which the country in question imposes a most-favored-nation tariff (MFN) on imports of good X. The difference between the domestic relative price, P_d, and the world price, P_w, represents the magnitude of the tariff.

When the country enters into a preferential trade arrangement (PTA) with a partner who is assumed not to be the low-cost producer of good X, the intra-PTA relative price is assumed to move to P_{pta}, which is lower than the initial tariff-inclusive domestic price, but higher than the world price. Domestic production moves to Q_1, domestic consumption to C_1, and imports increase. As drawn, the PTA is a welfare-reducing, net trade-diverting arrangement, as seen in the move of the consumption point to a lower community indifference curve.

Suppose that, instead of a narrow PTA, the two countries commit themselves to deeper integration which allows for the free flow of investment, joint ventures, and joint ownership, and which gives free rein to the operation of foreign affiliates and foreign persons within the country. Suppose further that production sharing is introduced in the country's import sector, so that the country imports the skill-intensive component from its partner. As has been shown in the studies cited above, the effect of this change is equivalent to technological improvement in the X-sector and has the result of shifting out the production possibility curve along the X-axis to point T.'

If the country is small relative to its trading partner, this adjustment will have no effect on the intra-area relative price. Production and consumption will move to points Q_2 and C_2, respectively, and the country will be better off than without production sharing, but not as well off as it was under the MFN tariff. If the country is large, the rise in X-production relative to the level of the PTA will put downward pressure on the price of X, rotating the price line to, say, P_{ea}. The price change moves production to point Q_3 and consumption to C_3. The result represents further welfare improvement.

The key conclusion is that as China and its Asian neighbors pursue various alternatives to economic integration in the region, trade liberalization narrowly defined may offer fewer opportunities for welfare improvements than deeper forms of integration, especially of the kind that allow specialization to be pushed beyond the level of products to that of parts and components.

Conclusion

The focus in this paper has been on the effects of cross-border component sourcing and production sharing on trade and welfare. Such arrangements offer emerging economies an additional means of developing their manufacturing (and service) sectors and competing in the world market. The organizing principle is still the notion of comparative advantage, except that it is extended from end products to the component activities of production.

Component trade implies that a country's exports will contain imported value-added, while its imports may contain domestic value-added. Under these conditions, trade-balance accounting needs to make due allowance for these cross flows and policy makers need to adjust their response to changes in trade flows. As the share of trade related to production sharing rises on the side of both exports and imports, the sensitivity of trade flows to movements in exchange rates is expected to decline. This is seen as having potentially important implications for the choice of exchange-rate regime.

The policies and conditions required to facilitate production sharing are typically more demanding than traditional trade liberalization, whether most-favored-nation or preferential. They apply greater openness and deeper integration with trading partners. We have seen that production sharing can play a key role in determining whether regional trade agreements are welfare-increasing or -reducing. The deeper integration represented by an agreement which allows for cross-border production sharing is shown to be welfare-improving.

Endnotes

1. See, for example, Arndt (1997, 1998), Deardorff (2001), Feenstra (1998), Jones and Kierzkowski (2001), and Kohler (2001).

2. See, for example, Knetter (1993).

3. Of course, all the well-known forces - including pricing to market - will also be at work and therefore affect the final outcome.

4. We take for granted the well-known argument that the overall U.S. current account deficit reflects macroeconomic imbalances in the U.S. economy and cannot be eliminated by changes in the rate of exchange with a single country. The current debate on revaluation of the yuan is reminiscent of discussions concerning the supposed undervaluation of the Japanese in an earlier period.

5. See Arndt and Huemer (2004) for details.

6. See the studies cited in footnote 1.

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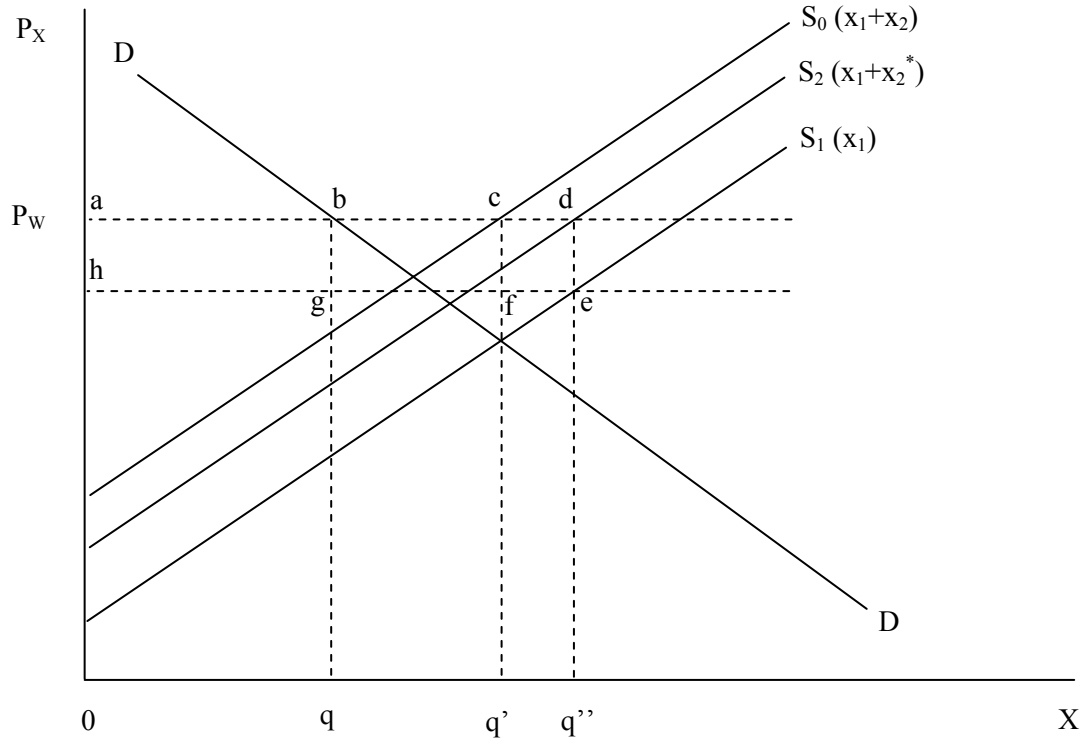

Figure 1

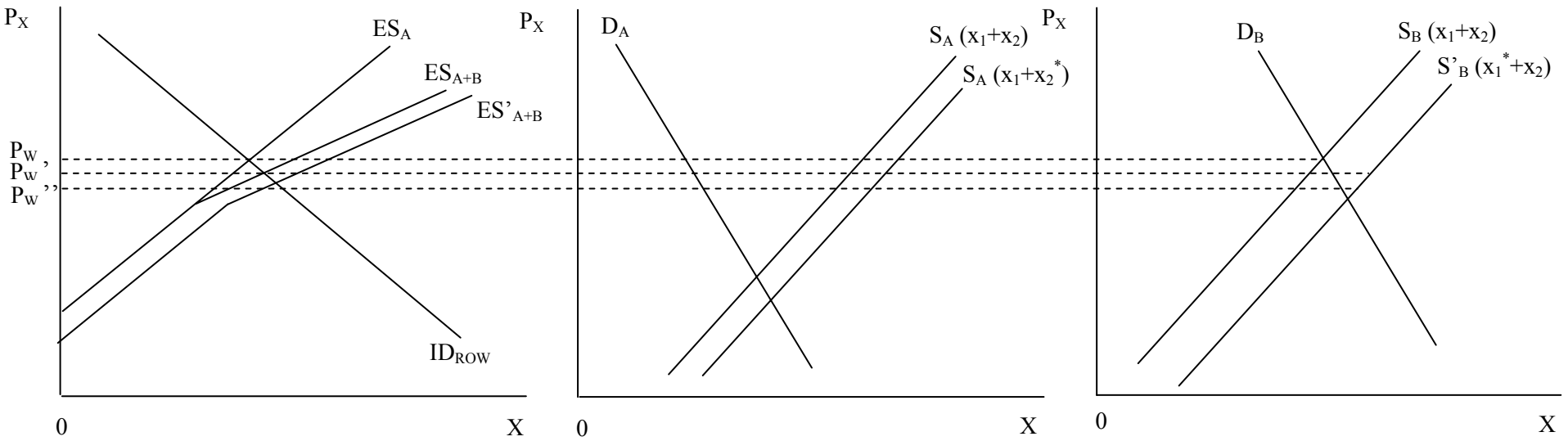
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Figure 2

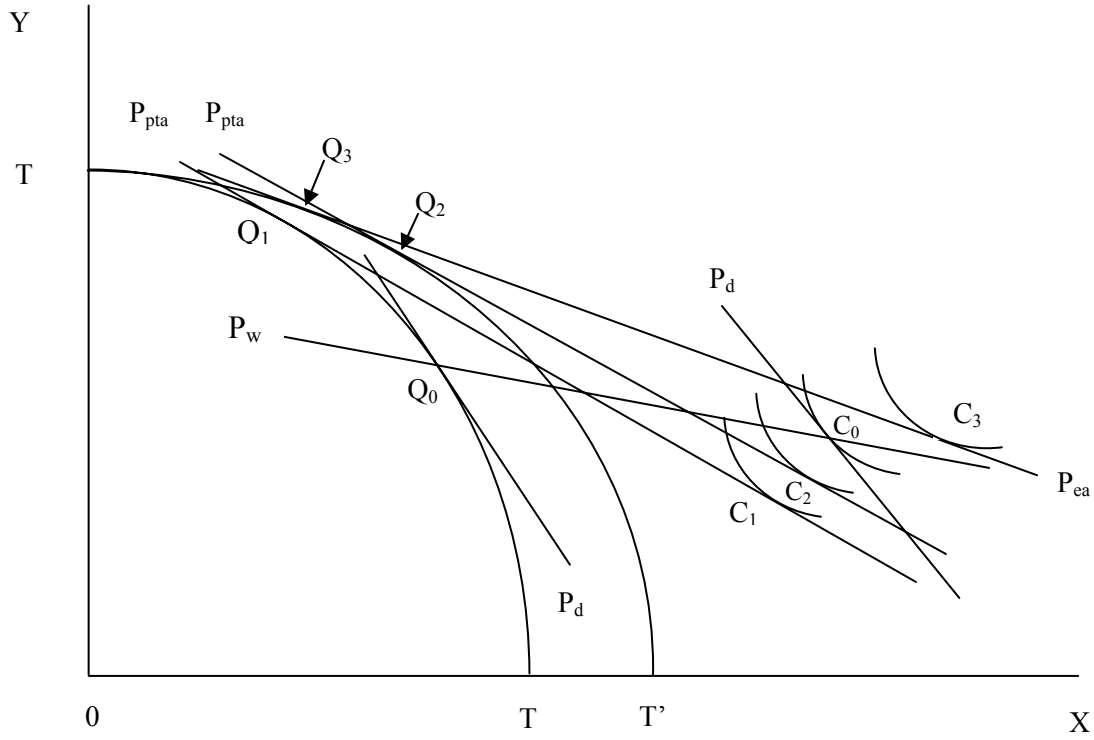

Figure 3