NATIONAL WELFARE IN AN OPEN ECONOMY
IN THE PRESENCE OF FOREIGN-OWNED FACTORS OF PRODUCTION*

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In the presence of foreign-owned factors of production in the economy, the effect of trade policy changes on national welfare needs to take into account the possible redistributive effect between foreign-owned and domestic factors. Therefore, an otherwise welfare-improving trade liberalization may paradoxically worsen national welfare. This paper analyzes this important, new area of trade theory and establishes the condition under which this paradox of immiserizing trade liberalization arises. The analysis is also applicable to analyzing the effects of external tariff variation in customs unions, with full internal factor mobility, on member countries' welfare.

1. Introduction

In the presence of foreign-owned factors of production in an economy, the traditional conclusions regarding the effects of exogenous parametric changes or policy changes on national welfare need to be modified. Thus, in an open economy, the absence of the usual foreign and domestic distortions à la Bhagwati (1971) and Johnson (1965) will not ensure that an exogenous term-of-trade improvement or a policy shift from autarky1 to free trade will improve national welfare.

For example, take the traditional 2 × 2 model of trade theory and assume that the importable good is labour-intensive, labour is wholly national, and capital is wholly foreign. A shift from autarky to free trade will then, by lowering the relative domestic price of the importable good, lower the real wage of labour à la Stolper Samuelson (1941) and thereby result in national

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1The term 'autarky' in the present context is taken to mean the absence of trade across national borders, in conformity with conventional terminology of economic policy discussion. More elaboration of this point is provided in section 4 below.
immiserization from the shift to free trade. Free trade therefore worsens rather than improves welfare, given the presence of foreign capital in this example.

Bhagwati and Tironi (1978) formulated the original problem as relevant to analyzing the widespread concerns of Latin American policymakers, who feared that regional trade liberalization would benefit foreign investors and could harm the Latin American nations themselves in consequence. In addressing this particular problem recently for the $2 \times 2$ model, the Bhagwati–Tironi analysis allows the tariff to vary by policy, but assumes that each of the two factors of production is wholly foreign or wholly national. This latter assumption permits them to adapt readily to their problem the well-known results on income distribution by factor class, originating from Stolper–Samuelson (1941) and developed in Bhagwati (1959); Johnson (1959, 1960) and Rao (1971).

Unfortunately, the real world does not permit us to divide all factors exclusively into the national or the foreign category. Capital flows to countries that cannot be assumed to have no capital of their own, and labour moves into countries that surely have native populations. Thus, it is necessary for this reason alone to examine the problem at hand by permitting the factors of production to be both national and foreign, as we do presently.

More importantly, while it is clear that a redistributive effect resulting from changing goods price-ratio could lead to paradoxical outcomes for national welfare, we are able to demonstrate a stronger proposition in this paper. Namely, the paradox of national immiserization following improvement in the country's external terms of trade will arise if and only if the redistributive effect against nationals goes so far as to result in the *differential-trade-pattern* phenomenon, as defined below.

Our geometric analysis, moreover, has the added advantage of using familiar trade-geometric techniques to simplify and resolve what appears to be a potentially complex problem. Furthermore, although the explicit focus of this paper is the national-foreign distinction, the two-group analysis presented here applies equally well to a broad spectrum of alternative domestic distinctions, e.g. those based on race, ethnicity or sex. Moreover, the analysis is just as readily applicable, as we demonstrate later, to the theory of customs unions.

In section 2 we trace the effects of variation in the goods price-ratio on the income accruing to national factors, thus defining their 'income line' at alternative price-ratios. In section 3, we relate this perfectly general analysis first to exogenously-induced changes in external terms of trade, assuming free

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2Thus, our general-equilibrium analysis can throw light on the conditions under which parametric changes at the national level may lead to conflicting outcomes for differently-endowed racial, ethnic, sexual and other differentiated groups within the nation.
trade, and therewith discuss the effects on national welfare that would follow from such changes. We also relate the analysis next to effects of tariff variation on national welfare. Section 4 offers some concluding observations.

2. National income variations as goods price-ratio is varied

The first problem that we analyze relates to the behavior of the national 'income line' as the prevailing price-ratio for goods is varied.

The model has two factors of production, $K$ (for capital) and $L$ (for labour). The overall factor endowment is $\bar{K}$ and $\bar{L}$, while the national (i.e. domestically-owned) factor endowment is $K_n$ and $L_n$. The two traded goods are $X$ and $Y$.

With the usual restrictions on the linear homogeneous production functions for the two goods, and assuming the absence of factor-intensity reversals for the rest of our analysis, we can define an aggregate production possibility curve, $T_x'T_y'$ in fig. 1 for the aggregate factor endowments ($\bar{K}$, $\bar{L}$).

![Fig. 1.](image)

For the usual trade-theoretic analysis, with well-behaved social utility curves, a goods price-ratio $AB$ will be defined for autarky and the utility index $U^G$ would rise monotonically as $P_x/P_y$ (the relative price of $X$ in terms of $Y$) was varied up from $A$ to $T_x'$ or down from $A$ to $T_y'$ (with reversed pattern of trade). (For simplicity of exposition, we assume that all income earned by factors from abroad is consumed locally, to avoid having to show re-
patriation of such income in fig. 1.) This relationship between \( P_y/P_x \) and \( U^G \), as illustrated in fig. 2, follows from deriving first the implication of the goods price-ratio variation for the aggregate budget line and then deducing the welfare level \( (U^G) \) achieved in fig. 1.

For national welfare, however, we need to define these two steps for domestically-owned factors alone. First, as in this section, we must derive the national budget line, as defined by the domestic goods price-ratio. Next, as in the following section, we must deduce the national welfare level \( (U^N) \) reached in consequence.

The natural way to proceed with the analysis then would appear to be to draw onto fig. 1 the national production possibility curve, \( T_xT_y \), defined by the domestically-owned endowments \( \bar{K}_n \) and \( \bar{L}_n \). One may then be tempted to draw the goods price-ratio tangent to it, as to \( T'_xT'_y \), and to treat the resulting income line as the national budget line.

But, except for a range of possible cases, this cannot be done. To see why, and to state the correct and complete analysis of the problem, let us turn to the familiar Samuelson diagram in fig. 3 – which relates the goods price-ratio \( (P_y/P_x) \), the factor-price (rental-wage) ratio \( P_K/P_L \), and the sectoral capital–labour ratios \( K_x/L_x \) (for good \( X \)) and \( K_y/L_y \) (for good \( Y \)). Assume, without loss of generality, that \( \bar{K}_n/\bar{L}_n < \bar{K}/\bar{L} \), i.e. the foreign-owned endowment is
There are two cases that can arise then: either there is a range of factor price-ratios at which incomplete specialization will obtain on both $T_xT_y$ and $T'_xT'_y$ or there is no such range. Fig. 3 illustrates the former, more interesting case; the latter, which corresponds incidentally to the Bhagwati–Tironi restrictive case, will be analyzed subsequently and related to the former.

The analysis then must distinguish among three zones of goods price-ratios: Zone I, where they lead to incomplete specialization in production for both the production possibility curves $T_xT_y$ and $T'_xT'_y$; Zone II, where complete specialization on the capital-intensive good $X$ occurs on $T'_xT'_y$ before it does on the national curve $T_xT_y$; and Zone III, where complete specialization on the labour-intensive good $Y$ occurs on $T_xT_y$ before it occurs on the aggregate curve $T'_xT'_y$. Take each, in turn.

**Zone I.** For the aggregate endowment ratio, $K/L$, the range of factor price-ratios for incomplete specialization is clearly $CE$ (i.e. $OC$ to $OE$) on the vertical axis of fig. 3. For the national endowment ratio, $K_n/L_n$, the range for incomplete specialization is $DF$. Therefore, $DE$ represents along the vertical axis the range of factor prices over which both $T_xT_y$ and $T'_xT'_y$ will show incomplete specialization. Consequently, for any goods price-ratio in the...
range $DE$ (i.e. $OD$ to $OE$) along the left-hand horizontal axis, it is evident that the choice of capital-labour ratios in $X$ and $Y$ will be identical for $T_xT_y$ and for $T'_xT'_y$, and hence there will be a unique set of real factor prices $(P_K/P_i$ and $P_L/P_i$, $i = x, y$) along both of these production possibility curves.\(^3\)

Given this uniqueness, the value of national income $(L_nP_i/P_i + R_nP_K/P_K$, $i = x, y$) can be represented by the goods price-ratio tangent to $T_xT_y$, for the same reason that the value of aggregate income $(LP_L/P_L + RP_K/P_K$, $i = x, y$) is representable by the goods price-ratio tangent to $T'_xT'_y$. Thus, even though $T_xT_y$ is only a hypothetical construct and national factors combine with foreign factors to produce at common techniques throughout the economy along $T'_xT'_y$, we can see immediately that the foregoing procedure for deriving the national budget line (by putting the goods price-ratio tangent to $T_xT_y$) will be valid as long as $P_y/P_x$ is in the range $DE$.

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\(^3\)For ease of identification, fig. 3 is marked, both for $P_K/P_L$ and for $P_y/P_x$, with identical lettering: C, D, E, and F. Thus, the factor price-ratio range $DE$ corresponds to the goods price-ratio range $DE$. Similarly, the positioning of the letters C, D, E and F on the $K/L$, and $K'/L_y$ schedules indicates, as noted in the text, corresponding points of specialization in production on $T_xT_y$ and $T'_xT'_y$. Again, the lettering on $T_xT_y$ and $T'_xT'_y$ in fig. 4 will correspond to the lettering in fig. 3, to facilitate grasp of the relationship between the two illustrations.
Therefore, for this overlapping range (DE) of incomplete specialization, we can indeed proceed in fig. 4 to place the goods price-ratio tangent to $T_xT_y$ to derive the national income line. Besides, a movement from $E$ to $D$ along $T_xT_y$ and $T_x'T_y'$ will imply – given the resulting rise in the wage-rental ratio and the condition $\bar{R}_n/L_n < \bar{K}/\bar{L}$ – a rise in the share of aggregate income going to domestically-owned factors.

Zone II. But vary now the goods price-ratio $P_y/P_x$ down from $OE$ in fig. 3. It is evident that there will be complete specialization on good $X$ on $T_x'T_y'$ while, on $T_xT_y$, we would get incomplete specialization in production until the goods price-ratio becomes $OF$ (fig. 3). Since the returns to domestically-owned factors must reflect what happens on $T_x'T_y'$, however, it follows that the relative rewards of $K$ and $L$ will remain fixed at $P_K/P_L = OE$ in fig. 3 for all changes in the goods price-ratio from $OE$ to $OF$ and further.

Therefore, the share of national in aggregate income will also remain constant, for such variations in the goods price-ratio, at $OQ/OE$. The national income line therefore will become $EQ$ in fig. 4 for the goods price-ratio $OE$ in fig. 3 and will shift on its anchor $Q$ thereafter to $QS$ through $QR$ as $P_y/P_x$ falls steadily from $OE$ to zero in fig. 3.

Clearly, therefore, the stretch $EF$ on $T_xT_y$ is not relevant to the determination of the national income line. The diminishing wage-rental ratio that it reflects as $K/L$ ratios change with a varying goods price-ratio are, in fact, arrested because of the opportunity to combine with the foreign factors. The gain that such an opportunity represents for national factors is measured by the distance between: (1) the income line produced by tangency of a goods price-ratio along $EF$ in fig. 4; and (2) the parallel income line (anchored on $Q$) that actually obtains, thanks to interaction with the foreign factors and the consequent anchoring of the techniques and factor rewards at $E$ on $T_x'T_y'$.

Zone III. Varying the goods price-ratio in the opposite direction, from $OD$ upwards toward $OC$ and beyond in fig. 3, then defines the remaining set of possible variations in the goods price-ratio.

At goods price-ratio $OD$, $T_xT_y$ shows specialization on good $Y$ and $T_x'T_y'$ shows incomplete specialization, in fig. 4. If factor prices were constant as $P_y/P_x$ rises, $T_xT_y$ would have led to continuous improvement in the national budget line, each successive budget line being anchored on $D$ and rotating upwards. However, $P_K/P_L$ is not fixed, but will continue to fall as the aggregate economy moves along $T_x'T_y'$ from $D$ to $C$. Therefore, given the associated increase in the wage-rental ratio and the condition $\bar{K}_u/\bar{L}_u < \bar{K}/\bar{L}$, the share of national in aggregate income will rise with the move from $D$
towards $C$ on $T_x T_y$. However, the move to $C$ from $D$ is also accompanied by a declining intercept of the aggregate income line with the vertical axis. Therefore, while the former effect works to raise the national income line, the latter effect works to lower it.

It is possible to establish, however, that the combination of these two effects yields an unambiguously upward shift in the national income line, according to the following reasoning. The real value of national income in terms of good $Y$ is given by $Q_y = \bar{L}_n P_L/P_y + \bar{K}_n P_K/P_y$. By differentiation of this equation, $dQ_y/d(P_L/P_y) = [\bar{L}_n/\bar{K}_n + d(P_K/P_y)/d(P_L/P_y)]\bar{K}_n$. Since the first-order conditions for profit maximization can be manipulated easily to show that $d(P_K/P_y)/d(P_L/P_y) = -L_y/K_y$, then $dQ_y/d(P_L/P_y) = (\bar{L}_n/\bar{K}_n - L_y/K_y)\bar{K}_n$. Thus, $dQ_y/d(P_L/P_y) \geq 0$ because $\bar{L}_n/\bar{K}_n \geq L_y/K_y$ within zone III, with the strict equality holding only for the borderline case of goods price-ratio $OD$. Consequently, as $P_L/P_y$ increases continuously with $P_y/P_x$ (à la Stolper-Samuelson) within zone III, $Q_y$ rises correspondingly, and hence the national income line shifts upwards while becoming flatter. Once the goods price-ratio reaches $OC$ in fig. 4, however, and specialization on good $Y$ ensues at $T_y$ for the aggregate economy, successive increases in $P_y/P_x$ will not change the share of national in aggregate income and the national income line will rotate upwards (along with $P_y/P_x$) from a fixed anchor on the vertical axis in fig. 4.

What happens in the goods price-ratio range from $OD$ to $OC$ is that the presence of foreign factors introduces diminishing wage-rental ratios, which would have been avoided if national factors had operated in isolation (at $D$ in fig. 4). At the same time, à la Stolper-Samuelson, an 'income-redistribution' phenomenon works to labour's and hence to national advantage. Apparently, however, the net impact on the national income line is unambiguously favourable in the general case for the subrange of goods-price ratios $OD \leq P_y/P_x \leq OC$. For price-ratios in the subrange $P_y/P_x > OC$, there is, of course, only a favourable rotation of the national income line as $P_y/P_x$ improves and the economy is specialized on good $Y$. These two subranges together define all the possibilities in zone III.

In concluding this section, note that the $T_x T_y$ curve clearly would be of little use if $\bar{K}_n/\bar{L}_n$ were so much below $K/L$ that zone I did not exist. In this case, we can see immediately that the situation can be described fully by the
foregoing analysis of zones II and III. Of course, it is clear that this case, where there is no zone I, is implied by the Bhagwati–Tironi analysis where capital is wholly foreign and labour is wholly domestic. For, in this case, where the Stolper–Samuelson–Bhagwati–Johnson–Rao analysis can be applied directly, the overall factor endowment ratio is $K/L_n$ and the national endowment ratio is $K_n/L_n=0$. Indeed, in this case, it is evident that the national income in units of $Y(Q_y)$ and of $X(Q_x)$ will unambiguously rise as the real wage of labour rises in terms of both $Y$ and $X$ with the rise of $P_y/P_x$, à la Stolper–Samuelson.

3. Welfare implications in an open economy

The preceding analysis can be readily grafted onto two familiar problems of the theory of trade and welfare: (1) the welfare effects of exogenously-induced changes in the external terms of trade (as a result of some type of parametric shift abroad) under free trade, and (2) the welfare comparison of free trade and autarky. The critical role of the differential-trade-pattern phenomenon emerges from our analysis. The discussion holds equally well for both the large-country and small-country cases, even though the magnitude of adjustment in the equilibrium value of international prices could depend upon the economy's degree of monopoly power in world trade.

3.1. Exogenously-induced changes in the terms of trade

As noted above, in the context of fig. 2, the conventional result, with a standard social utility function, is that improvements in the terms of trade monotonically improve welfare under free trade, given the pattern of trade. This result, however, does not hold necessarily in the presence of foreign factors of production. To see this, consider terms of trade variations within the three zones distinguished in section 2 for the general case where zone I also obtains. The analysis can be readily extended by the reader to terms of trade changes between the Zones.

3.1.1. Changes within zone I. Within zone I, the domestic price-ratio (which is identical to the external terms of trade under free trade) can be put tangent to $T_xT_y$ to derive the national income line, as shown above in section 2. It follows therefore that terms-of-trade improvement within zone I ought to increase national welfare.

It should be observed, however, that a given change in $P_y/P_x$ may mean both an improvement in the terms of trade for the economy as an aggregate
and a simultaneous terms-of-trade deterioration from the national point of view. This apparent paradox is easily seen and quickly resolved, by noting simply that the equilibrium value of $P_Y/P_X$ may differ between aggregate autarky (along the actual production possibility curve $T'_xT'_y$) and national autarky (along the hypothetical curve $T_xT_y$), so that the aggregate (actual) pattern of trade may differ from the national (hypothetical) pattern of trade. For this reason, although national welfare improves monotonically with the national terms of trade, aggregate terms-of-trade improvement will not imply an increase in national welfare unless the aggregate and national patterns of trade happen to be the same.

This is illustrated in fig. 5, where the $T'_xT'_y$ curve has been omitted, to avoid cluttering the diagram. The aggregate-autarky price-ratio (determined along the omitted curve $T'_xT'_y$) is drawn tangent to $T_xT_y$ at $A'$. The national-autarky price-ratio is tangent to $T_xT_y$ at $A$. (To have ray $OA'$ steeper than ray $OA$ as drawn, a sufficient but not necessary condition is a unique set of homothetic indifference curves corresponding to both $U^A$ and $U^N$, in view of

![Fig. 5](image_url)
the well-known Rybczynski Theorem. For any reductions in \( P_y/P_x \) from \( A' \), \( U^G \) would have improved. However, for all such changes between \( A' \) and \( A \), within the autarkic price-ratios cone \( AOA' \), \( U^N \) obviously declines because for national factors the aggregate terms-of-trade improvement is a terms-of-trade deterioration. Therefore, \( U^N \) declines steadily from \( U^N_A \) through \( U^N_1 \) to \( U^N_A \). However, further declines in \( P_y/P_x \) will start improving \( U^N \) and fig. 5 shows the \( P_y/P_x \) at \( G \) which raises \( U^N \) back to the level \( A' \) consistent with the aggregate-autarky price-ratio. Obviously, then, still further decline in \( P_y/P_x \) would have raised \( U^N \) above the level at \( A' \).

It follows that the net result of terms-of-trade improvements for the aggregate economy may be to raise, lower or leave national welfare unchanged. This general result still would hold if ray \( OA' \) were flatter than ray \( OA \). Only if the two rays coincided would aggregate terms-of-trade improvement necessarily imply an increase in national welfare. We have thus shown that, in zone I, the paradox of conflicting movements in aggregate and national welfare will arise when there is a difference between the national and aggregate patterns-of-trade. This differential-trade-pattern phenomenon will now be discussed in the context of the other two zones.

3.1.2. Changes within zone II. Within zone II, there is (aggregate) specialization on good \( X \) along \( T_xT_y \) in fig. 4. It is evident then that any improvements in the aggregate terms of trade will imply corresponding improvements in the national terms of trade since both the national and aggregate patterns trade will necessarily involve excess supply of good \( X \). Successive rotations outwards of the national income line, anchored on \( Q \), will produce increasing national welfare, \( U^N \). Therefore, changes in \( U^G \) may be used to infer the direction of change of \( U^N \); there is no complication as in zone I, since the differential-trade-pattern phenomenon cannot arise here.

3.1.3. Changes within zone III. Within zone III, however, the possibility of differential-trade-pattern phenomenon re-emerges. In the aggregate, there is first the range of incomplete specialization (up to \( C \) from \( D \) on \( T_xT_y \) in fig. 4) and then complete specialization on good \( Y \). For variations in the aggregate terms of trade within the incomplete-specialization range, our earlier analysis shows that the national income line must rise with \( P_y/P_x \). By the same token, \( U^N \) must also rise with \( P_y/P_x \). Thus, when \( P_y/P_x \) rises, \( U^N \) and \( U^G \) will move together or in opposite directions according as the economy (in aggregate) exports good \( Y \) or \( X \) respectively.

However, beyond the point of specialization on good \( Y \), the aggregate terms-of-trade improvement (resulting from a rise in \( P_y/P_x \)) must also increase national income and therefore \( U^N \). The net effect of terms-of-trade improvements in zone III therefore may be to lower or increase national welfare.
when there is incomplete specialization along $T_x^p T_y^p$, but must be to raise national welfare when aggregate specialization is complete on good Y.

Note, moreover, that the contrary behaviour of $U^N$ and $U^G$, possible in the case of incomplete specialization, does require that the aggregate pattern of trade be different from the national pattern of trade: for, such a possibility will arise if and only if the aggregate trade pattern involves the export of good $X^6$ and the national trade pattern (owing to complete specialization on good Y, necessarily in zone III) involves the export of good Y instead.

It is evident therefore that directional changes in national welfare generally cannot be inferred from the direction of changes in the terms of trade in the aggregate, if the economy is in zones I and III. Interestingly, for both these zones, the paradoxical behaviour of national welfare arises simply because the aggregate pattern of trade masks a contrary pattern of trade for the domestically-owned, national factors of production. If only we could draw aside the veil imposed by the presence of foreign factors, and see directly the national (hypothetical) equilibrium production and consumption, the paradox would have disappeared. Therefore, we may describe the paradox of zones I and III as arising from the differential-trade-pattern phenomenon. The redistribution of income à la Stolper-Samuelson does indeed take place in both zones I and III; but it might not be sufficiently strong to create the paradox of deterioration (improvement) in national welfare when the economy's terms of trade improve (deteriorate). Sufficient strength, moreover, is here synonymous with a difference between the national and aggregate patterns of trade.

3.2. Autarky versus free trade

Since neither free trade nor autarky creates tariff revenue, the analysis of this paper can be readily used also to rank these two trade policies in the presence of foreign-owned factors of production.

It is seen immediately that, in zones I and III, the differential-trade-pattern phenomenon may arise and thus lead to autarky (in the aggregate) being better for national welfare than free trade. (Zone II can be ignored at this stage in the discussion, since aggregate autarky cannot occur when only

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6This is, in fact, the paradoxical case considered in Bhagwati and Tironi (1978, section II), but without the underlying explanation and argumentation à la the national production possibility curve, as set out in this paper.

7Of course, this does not mean that the paradox cannot arise if national and foreign tastes are homothetic. For, it is the difference in the trade pattern, as determined by the production and consumption choices at the specified goods price-ratio, that is the critical variable in creating the paradox in both zones. Nor should the reader forget that the hypothetical national equilibrium production will reflect, in zone III (as also zone II, for that matter), the interaction with foreign factors: the national income line cannot simply be drawn by reference to $T_x T_y$ alone by tangency of the goods price-ratio with it. In zone I, however, the presence of foreign factors does nothing to affect the correctness of such a procedure.
good $X$ is produced along $T' \times T'$, assuming that aggregate consumption is always positive for each good.) Thus, the conventional welfare ranking (of free trade being superior to autarky) may be reversed, in the presence of foreign-owned factors of production within an economy.

4. Concluding remarks

In conclusion, a few words should be said about the meaning of the term ‘autarky,’ as used by us in this paper. By general convention in practical parlance, autarky refers to the absence of trade across national borders. At the same time, evidently ‘autarky’ does not exclude domestic ‘trade’ between resident citizens of different countries. The national and foreign factors in our analysis are indeed engaged in domestic trade, even in the absence of international (i.e. trans-border) trade. The analytical problem is therefore identical to that which would arise in the case of customs unions. For, once a customs union is formed with common external tariff and free internal trade and factor mobility, changes in individual member countries’ welfare as external conditions change for the union as a whole are evidently analyzable in precisely the same fashion as changes in national welfare in the presence of foreign factors of production!

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