

## Comments

### Professor Jones' Re-appraisal of Heckscher-Ohlin Trade Flows

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*Jones (2008) questions Leontief's procedure to test if a country's trade pattern is according to the Heckscher-Ohlin theory of factor abundance. In a Heckscher-Ohlin framework he shows that the country with the higher capital/labor endowment ratio may export a relatively labor-intensive commodity whereas its import-competing sector is more capital-intensive. In this paper I argue that imports which drive domestic producers out of the market should enter the calculation. This observation is shown to resurrect Leontief's procedure. Finally, I shed some light on his paradox that American exports are more labor intensive than its imports.*

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In the paper that inaugurated Trade and Development Review, Jones (2008) discusses the famous Leontief paradox. Leontief (1953) found that the American exports were produced by more labor-intensive techniques than those used in American production activities that competed with imports. This finding contradicted the Heckscher-Ohlin Theorem, according to which a country exports products which are intensive in the relatively abundant resource. The United States is well endowed with capital rather than labor. The paradox proved a fountain of articles, both theoretical and empirical. The theoretical ones, including earlier ones by Jones, pointed out that there are conditions which violate the Heckscher-Ohlin Theorem assumptions. The two such conditions Jones mentions are factor-intensity reversal and demand asymmetry. The amazing

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feature of Jones' present paper is that he seems to reconcile Leontief's finding with Heckscher-Ohlin theory without invoking these peculiarities. In his own words (Jones 2008, p. 4), "Here I have explicitly avoided that technological reversal phenomenon" and "Here demand conditions could be the same between countries and balanced among commodities (say equal shares in a Cobb-Douglas setting)."

Jones illustrates his point with a pair of countries producing four commodities. As the factor endowment ratio of a country changes--say towards relatively more capital--it switches to the production of a more capital intensive product. At the switch any weighted combination of the two products is possible. Ordering products by increasing capital/labor intensity, he considers a pair of countries where the country with the lowest capital/labor endowment ratio ("Home," think of India) switches from product 1 to product 2 and the other country ("Foreign,") switches from product 3 to product 4. The locations of either country on the switch (the shares of the two products) are determined by demand and the endowments and are manipulable indeed. Jones (2008) assumes this is fixed such that Home is near the end of the switch between products 1 and 2, producing much of 2, exporting it, but little of 1, importing it to meet domestic demand. Similarly, he assumes Foreign is at the beginning of the switch between products 3 and 4, exporting 3 and importing 4. In technical language the two countries are in different "cones of diversification" and that is a known upsetter of the Heckscher-Ohlin Theorem.

Jones rightly observes that in Foreign (think of the U.S.) the exports sector (which produces commodity 3) is labor intensive relative to the import-competing sector (which produces commodity 4). This would resolve the Leontief paradox in a non-anomalous two-country framework with a common technology (reversal-free), but different factor endowment properties. Or, to put it more sharply, it "invalidates" the Leontief procedure.

I doubt it. More precisely, I question if the representation of Leontief's procedure is accurate. In other words, would Leontief compare the factor contents of exports to the factor contents of competing imports? A case in point is that Leontief (1953) calculated the factor contents of American imports using U.S. input-output coefficients. The latter are known only if the imports are produced domestically as well, i.e. are competing imports. The crucial distinction between competing and noncompeting imports, however, is not that noncompeting imports are not produced domestically, but cannot be produced domestically. In Jones' model technology is common to the different countries and, therefore, any import is competitive import. Some commodities may not be produced domestically, but that is because it would incur a loss. Moreover, even in this case it is very well possible to calculate the factor contents of such imports, at least under constant returns to scale, namely at the optimal point where the marginal

rate of substitution equals the factor price ratio. It seems to me that correct application of the Leontief procedure would include the factor contents of all imports.

This correction unravels Jones' finding that the country endowed with relatively more capital may export relatively labor intensive products. My point is made forcefully if the (universal) technology is a Leontief technology, i.e. with fixed input-output coefficients. Then factor contents calculations do not depend on the country and the four commodities can be represented as packages of labor and capital, of which the quantities are determined by the product of the direct factor input coefficients and the Leontief inverse of the matrix of intermediate input coefficients. Now Jones (2008) assumption of demand symmetry equalizes the commodity proportions of consumption between the countries and, therefore, the factor proportions of consumption. By the material balance these common factor proportions must be equal to the proportions of the total or world endowments of labor and capital. It follows that the country with the low capital/labor endowment, Home, has a consumption package with a greater capital/labor intensity (than its endowment) and vice versa for Foreign. Now the calculation that consumption equals output (net of intermediate demand) minus net exports is true not only in terms of commodities, but also in terms of labor and capital contents. Since Home's output "package" is equal to its endowment package--which is more labor intensive than the world endowments--it must be that its net exports are also more labor intensive. The final point is to conclude that its exports are more labor intensive than its imports. Leontief was not explicit about this theoretical step and Leamer (1980) made a big fuss of this, but the conclusion remains valid if there is no trade deficit.

If technology is not Leontief, some extra work has to be done. Even though technology is assumed to be the same in Home and Foreign, the factor contents can now be different, since the countries may substitute factor inputs to accommodate their endowments. However, under the assumption that capital/labor ratios of the different commodities do not overlap (the aforementioned ordering of commodities is uniform with respect to factor input prices) Jones (1956) has shown that there is a uniform ordering of commodities in terms of relative production costs, in the sense that if Home's price of a product is lower than of Foreign's, the same will be true for the more labor intensive products. There can be no reversals and the result that Home's exports are relatively labor intensive--proved for fixed input-output coefficients--stands firm.

Jones not only shows that the better capital endowed country may have an exports sector which is more labor intensive than the import-competing sector, but also the export sector cycles relative to its import-competing sector, as a country's relative capital endowment rises. I find this intriguing. However, this is not true relative to total imports.

There have been numerous attempts to solve Leontief's paradox. I mentioned the role of the balance of payments and now the focus is on the different cones of diversification. When I was his research assistant, I asked Wassily Leontief what he thought explained his result that American exports are relatively labor intensive. He replied that in the U.S. it takes one worker to operate a tractor. In India, he said with a twinkle, in his eyes, it takes two workers, one drive and one to chat. (This conversation was before the liberalization of the Indian economy was in full swing.) In his view, the Achilles heel of Heckscher-Ohlin theory is its assumption of a common technology. This assumption can be dropped, by adjusting a reference technology, the U.S. (Trefler, 1993), or by working directly with independent input-output tables. Factor abundance remains a source of comparative advantage--that can be assessed using Leontief's procedure--along with the other sources, namely asymmetries in technologies and demand (ten Raa and Mohnen, 2001).

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