Real Wages and Trade: Insights from Extreme Examples

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The effect of international trade on wage rates within a country has been the object of much scrutiny in journal articles, conferences, as well as the wider media. The classic theoretical observation dates back to the 1941 article by Wolfgang Stolper and Paul Samuelson wherein the effects of commercial policy or of more open trade on real wage rates was seen to depend only upon the factor intensity ranking of a nation's import-competing product with its exportables. Their theorem presupposed that productive factors had the same high degree of ability to relocate from one industrial activity to another. However, labor is often thought of as different from other productive factors, in being more mobile between sectors compared with capital or natural resources, and modeling of such an asymmetry leads naturally to the specific-factors model (Ronald Jones, 1971, Samuelson, 1971). In this context a quarter century ago Roy Ruffin and Jones (1977) argued that there was a *presumption* that international trade would lead to real wage gains for labor, regardless of the pattern of trade. James Melvin and Robert Waschik (2001) recently questioned this result; they provided a computer-generated example wherein labor would suffer real wage losses with any kind of international trade. In response, Jones and Ruffin (2003) probed more deeply into the properties of specific-

* The ordering of author names has been selected in order to avoid confusion with the referenced paper, Jones and Ruffin (2003), which order was itself chosen to avoid confusion with Ruffin and Jones (1977). Both authors claim equal input of the other author in all these papers, regardless of any signal sent by the alphabet.

factors models to emphasize that asymmetries between sectors in labor intensity as well as in the flexibility of technology were crucial in determining how real wages would fare when international trade brought about changes in commodity prices. Furthermore, they showed how the Melvin/Washik challenge properly reveals how such asymmetry depends endogenously on the degree of factor substitutability in both sectors.

Simple examples often do much to reveal the essence of an argument without the need to follow the more elaborate reasoning required for the general case. This remark, we would argue, has relevance for the effect of trade on real wages. In this article we show how the extreme cases concerning production structure can exhibit many of the results of more elaborate reasoning. In particular, we consider cases either in which there is no possibility of factor substitution in either sector (the Leontief case of fixed coefficients), or in which each factor can independently produce commodities on its own (we call this the "Ricardian" case). As well, we investigate the case in which one sector is Leontief and the other is Ricardian.

1. The Similarity in Production Possibilities

It proves convenient to begin by contrasting the production possibilities schedule appropriate to each of these extreme cases. Technology (in both cases) is linear homogeneous and we suppose that in each of two sectors capital, K_i, is specific to that sector whereas labor, L, is mobile between sectors.

The Leontief case is probably the more familiar of the two, with its right-angled isoquants illustrating that labor and capital must co-operate with each other in rigid

proportions. Letting a_{ij} indicate input-output coefficients, the representation of production functions is shown by (1):

(1) $X_i = \text{Min}\{L_i/a_{Li}, K_i/a_{Ki}\}$

We assume that there is sufficient labor that either one or the other type of capital could be fully employed, but not enough labor to allow both types of capital to earn positive rents simultaneously. These assumptions are captured in the three constraint lines in Figure 1 as well as in the solid inner broken-line transformation schedule that disallows over-full employment of any of the three factors. The slope of the *AB* middle section is minus $a_{L1}/a_{L2.}$ Only along this section (including end points *A* and *B*) will the entire labor force be employed (and labor receive a positive wage rate). Letting p_1 denote the price of the first commodity, with commodity *2* always serving as numeraire, consider the end points, *A* and *B*. For positive values of p_1 smaller than the ratio a_{L1}/a_{L2}, the country produces at point *A*, with type-2 capital receiving a positive rental. Type-1 capital, by contrast, is not fully employed at this point and receives no rent. Thus all revenue received in sector 1 accrues to labor so that the nominal wage rate is shown by p_1/a_{L1}. If, instead, the price of the first commodity should exceed a_{L1}/a_{L2}, production would take place at point *B*. Now it is type-2 capital that suffers unemployment (and a zero rent), while labor and type-1 capital are fully employed. In the second sector labor receives all the revenue, so that the nominal wage rate, *w*, would stay equal to $1/a_{L2}$ even as p_1 increases. That is, increases in the price of the first commodity when production is at *A* get captured entirely by workers, while at *B* further increases in the price of the first commodity go only into increasing the rents earned by type-1 capital. The determination of the wage rate in the Leontief case can be summarized by equation (2):

(2) $w = \text{Min } \{p_1/a_{L1}, p_2/a_{L2}\}$

Intuition is aided by the fact that one of the specific capitals must always be unemployed, receiving zero rent, so that the wage rate is determined by the price in that sector, which is the sector with the lower p_i/a_{Li}.[1]

Figure 2 displays the comparable transformation schedule for the Ricardian case in which each factor can, on its own, produce a commodity – labor can produce either, but capital of each type can only produce that specific commodity. Thus the production functions are shown by equation (3):

(3) $X_i = L_i/a_{Li} + K_i/a_{Ki}$

In Figure 2 an origin for labor, 0_L, has been positioned at the intersection of the two capital constraint lines. The labor constraint line has been measured from this origin since factor outputs are additive. As a consequence, the production-possibilities schedule for the Ricardian case has a somewhat similar three-part shape as that in the Leontief case! The slope of the middle section is again given by the ratio of labor input coefficients, $- a_{L1}/a_{L2}$. But if the (relative) price of the first commodity is lower than this ratio, so that production takes place at point *A*, each type of capital is fully employed and earns rentals, while the entire labor force is engaged in producing the second commodity. As a consequence, any increase in the price of the first commodity that keeps production at *A* does nothing for the nominal wage rate and therefore accrues only in the form of greater rents for type-1 capital. By contrast, if p_1 exceeds the crucial ratio, a_{L1}/a_{L2}, the entire labor force is devoted to the production of the first commodity so that now the

[1] Consider the typical back-to-back diagram for determining the wage rate in the specific-factors model. In each sector the demand for labor curve would be horizontal at the level p_i/a_{li} up to the point at which all the specific capital gets employed. It falls vertically after that. Equilibrium wages are at the level at which the vertical section of the commodity with the relatively high price intersects the horizontal section of the commodity whose relative price is lower than a_{L1}/a_{L2}.

nominal wage is p_1/a_{L1} and any further rise in p_1 would raise the wage rate by the same relative amount. (Of course the rentals on type-1 capital also rise by this same relative amount, and the return to type-2 capital would remain the same.) In the event that the relative commodity price ratio matches the slope of the labor constraint line, labor can be used in both sectors. In general for this case:

(4) $w = \text{Max } \{p_1/a_{L1}, p_2/a_{L2}\}$

Each commodity can be produced by labor alone, so that labor simply moves to the sector with the higher valued marginal product. In the Ricardian case factor prices are determined uniquely by commodity prices, independently of factor endowments because each factor can, on its own, produce a commodity regardless of other factor supplies.[2]

The production-possibilities locus in the mixed case illustrated in Figure 3 has technology in sector 1 of the Ricardian type, while that in sector 2 is Leontief. Thus production of the second commodity is capped by the amount K_2/a_{K2}, just as in Figure 1, while that in the first sector would reach a maximum at point *B* (when the relative price of the first commodity exceeds a_{L1}/a_{L2}) shown by the sum of K_1/a_{K1} and L/a_{L1}, just as in Figure 2. For low prices of the first commodity that lock production at point *A*, small increases in p_1 now raise the wage rate by the same proportional amount since some labor does produce the first commodity (on its own). This stands in contrast to the position of labor at point *A* in Figure 2. Note also that such a rise in p_1 that keeps production at *A* must serve to reduce rentals to type-2 capital since the wage rate increases and commodity 2's price is fixed (good 2 being the numeraire). When the price of the first commodity increases sufficiently that point *B* is the production point, all labor produces

[2] Ruffin (1988) examines the Heckscher-Ohlin model under this "Ricardian" technology and finds this same property of universal factor price dependence only upon commodity prices.

the first commodity and, just as in Figure 2, the wage rate rises in proportion to p_1. Indeed, labor *always* benefits by an increase in commodity 1's relative price since the wage rate always equals p_1/a_{L1}. Wages are determined in the sector with the more flexible technology.

2. Real Wages and Trade

In the general treatment found in Jones and Ruffin (2003) emphasis is placed on what we call the "Beta" function, where β_1 represents the relative increase in the nominal wage rate given a one percent increase in the price of the first commodity (with the price of the second commodity remaining constant). In the earlier Stolper/Samuelson model the value of β_1 would exceed unity if the first commodity is labor intensive, and be negative if it is capital intensive. In our specific-factors setting the value of β_1 must lie in the interval from zero to one. If it is a proper fraction there emerges the possibility of a *neo-classical ambiguity* as to the effect of price changes on the *real wage*, since if p_1 should increase, the rise in the cost of living for laborers might exceed the increase in the nominal wage rate if commodity 1 looms especially large in labor's expenditures. As we shall see, this possibility disappears in our examples as long as labor consumes both commodities. Nonetheless it is convenient in our subsequent diagrams and discussions to adopt the constraints on labor's consumption habits that we used in Jones and Ruffin (2003). In particular, we assumed that labor shared a homothetic taste pattern with other members of the community and, in our diagrammatic treatment, everyone's tastes were captured by a Cobb-Douglas utility function.

We start once again with the Leontief case, pictured in Figure 4. In the top diagram , Figure 4(a), the horizontal axis measures the first commodity's relative price, while the vertical axis measures three magnitudes: (i) the share in national income of the production of the first commodity, θ_1. This share rises monotonically with price, with a vertical section along the downward-sloping flat of the transformation schedule[3]; (ii) the share in labor's consumption of the first commodity, δ_1, and (iii) the percentage increase in the nominal wage rate of a one percent increase in the price of the first commodity, β_1. Note that three alternative $\delta_1(.)$ loci have been drawn. Each is horizontal, reflective of the Cobb-Douglas utility function assumption. The $\delta_1(3)$ line illustrates a taste pattern that would lead the economy in autarky to be producing somewhere along the flat *AB* portion of the transformation schedule shown in Figure 1. Autarky is always shown at the intersection of a δ_1 consumption share line and the θ_1 production share curve in Figure 4(a). If tastes strongly favored the first commodity instead, as reflected in the $\delta_1(1)$ line, in autarky production and consumption would be found at point *B* in Figure 1, with an autarky price, $p_1^A(1)$, such that the rental on type-1 capital now becomes positive. Alternatively, point *A* in Figure 1 becomes the production and consumption point, with $p_1^A(2)$ the autarky price, if tastes are heavily biased towards the second commodity, shown by the horizontal $\delta_1(2)$ line.

The β_1-function in Figure 4(a) takes an extreme "downward step" form. Recall that for any price of the first commodity lower than a_{L1}/a_{L2}, type-1 capital is not fully employed, so that all revenue earned in the first sector goes to labor. As a consequence, should the price of the first commodity increase in this range, all the gains accrue to

[3] As p_1 rises, the θ_1 share increases, but not as much, relatively, as does p_1.

workers; until the price of the first commodity reaches a_{L1}/a_{L2}, the value for β_1 is unity. However, it plunges to zero for any higher value of p_1, since now the wage rate is trapped at the level set in the second industry by the fixed price of numeraire industry 2 with zero rentals on type-2 capital. As the price of the first commodity rises in this higher range, all gains get collected by the specific factor, K_1.

The bottom diagram, Figure 4(b), plots the fate of the *real wage* along the ω_1-curve at various prices for the first commodity. In the lower range of these prices β_1 is unity, so that a price increase raises the nominal wage rate by a greater relative amount than the increase in the cost of living to workers. For prices above the crucial a_{L1}/a_{L2} level the value of β_1 is zero, so that the real wage must decline for increases in p_1. There is no "neo-classical ambiguity" about the effect of price changes on the *real* wage. Of course there is a different ω_1-curve for each of the consumption patterns shown in Figure 4(a), but since each reaches a peak at the same $p_1^A(3)$ price level and rises to this point and falls below it for higher prices, we have simplified by drawing in only one ω_1-curve.

So far nothing has been said about international trade. In this section the scenario we have in mind is that this is a country that initially has been isolated from trade and then opens up with free trade to the rest of the world, where relative prices there have been dictated by technology, tastes, and factor endowments unrelated to those in this country. Consider, first, the case in which tastes at home are depicted by the $\delta_1(3)$-line in Figure 4(a), with initial autarky price at $p_1^A(3) = a_{L1}/a_{L2}$. This is the case that reveals the possibility emphasized by Melvin and Waschik (2001)[4], *viz.*, labor loses by *any* trade,

[4] The case in Melvin and Waschik (2001) has elasticities of substitution equal to 0.4 in each sector. In Jones and Ruffin (2003) that corresponds to a downward-sloping β_1-function. Here we have illustrated the extreme case in which substitution elasticities in production are even lower, zero.

regardless of the pattern. Real wages are at a peak in autarky, and trading contact with the rest of the world must depress real wages. Note how this result corresponds with what might be expected because of the factor intensity ranking of exportables and import-competing goods. As already described, in the lower range of prices for the first commodity type-1 capital is unemployed and receives zero rents. Therefore labor's distributive share in the first sector, θ_{L1}, is unity. That is, the first commodity is labor intensive in this range. However, the intensity ranking switches over for p_1 in the higher range since there it is the second commodity in which capital is unemployed so that θ_{L2} is unity. If the world price of the first commodity is higher than in autarky, the country exports the first commodity, which is capital intensive, and this depresses the real wage. By contrast, if the world price of the first commodity is lower than in autarky, this country imports the first commodity, which is now labor intensive, which once again spells trouble for labor, which suffers from a fall in nominal wage rates exceeding that in the cost of living. The country *always* imports its labor-intensive commodity and labor *always* suffers from trade.

Figure 4(a), however, has illustrated two other alternative taste patterns for labor, and in these the possible effects of trade on real wages are not so grim. If tastes are described by the $\delta_1(1)$ line, the home country has a relatively high price for the first commodity in autarky. If the world price is even higher, real wages would be depressed by trade since the home country would export the (capital-intensive) first commodity. However, suppose the world price of the first commodity were somewhat lower. Then there is a range in which trade (with the home country now importing the first commodity) would raise the real wage rate. Indeed, if the world price settled so that real wages are shown by

a point such as *T* in Figure 4(b), labor would find that free trade has been beneficial, but would also note that some degree of protection for local producers of the first commodity (say to raise the domestic price to a_{L1}/a_{L2}) would prove to be an even better solution for workers. (Such a move would indeed maximize labor's position, since all returns to capital would vanish). Analogous remarks could be made if local tastes had led to situation 2, with $p_1^A(2)$ the autarky price.

The two parts of Figure 5 illustrate how radically different the scenario is for labor in the case in which each sector possesses a Ricardian technology. The basic pattern for the θ_1 and $\delta_1(.)$ curves is similar to that of the Leontief case, reflecting the parallels between transformation loci for the two types of technologies. But the effect of trade on real wages is much different. In the lower range of prices for the first commodity no labor is used in that sector (i.e. commodity 1 is capital intensive, with θ_{L1} equal to zero), so that any increase in commodity 1's price leaves the nominal wage rate unchanged. Since the price increase raises labor's cost of living, real wages must decline in this range. Similarly, in the higher range of prices all the labor force is employed in the first sector and thus it becomes the labor-intensive sector. Increases in p_1 would raise the nominal wage by the same relative amount and thus unambiguously raise the real wage. If tastes are illustrated by the $\delta_1(3)$ line, autarky price for the first commodity is a_{L1}/a_{L2}, and trade with the rest of the world *in either direction* must serve to increase the real wage at home. Note that in this case the home country must export its labor-intensive commodity.[5] Such

[5] Melvin and Washik (2001) also illustrate the case in which each sector's elasticity of substitution is unity, and with appropriate tastes labor always gains from trade. Here, of course, the elasticities of substitution are both infinite. The value of unity for the elasticity puts results more in line with the Ricardian case of Figure 5 than the Leontief version in Figure 4.

a rosy picture for labor would, of course, need to be appropriately modified if the autarky price is at some other level, e.g. as it would be under taste pattern $\delta_1(1)$ or $\delta_1(2)$.

Finally, we consider the case of mixed technologies in Figure 6, where it is assumed that the second sector is Leontief while the first sector is "Ricardian". The transformation schedule was illustrated in Figure 3, supporting the fact that the β_1 function is the horizontal line at value unity. For *all* positive prices of the first commodity labor on its own can produce the first commodity and the wage rate will increase in proportion to p_1. Commodity 1 has an extremely more flexible technology than does commodity 2, and this asymmetry firmly establishes that any trade that follows from the world price for commodity 1 being higher than in autarky helps labor, while a lower price would unambiguously hurt labor. This type of example, in which there is a strong asymmetry between sectors in the degree of technological flexibility, is investigated more deeply in Jones and Ruffin (2003).

3. Two-Country Trade

The preceding discussion presented the home country, originally in autarky, with some arbitrarily different terms of trade ruling in world markets. Instead, now we consider the possibility that the price ratio ruling in world markets is *endogenously* determined by the interaction between the home country and a foreign country, differing either in its factor endowment base or in its technology.

A. Labor Abundance

Suppose the foreign country has a larger endowment of labor than does the home country, but shares the same technology as well as endowment of the specific capital in each sector. In Figures 4-6 this implies a different θ_1^* production share curve for the foreign country, but no change in the $\delta_1(.)$ consumption lines or, most importantly, the β_1 function. In the Leontief case of Figure 4 in the lower range of prices for the first commodity, good 1 is labor intensive, so that at a given price ratio the relative share of the first commodity produced is higher abroad than at home. In the higher range of prices the first commodity is capital intensive, and thus its share in the labor-abundant foreign country is lower than at home for each price. In Figure 4(a) the foreign θ_1^* curve is shown by the dotted curve. Figure 1 confirms that an increase in the labor supply moves point *A* to the right and point *B* upwards, thus shortening the vertical stretch in Figure 4(a) at both ends.

Because the factor-intensity ranking in the Ricardian case of Figure 5(a) is reversed, so also is the shift in the foreign θ_1^* curve.[6] The first commodity is capital intensive in the lower range of prices for the first commodity, and thus the labor-abundant foreign country would, at each price, produce relatively less of the first commodity. In the higher range of prices the labor-abundant foreign country would again produce relatively more of the labor-intensive commodity at each price than does the home country, but this is now the first commodity. This supports the drawing in Figure 5(a) of its dotted θ_1^* curve. In the mixed technology case of Figure 6, in the lower range of prices for the first

[6] In Figure 2 an increase in the labor endowment moves point *A* vertically upwards and point *B* to the right.

commodity it is labor intensive, so that the foreign country's θ_1^* curve lies above that for the home country. In the higher range of prices both countries are specialized completely to the first commodity, so that the value of the θ_1 share is unity for both.

The repositioning of the foreign country's production share curve implies that autarky prices are different from those at home. The free trade price lies between the autarky price ratios in the two countries. Thus the pattern of trade will be determined by the difference in labor endowments. In the Leontief case if (common) tastes are shown by the $\delta_1(1)$ line, the labor-abundant foreign country must with trade face a lower price for the first commodity than in autarky, and thus must export the second commodity, which is labor intensive. Trade will increase real wages in the foreign labor-abundant country and lower them in the home capital-abundant country. In the event that both countries have a much stronger preference for the second commodity, the $\delta_1(2)$ case, the foreign country will find that the free trade relative price of the first commodity is higher than in autarky and thus export this good to the home country. Once again it is the relatively labor abundant country that finds its real wage improved by trade, and it is in the capital abundant home country that trade has caused the real wage to deteriorate.

How different is the story in the Ricardian case of Figure 5? Now in the lower range of prices for the first commodity (with common tastes shown by the $\delta_1(2)$ line), its relative autarky price is higher abroad than at home, so that with trade the foreign country will import the first commodity. Once again, trade causes the real wage rate to increase in the labor-abundant foreign country (and fall at home). And a similar pattern is revealed should the common taste pattern be shown by the $\delta_1(1)$ line – the labor abundant foreign country exports the first commodity and its labor force once again gains.

A robust result is obtained in all cases: If the world free trade price is determined endogenously in trade between two countries sharing the same technology and endowments of specific factors but differing in the supplies of labor, and if the free-trade price differs from autarky price[7], *it is always the case that the real wage rises in the relatively labor-abundant country and falls in the other country.* This is a strong result in that it holds for either type of technology (or, indeed, the mixed case of Figure 6). Although the actual *pattern* of trade depends on the common taste pattern, *the relatively labor-abundant country always exports its labor-intensive commodity.*

B. Abundance in a Specific Capital

The fate of labor in each country when trade is opened up and they differ only in labor endowments is asymmetric: Labor gains by trade in the labor-abundant country and loses in the labor-scarce country. Of course an analogous result would hold if both specific capitals were greater in one country by the same percentage amount, with the same labor force. Here we consider a different case, one in which the foreign country has a richer endowment of type-1 capital, but the same endowment of type-2 capital and labor as does the home country. Consider the Leontief case. In Figure 4(a) the θ_1* schedule to the left of a_{L1}/a_{L2} is unchanged (since K_1 is in excess supply in any case), while the foreign θ_1^* curve to the right gets shifted upwards. Either there is no trade (for low autarky price of the first commodity), or the labor-abundant home country exports its labor-intensive commodity and experiences an increase in its real wage for high prices of the first commodity. In the Ricardian case shown in Figure 5 the θ_1* curve is shifted

[7] If each country has taste pattern $\delta_1(3)$, differences in labor endowments may not alter their common autarky price ratios.

upwards for all prices. Although this is not shown explicitly in the diagram, it now could be the case that the autarky prices in the two countries straddle the central a_{L1}/a_{L2} ratio. As a consequence free trade could *lower* the real wage in *both* countries, with each country exporting its capital-intensive commodity. This is reminiscent of the older literature on factor-intensity reversals, in which free trade moves relative wages in the same direction in both countries.[8]

C. Different Technologies

If two countries have different technologies, the only effect on the β_1-function will be on the position of the vertical section if labor input coefficients are not proportional between countries. In such a case the ω_1-curves for the home country and foreign country reach a peak in Figure 4(b) or a low point in Figure 5(b) at different relative prices. Suppose that autarky in each country takes place along the downward-sloping section of its transformation schedule. If both have Leontief technologies this implies that real wages will be at their maximum in autarky so that international trade at different prices harms mobile labor in *both* countries. International trade, by pushing economies towards greater specialization, lets the associated complementary (specific) factor reap the rewards at the expense of labor. By contrast, if production is exemplified by Ricardian technology in both sectors in each country, autarky will be at the point of minimum real wage rates for each country. International trade now encourages labor to specialize in the sector with the greater value of its marginal product, and the real wage is raised in both countries. This case indeed merits the "Ricardian" label.

[8] For example, see the implications of free trade on factor prices in Figure 5 of Jones (1956).

4. Concluding Remarks

In a specific-factors setting, with labor mobile between two sectors and capital specific to each, the effect of opening trade or of changes in the terms of trade on real wages is more complex than in the simple Stolper-Samuelson theorem wherein real wages are unambiguously harmed by more open trade if the country imports its labor-intensive product. Here we have chosen two extreme examples in which technology either exhibits the Leontief characteristic of perfect complementarity with zero substitution between factors possible or exhibits a "Ricardian" characteristic whereby each factor on its own can produce commodities – labor in either sector and specific capital only in the sector in which it is located. Without having to pursue the formal analytical treatment required in the general case discussed in Jones and Ruffin (2003), we nonetheless have illustrated several important results in these examples:

(1) The impact of trade on real wages in these examples does not suffer from the "neoclassical ambiguity" often found in the more general case, in which a price change has a less than proportionate change in the nominal wage rate, which might be outweighed by a change in the consumption price weight for labor. A price change either leaves nominal wages unchanged, or moves them in the same proportion as the price change.

(2) Another consequence of dealing only with these extreme cases is that the argument put forth in Ruffin and Jones (1977) and Jones and Ruffin (2003) for a *presumption* that labor gains from free trade cannot be maintained. As those papers suggest, the presumption rests upon the possibility that the β_1-curve for

nominal wage changes might lie between the θ_1-curve of production shares and the δ_1-locus of consumption shares.

(3) Even if both sectors share the same extreme type of technology, the impact of trade on the real wage depends very much on whether the two sectors exhibit either zero or infinite substitution possibilities. If they share the Leontief rigid technology and if in autarky neither specific capital is "binding" in the sense of being fully employed, any different terms of trade in the world economy will cause labor to suffer a deterioration in its real wage. It was a computer-generated example of this kind of result (in a less extreme case than Leontief) that was introduced by Melvin and Waschik (2001) to cast doubt on the "presumption" about real wages argued by Ruffin and Jones (1977), *viz.* that labor would gain from trade. As the country trades, an improvement in its terms of trade leads to gains for the country but not to labor since the specific factor employed in the export sector captures all the increased revenues. At the other extreme, if at autarky production takes place on the downward-sloping portion of the transformation schedule in the case in which factors can independently produce commodities with constant returns to scale (the "Ricardian" assumption), labor gains in real terms if world prices differ from autarky, regardless of the direction of trade.

(4) If we suppose that the world terms of trade are endogenously determined by trade only between two countries that share the same technology and tastes but differ in their endowment of labor, a strong result is obtained: The labor abundant country's labor force will, once trade is opened, experience an improvement in its

real wage and whatever the commodity it exports, it will be produced by relatively labor-intensive techniques. The other country's labor force suffers by trade. This result does not depend on the common value of elasticities of substitution, whether low or high. The Melvin and Waschik (2001) possibility does not arise.

(5) If, instead, the two countries have the same technology and labor force but differ in the endowment of one of the specific factors, it is possible (in the Ricardian case) that with trade the real wage could fall in both countries. This was not the case if they differ only in their labor endowment. If countries differ in their technologies, trade may move real wages together or apart.

(6) In the case in which one sector exhibits Leontief rigid coefficients while in the other sector factors can independently produce commodities, so that sectors are extremely asymmetric in the flexibility of their technologies, labor's fate is always linked to the commodity with the more flexible technology. The real wage is monotonically and positively related to that commodity's relative price.

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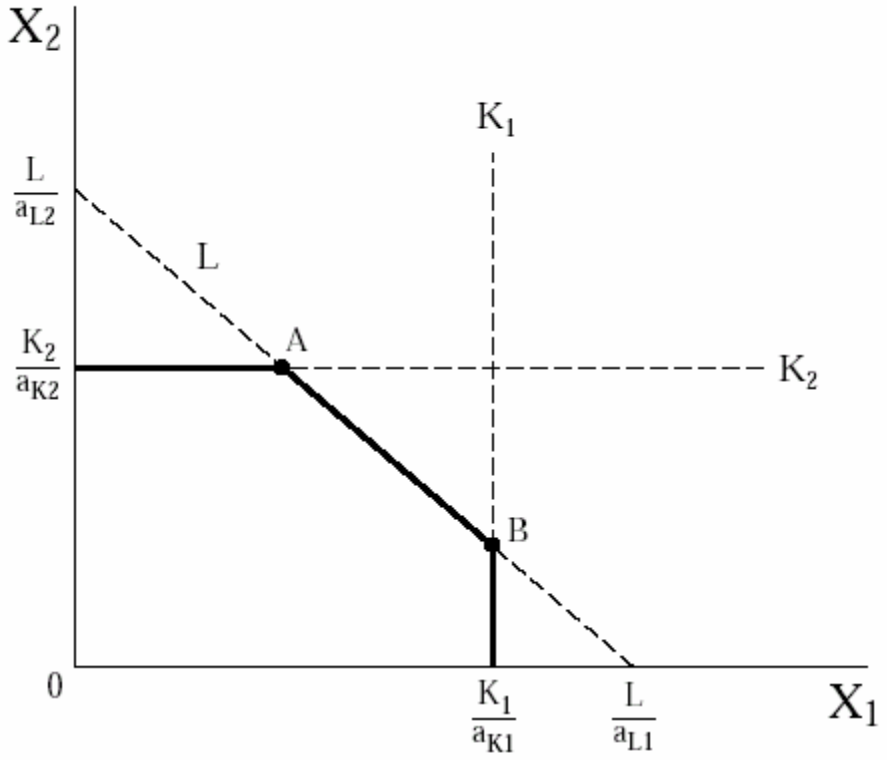

Figure 1: The Leontief Transformation Schedule

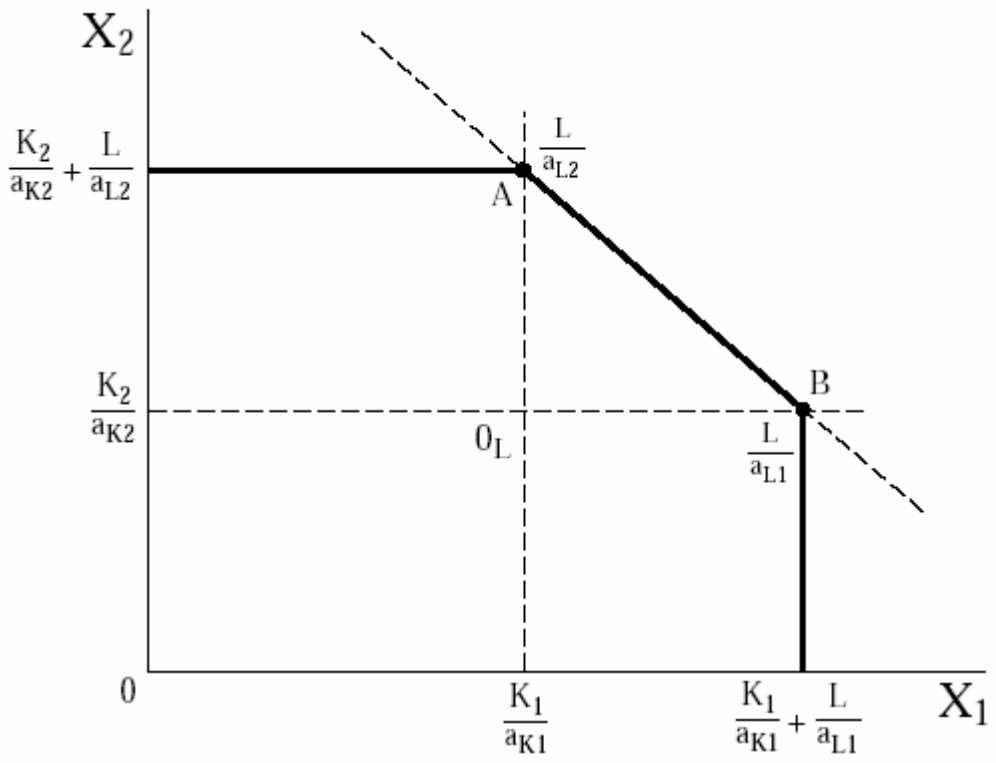

Figure 2: The "Ricardian" Transformation Schedule

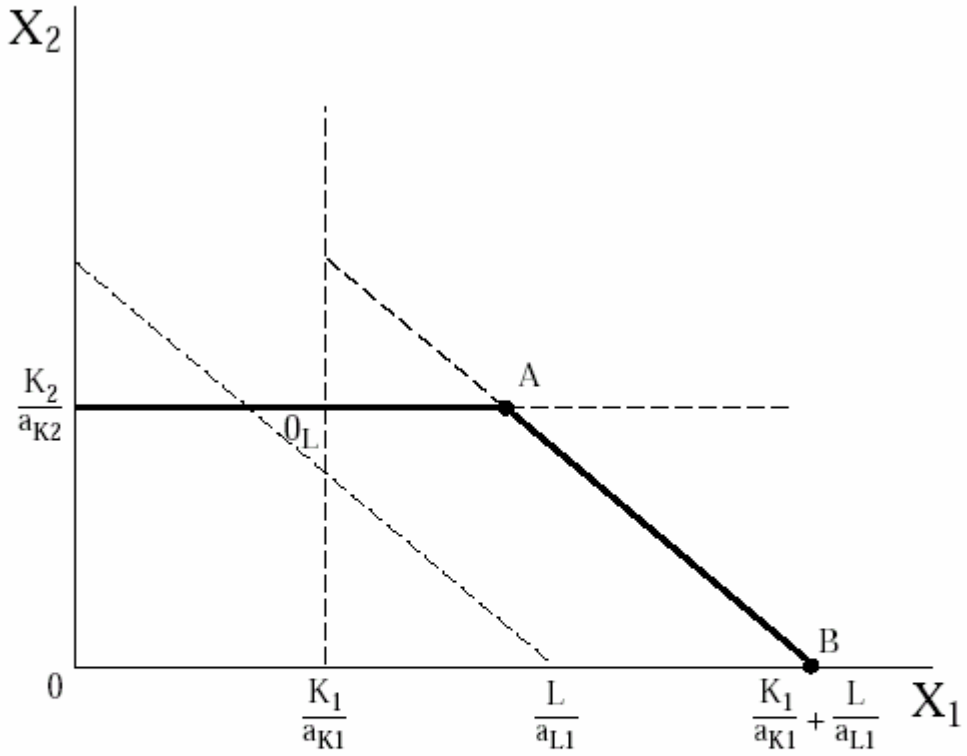

Figure 3: Mixed Technologies

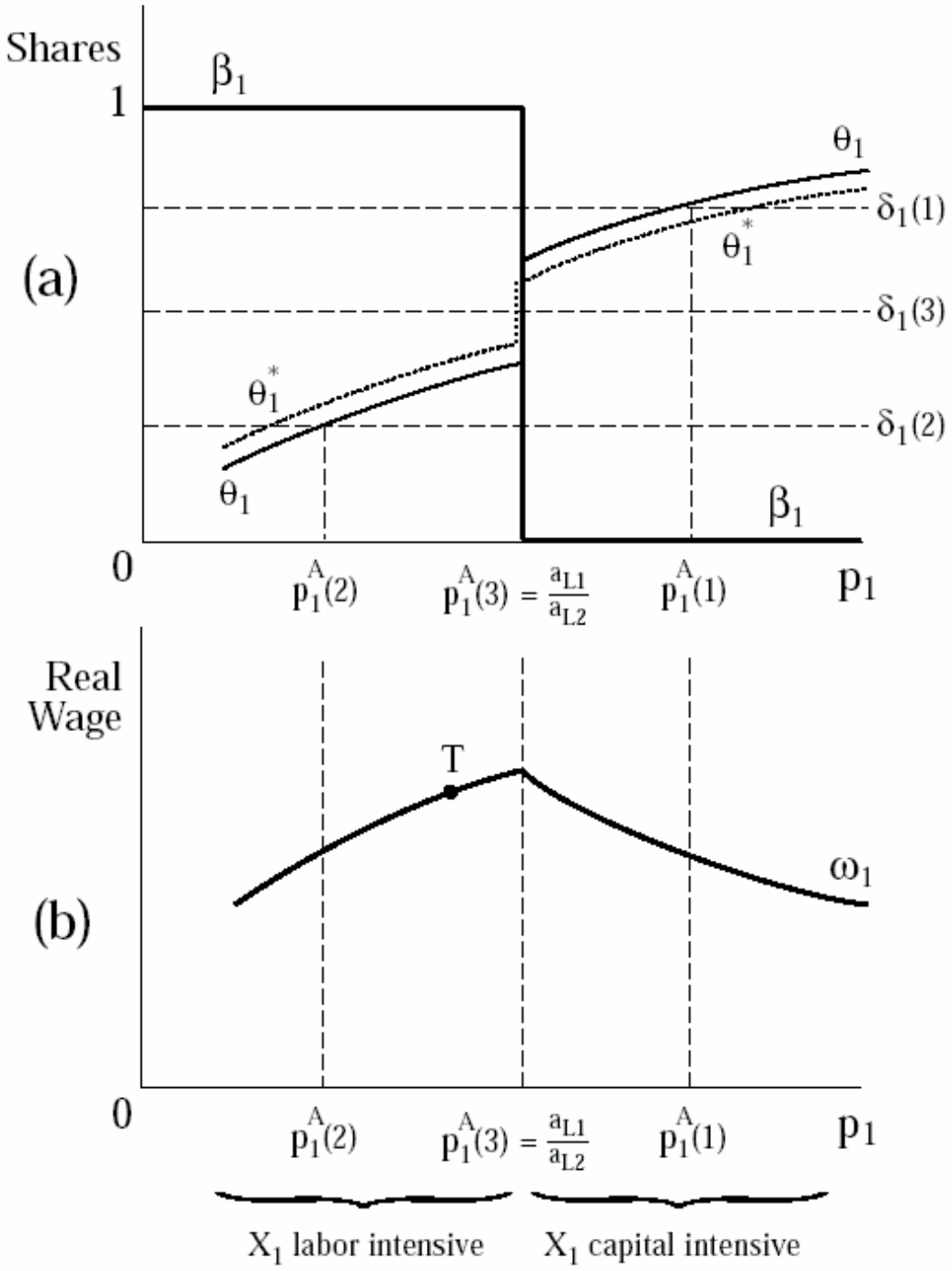

Figure 4: The Leontief Case

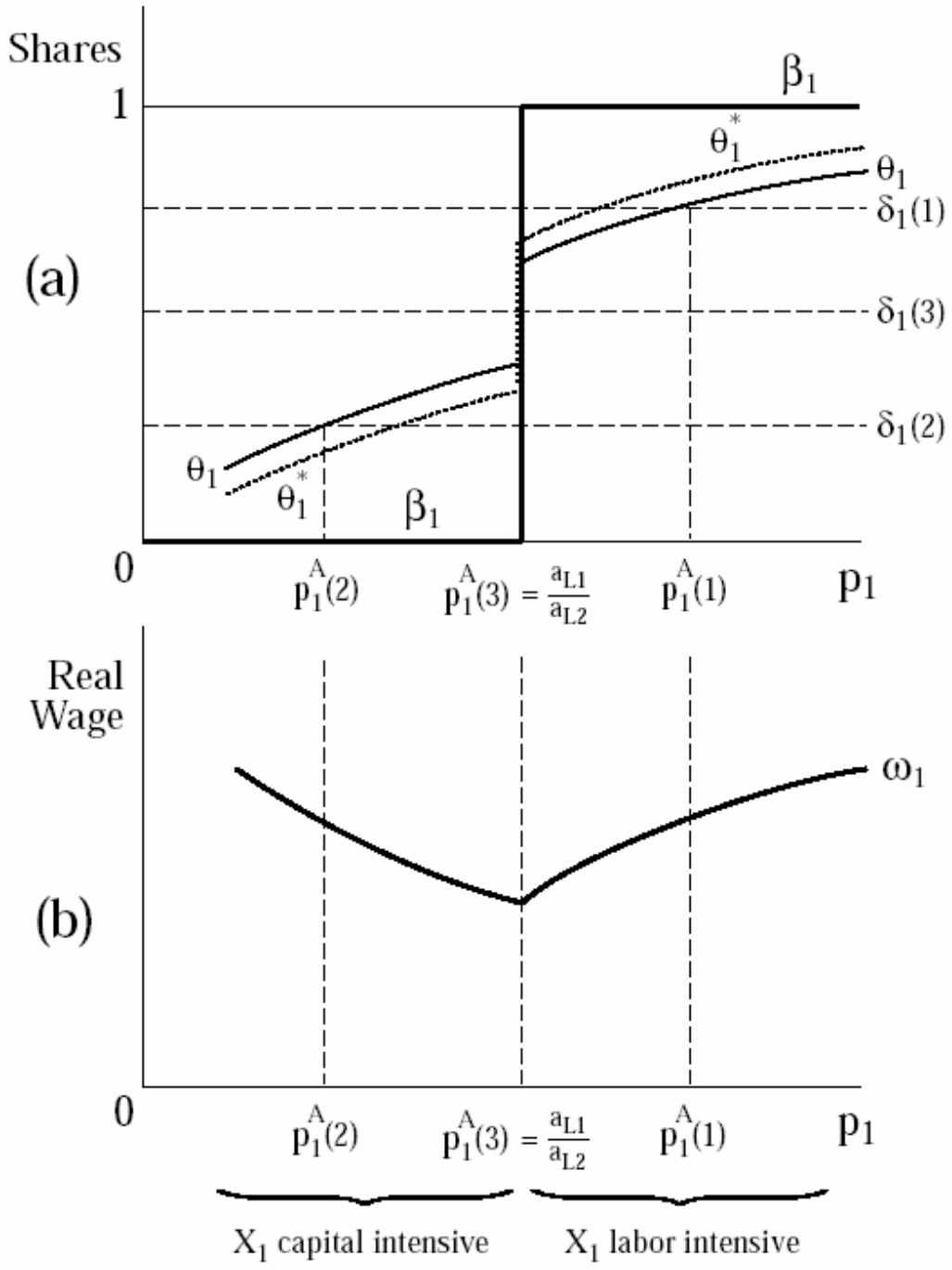

Figure 5: The "Ricardian" Case

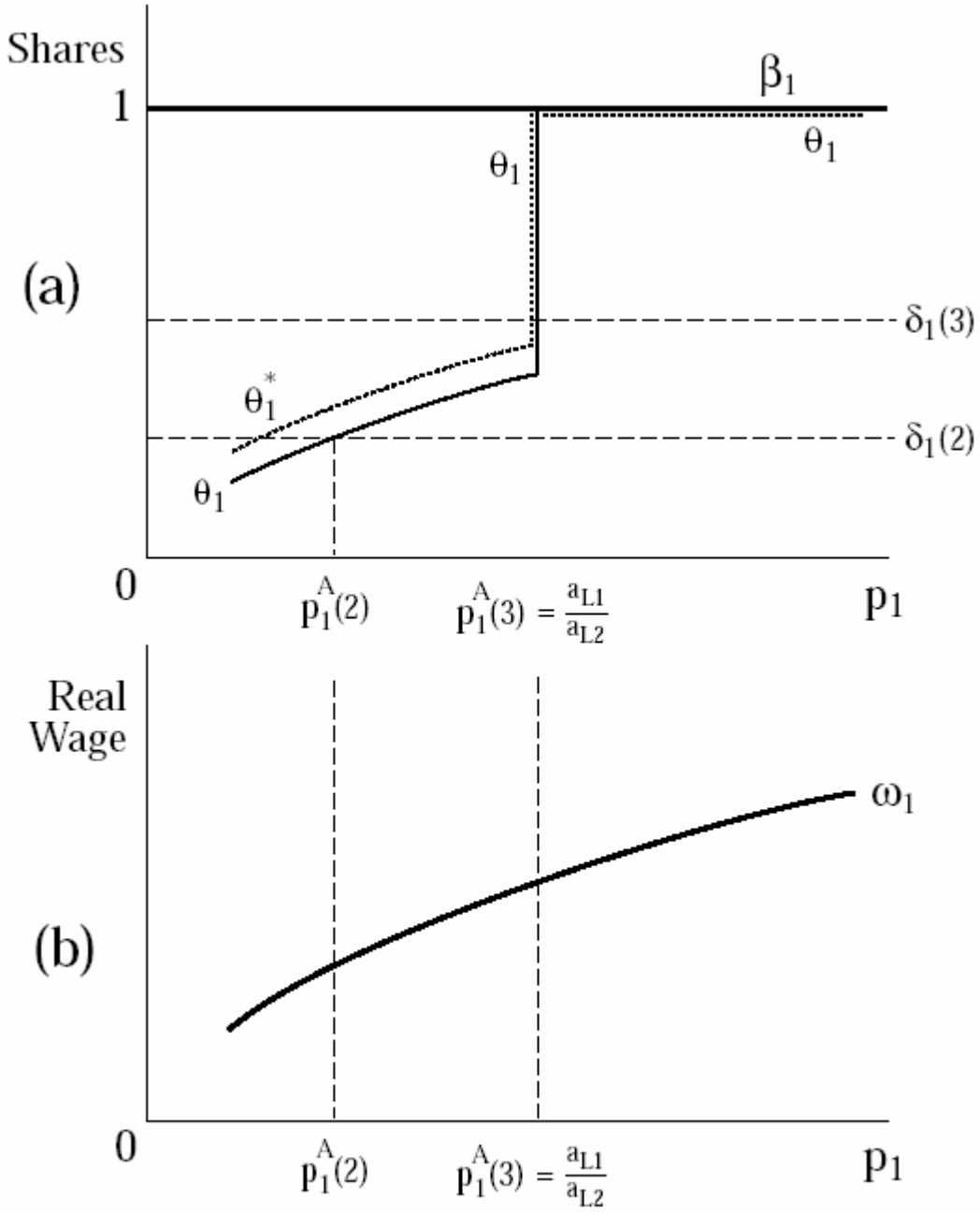

Figure 6: Mixed Technologies