Kiel
Working Papers

Kiel Institute
for the World Economy

Look Before You Leap: The Economics of Free Trade and Income Redistribution

by Erich Gundlach and Albert de Vaal

No. 1583 | January 2010

Web: www.ifw-kiel.de

Kiel Working Paper No. 1583 | January 2010

Look Before You Leap: The Economics of Free Trade and Income Redistribution

Erich Gundlach and Albert de Vaal

Abstract:

Economists tend to exalt the virtues of free international trade, while politicians are more skeptical. This paper suggests that this is the case because politicians mainly worry about the income distribution effects of trade liberalization, while economists focus on efficiency. Using textbook economic analyses we show that compensating the income distribution effects of free trade may be more complicated and hazardous than is often assumed, at least from a comparative static point of view. Hence politicians may favor trade liberalization only when distributional effects are ignored. By using a multitude of analytical tools and approaches, our paper also makes a useful teaching case for undergraduate students to test and gear their thinking about trade policy issues.

Keywords: trade policy, income distribution, compensation schemes, undergraduate teaching

JEL: A20, F13, H20.

Erich Gundlach
Kiel Institute for the World Economy
24100 Kiel, Germany

Telephone: +49 431 8814284
E-mail: erich.gundlach@ifw-kiel.de

Albert de Vaal
Radboud University Nijmegen
Department of Economics, P.O. Box 9108
6500 HK Nijmegen, The Netherlands

E-mail: a.devaal@fm.ru.nl

1. Introduction

If the current economic crisis makes one thing clear it is that the income distribution has top priority amongst politicians. Examples abound of plans to soften the negative income and employment effects of the sudden and sharp decrease in economic activity worldwide and the concomitant shake-out in domestic industries. This policy reaction is not new as also in the past on many occasions politicians showed prime interest in the income distribution consequences of output shocks, seeking ways to redress negative effects. Prominent examples include measures to soften the decline of traditional sectors like mining, steel, and shipbuilding across western Europe or the economic measures taken in the realm of the re-unification of Germany (e.g. Sinn & Sinn, 1992).[1]

Politicians also worry about income distribution effects with regard to the effects of trade liberalization. As Corden (1997) notes this goes back as far as the Napoleonic Wars, but it can also be seen in more modern times. Examples include the institutionalization of EU's Common Agricultural Policy or the protectionist policy responses to increased cheap imports of textiles from East-Asia in the 1950s and 1960s. Moreover, income distribution effects constitute a prime rationale for countries to engage in multilateral trade negotiations on a reciprocal basis as in the World Trade Organization (WTO). Reciprocity reduces the political costs of trade liberalization as it creates a positive export sector counterweight to the negative effects of liberalizing trade for import competing industries (e.g. Hoekman & Kostecki, 2001). If efficiency were all that mattered, there would hardly be a need for multilateral trade negotiations and a WTO.[2]

This is not to deny that income distribution effects are well acknowledged in trade theory. For instance, the Heckscher-Ohlin trade model shows that whereas trade is beneficial to all countries involved, there are also clear income distribution effects. Due to trade, the owners of abundant production factors gain, while owners of scarce production factors lose. But, as trade economists forcefully rebut: the overall gains from trade are large enough to allow for the full compensation of the losers without taking all the gains from the winners. Trade can be made Pareto-efficient. To achieve this, economists then typically favor lump-sum transfers

[1] The western European welfare state can actually be seen as a political response to the long run changes in the structure of the economy and the accompanying volatilities in market outcomes.

[2] Except perhaps to escape from the prisoner's dilemma of trade policy setting for large countries, which is based on the terms of trade argument for trade policy. However, this is typically seen as a theoretically sound but politically irrelevant reason for implementing trade policies.

that preserve the operation of market forces and do not affect the allocation of resources. However, such transfers are hardly used in reality – poll-taxes are perhaps the only real world examples – and one can therefore doubt whether the solution suggested by trade theorists actually matters for the income distribution problem perceived by politicians.[3] And even if trade can be made Pareto-efficient in theory without lump-sum taxes and transfers (Dixit and Norman, 1980), such a solution ignores many complicating real-world issues that arise when designing and implementing schemes to redress the income distribution effects that result from efficiency gains.

It is therefore hardly surprising that economists' suggestions regarding the advantageous effects of free trade do not resonate within political decision making. This not only happens because economists typically use a language that other professions do not (fully) understand, but their focus on efficiency also makes their argumentation badly aligned to the interests of politicians who want to hear about equity and redistribution. What's more, economists disagree about a workable definition of an equitable distribution of income. Any economist who wants to say something meaningful about the links between efficiency and equity thus faces a hard time within her own profession. Arguments that do not fit the established standards of rigorous economic methodology will be dismissed as being irrelevant.

One goal of this paper is to explain that it does not have to be this way. We will argue that it is possible, even with simple textbook economics, to analyze the effects on efficiency and income distribution of trade liberalization such that it is not only meaningful politically, but also economically.[4] The main argument runs as follows. By opening up a previously closed market, two things will happen. Welfare will be redistributed from "producers" to "consumers", or vice versa, depending on the new product price after liberalization, and there will be a net welfare gain. While for economists this would be sufficient reason to let the policy survive the political process, politicians will not even want to think about it before it has been made clear how and at what cost the losers of market liberalization will be compensated. The point is that the winners will have to be taxed in order to compensate the losers. But taxes create net welfare losses – as economic textbooks also emphasize. The real question an applied economist

[3] See Graaff (2008) for a basic explanation of what lump-sum taxes constitute. To be fair to trade economists, the viability of lump-sum transfers has been questioned in the trade literature as well. Dixit and Norman (1986) argue that lump-sum taxation is not incentive compatible, yet see Wong (1997) for an analysis how trade could nevertheless still be gainful. Kemp and Wan (1995) and Wan (1997) argue that the issues raised by Dixit-Norman do not apply to Grandmont-McFadden lump-sum transfers and are therefore beside the point.

[4] The example of trade liberalization can be easily generalized to other reform policies as well.

has to answer is therefore whether market liberalization still leads to net welfare gains after the losers have been fully compensated by taxing the winners. If that is the case, she will really have a story to convince politicians.

This will not be an easy task however, which is the second goal of this paper. Using textbook economic analyses we will show that repairing the income distribution effects of trade is more complicated and hazardous for policy makers than is often assumed by trade theorists. Trade liberalization with full income compensation may even make the economy worse off compared to the situation before liberalizing trade because there is no guarantee that the efficiency gains from moving to free trade are large enough to outweigh the efficiency loss that would result from politically feasible but economically distortionary taxation. Taking into account politically warranted income redistribution effects thus may easily turn an economic virtue – the gains from trade – into an economic vice. Politicians may therefore have a genuine case when being hesitant about liberalizing trade, at least from a comparative static point of view.

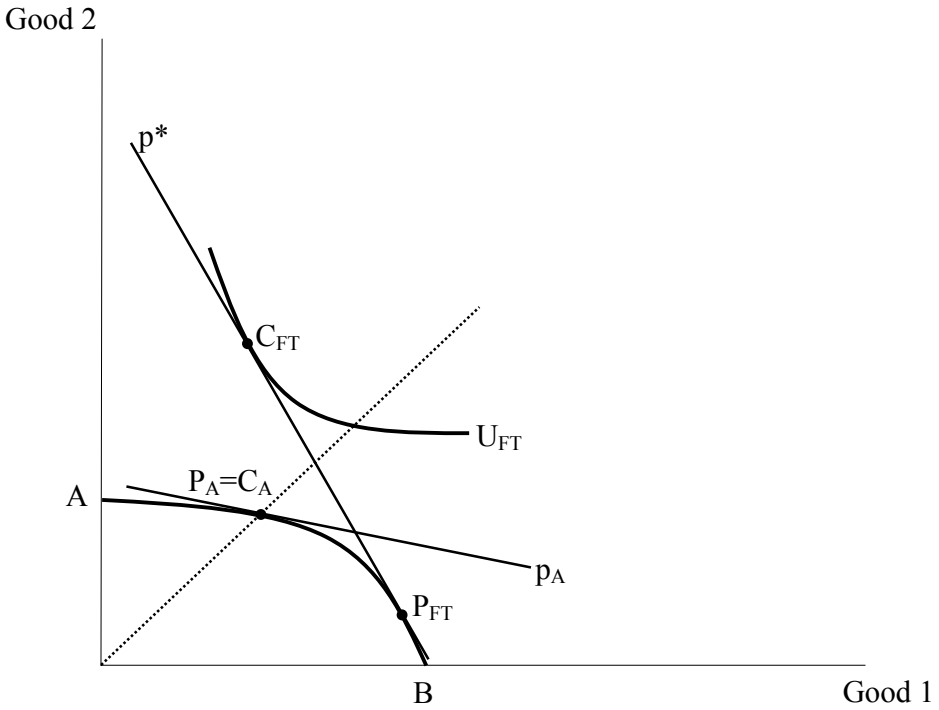
We finally note that by building our story on text book analyses, our paper also provides a useful addition to any standard treatment of trade policy effects at the undergraduate level, which is the third goal of our paper. We use general equilibrium analysis to verify some general conditions for income redistribution to work after opening up to free trade. We use partial equilibrium analysis to bring the analysis closer to the policy arena as well as to allow for a standard consumer-producer surplus treatment of the welfare effects of alternative redistribution policies. Finally, to shed light on the information requirements for designing optimal redistribution policies, we cast the (partial equilibrium) analysis in mathematical terms. By using such a multitude of analytical tools and approaches to clarify conditions that would make income redistribution work, our paper can be seen as an extensive exercise for undergraduate students to gear their thinking about trade policy in the real world.

The structure of this paper is as follows. In Section 2 we review the gains from trade and the concomitant income distribution effects. Section 3 analyzes in a general way the welfare effects of alternative policy options to redress income distribution effects, and discusses complications. Section 4 uses partial equilibrium analysis to address the gains and losses from income redistribution. Section 5 elaborates on the potential costs of using incorrect information for designing optimal redistribution policies, and Section 6 concludes.

2. The textbook gains from trade

As a textbook exercise, the overall gains from trade are usually demonstrated by considering a standard production-possibility diagram as in Figure 1. The economy can produce two alternative goods labeled good 1 and good 2. Each of these goods requires the use of two homogeneous factors in fixed supply, here labeled labor and capital. Technology features constant returns to scale. Both goods differ in their relative use of capital and: labor one good is produced more capital intensive than the other. The country's production possibility frontier (ppf) is therefore concave to the origin, featuring increasing opportunity costs of production. The locus AB in Figure 1 depicts such a ppf. Consumers desire both goods in their consumption baskets and, assuming that all consumers are identical, preferences are represented by community indifference curves. Autarky equilibrium is then established where the highest utility curve is just tangent to the production possibility curve, point PA=CA in the diagram.

Figure 1: The gains from trade and sectoral reallocation



All these assumptions are assumed to hold for countries in the rest of the world as well, yet countries are supposed to differ regarding their relative factor endowments. With demand conditions and technology assumed to be the same across countries, the good that uses a country's abundant production factor intensively will be produced relatively cheap in that country. Countries have a comparative advantage in the good that uses their abundant production factors intensively.

If the country depicted in Figure 1 is relatively well-endowed with capital and the production technology of good 1 is relatively capital intensive, then good 1 is its comparative advantage good. Hence upon trade, the country will specialize in the production of good 1 conditional on the price that comes about in international trade equilibrium. With an international price ratio of p*, the free-trade production point is P_{FT} from which the country can reach any consumption point along the p*-line. The optimal point is of course where the highest utility function is just tangent to the equilibrium price line, C_{FT} in the figure. The gains from trade become visible by comparing utility before and after trade.

However, the gains from trade do not accrue to both production factors. Whereas the country as a whole gains from trade, the distribution of these gains over the two production factors is such that the abundant factor gains, while the scarce factor loses. With capital being abundant in this country, capital gains, and labor loses. This can be seen by noting that trade in fact increases the (relative) demand for the country's abundant factor, while it decreases (relative) demand for its scarce factor: at P_{FT}, more of the capital intensive good 1 and less of the labor intensive good 2 is produced domestically. With fixed endowments of capital and labor, factor rewards will have to adjust to clear factor markets. The reward of capital will rise and that of labor will decline. This is the well-known Stolper-Samuelson result of international trade in a Heckscher-Ohlin setting. It holds as long as the economy is diversified, that is when specialization in its exportable goods sector is not complete.

3. General equilibrium analysis of redressing income distribution effects of free trade

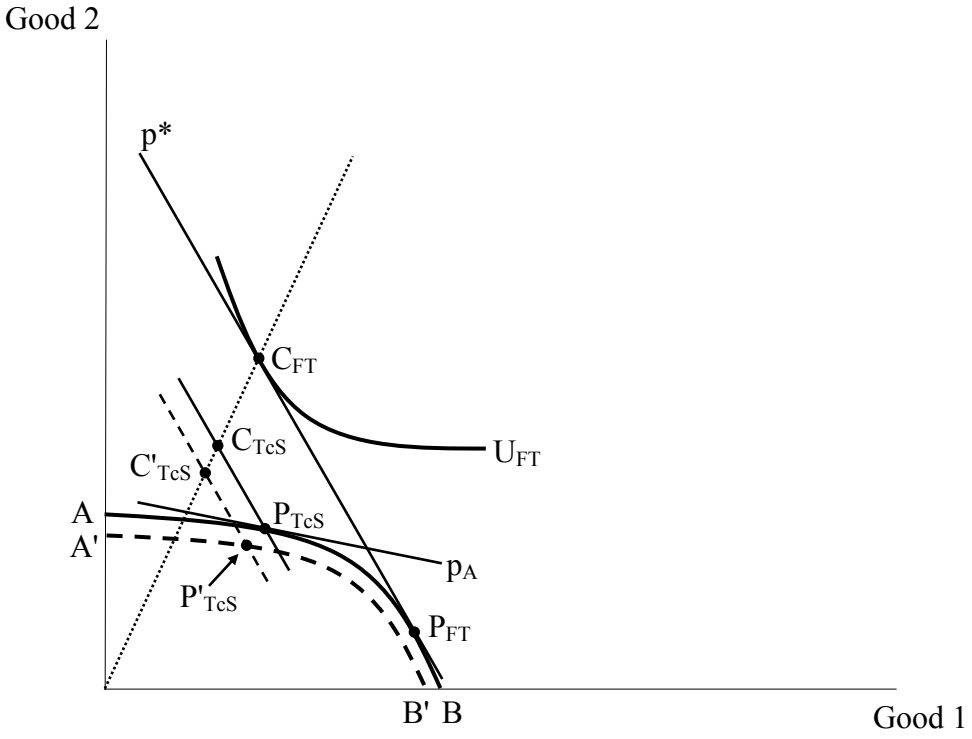
Suppose politicians do see the overall gains from free trade, but realize that the adverse income distribution effects – rising capital rewards and declining labor wages in our example – may make free trade a politically hazardous affair. Consequently, they might be interested to keep the income distribution as it was – the rigid solution – or at least such that some are better off but no one is worse off – the Pareto-optimal solution.[5] For both cases one could apply

[5] Our distinction fits in with Corden's (1997) distinction between Pareto optimality, agnostic, and social welfare function approaches to assessing welfare implications of trade and protectionism. The fit of our Pareto-optimal solution is clear while our rigid solution would be in line with the *conservative* social welfare function that Corden introduces as being "particularly helpful for understanding actual trade policies of many countries" (ibid, p. 74).

standard Lerner-diagrams[6] to show that for fixed factor endowments, both solutions imply that wage-rental ratios and capital-labor intensities should remain at pre-trade levels. This can be accomplished either by imposing a (prohibitive) tariff that makes the domestic price ratio equal to the pre-trade price ratio and moves the economy back to the autarky point, or by a tax-cum-subsidy scheme that invokes producers to make the same input choices as in the pre-trade situation but leaves consumers free to respond to the international price ratio.

It is again a textbook exercise to verify this by comparing Figure 2 with Figure 1. Both diagrams have been drawn for homothetic preferences, implying that the consumption ratio remains the same with increasing income as long as relative prices do not change. Hence for any given price ratio, the consumption expansion path is a straight line from the origin through the initial equilibrium point. We will return to this assumption further below. For now it suffices to say that assuming homothetic preferences facilitates the (graphical) analysis considerably.[7]

Figure 2: A tax-cum-subsidy scheme with and without collection costs



[6] The Lerner diagram is due to Lerner (1952) and posits a comprehensive graphical treatment of the relations between goods prices, factor prices, and factor intensities.

[7] Homothetic preferences imply that drawing one community indifference curve suffices to draw all consumption expansion paths.

In Figure 2 the production tax-cum-subsidy scheme is set up such that the economy produces at the same point as in autarky: P_{TcS} is at the same position on the ppf as P_A in Figure 1. If the domestic production point is unchanged, no one is made worse off due to trade. However, the relevant price for consumers is still determined at world markets. Assuming for now that the country is small and does not affect world market prices, the tax-cum-subsidy scheme leaves the international price unchanged and the consumption point is determined by the intersection of the consumption expansion path for free trade with the price line through P_{TcS}, which is given by a parallel shift of p* at point C_{TcS}. A higher consumption indifference curve is reached than under the case of a prohibitive tariff, which is represented by the autarky position. So the textbook result clearly speaks in favor of free trade with a tax-cum-subsidy scheme, which leads to higher welfare with unchanged factor allocations and without a change in factor prices.[8]

However, the costs of collecting taxes and disbursing subsidies also warrant analysis. This can be accommodated within Figure 2 by assuming that a tax-cum-subsidy bureaucracy consumes a certain portion of total production. Hence the ppf would move inward to A'B' in case of a tax-cum-subsidy scheme. By contrast, we assume that collecting tariff revenue is (relatively) costless in terms of bureaucracy, so the production point would remain on the ppf AB in case of a tariff. In choosing the optimal policy instrument to redress the income distribution effects of free trade, the textbook exercise no longer gives a clear answer. The government in our example now faces trade-offs: (i) a prohibitive tariff keeps the income distribution constant but foregoes all the gains from trade, (ii) the welfare gain of free trade may be small (or may even become negative) if the tax-cum-subsidy scheme comes with large bureaucracy costs such that the production point moves to P'_{TcS} and the consumption point moves to C'_{TcS}, and (iii) a non-prohibitive tariff would allow for some trade and hence for some welfare gains,[9] but the income distribution would be different from the pre-trade situation in the absence of further measures. Moreover, from a political economy point of view, import taxes also look much better on the budget, showing tariff revenues rather than subsidy outlays.[10] So for practical reasons, tariffs may become a first-best policy for partial income distribution repairs after all (Corden, 1997).

---

[8] A mathematical treatment of the welfare implications of using tax-subsidy schemes is given in Dixit and Norman (1980). See Appendix A for a summary of their elegant analysis.

[9] This would be indicated by a price line with a slope that is larger than the slope of the domestic price line and smaller than the slope of the international price line (not shown).

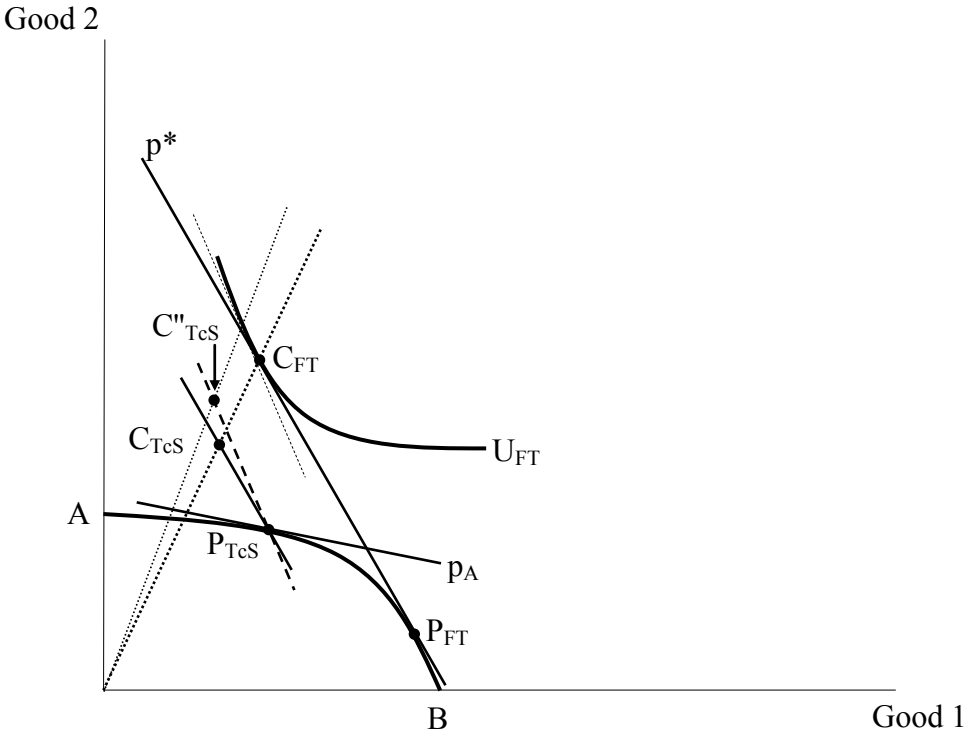
[10] Except for the case of a prohibitive tariff, when there would be no government revenue.

The preference for either policy option may also depend on a country's development level. Governments in relatively poor countries may find it easier, less costly and less cumbersome to implement import taxes rather than elaborated tax-cum-subsidy schemes. For instance, granting subsidies and levying taxes require more administrative capabilities from governments than collecting import tariffs, implying that governments in developing countries may have a relative preference for tariff revenues. Data taken from the World Bank's World Development Indicators show, for instance, that in 2002 the share of taxes on international trade in total revenue was on average 7 percent for low & middle income countries, whereas the reported average for high income countries was zero at that time. These data are consistent with the finding by Ebrill et al. (1999) that the share of trade taxes to GDP is inversely related to the level of development, with many low-income countries from Africa accounting for 5.5 percent of trade taxes to GDP on average in 1995, only marginally down from 6.7 percent in 1975. Gordon an Li (2005) suggest that the high tariff protection of capital intensive industries in developing countries reflects compensation for the typically differential taxation of capital intensive and labor intensive industries in developing countries.

Another complication for choosing the best policy option is related to the size of the country, in the sense that policy actions of large countries may influence world market prices. The textbook assumption is that a large country can improve its terms of trade by reducing its imports.[11] From this perspective, a tax-cum-subsidy scheme implies a terms of trade change that also leads to income distribution effects, which would have to be redressed as well. Hence for a large country, the information requirements to keep the income distribution at pre-trade levels are higher than for a small country. Figure 3 represents this additional information requirement, noting that the large country's consumption point would be C''_{TcS} instead of C_{TcS} if the tax-cum-subsidy scheme leaves the factor allocation unchanged and positively affects the terms of trade.

[11] The textbook assumption is that the Marshall-Lerner condition holds, as required for the stability of international equilibrium. The Marshall-Lerner condition asserts that the price elasticity of imports of the importing country is smaller than the price elasticity of the exporting country's exports. But the empirical evidence on price elasticities, and especially on supply elasticities, appears to be weak. For instance, Broda et al. (2008) conclude that almost all countries are large in world trade and hence can affect their terms of trade, whereas Magee and Magee (2008) conclude that not even the United States is a large country in world trade.

Figure 3: A tax-cum-subsidy scheme with terms of trade effects



We end this section with two further complications. First, our analysis rests on the assumption that the economy is diversified before and after trade liberalization. If so, the Stolper-Samuelson theorem holds and there is a direct and monotone link between goods prices and factor prices. But this is no longer true if the economy is fully specialized in one of its sectors. With full specialization, an increase in the domestic price of the imported good would affect all factors of production alike, reducing real incomes for all. The importance for policy is that such a situation would also increase the information requirements for taking optimal redistribution measures. Not only does it require insight into the extent of specialization of the economy, but also information is required as to the state of the economy before and after trade liberalization. Put differently, the appropriate policy intervention to redress the distributional effects of free trade also depends on the degree of specialization that is realized in the new equilibrium.

Second, our analysis has assumed homothetic preferences. But apart from the highest levels of aggregation, there is clear evidence that preferences are nonhomothetic. For example, Deaton and Muellbauer (1980) report that homotheticity is empirically rejected for all known household budget studies. Likewise, individuals in countries with lower per capita income tend to buy relatively simple products, e.g. Schott (2001). Furthermore, in the realm of international trade, Hunter and Markusen (1988) and Hunter (1991) report that as much as

29 percent of world trade may be caused by nonhomothetic preferences. Consequently, if the choices that people make not only depend on relative prices, but also on their income levels, any redistribution across income groups with different income levels will imply changes for the equilibrium that is achieved.[12]

4. Politicians may think partial equilibrium

So far the analysis has been cast in general equilibrium format. Arguably, governments may not have a general equilibrium framework in mind when contemplating whether or not to redress the income distribution in those sectors of the economy that are affected by a trade shock. Hence in order to better understand the alternatives for policy makers *as they perceive them*, it may be useful to switch from an economy-wide perspective to a sectoral level. Most politics is local, as they say.

Comparing alternative policies once again: Subsidies vs. tariffs

For a start, the income distribution effects of a more liberal trade regime are usually perceived as increases in bankruptcies and declining employment in import-competing sectors. The fact that production and employment go up in export sectors in response to a more liberal trade regime is much less noticed and debated in parliaments. Accordingly, partial equilibrium analysis may provide a more appropriate reference system to study political decision making, focusing as it does on production and consumption in one particular sector.

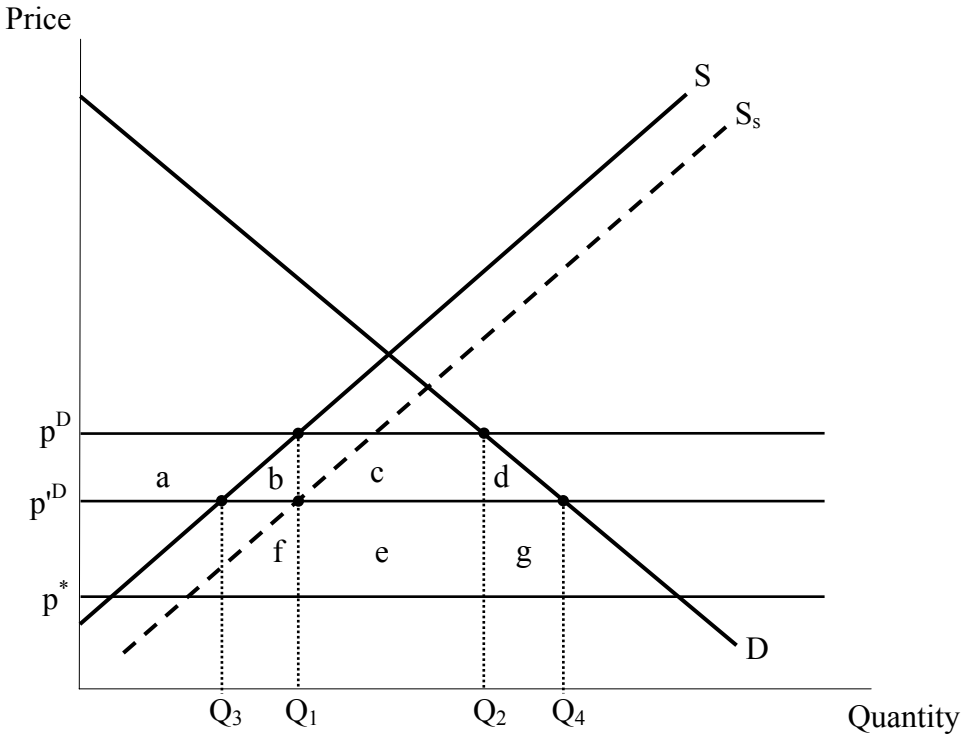
The partial equilibrium effects of alternative measures can be demonstrated by considering the textbook diagram of supply and demand for a single good (Figure 4). The initial domestic price of some import-competing commodity is p_D, which is equal to the price at world markets, p*, plus transportation costs. Suppose that due to a significant reduction in the costs of international transportation,[13] the transportation surcharge declines, lowering the domestic price to p'_D. Domestic production declines from Q_1 to Q_3 and employment goes down

[12] In a recent and preliminary paper, Broda and Romalis (2008) report that the income distribution effects on US citizens due to increased imports from China are less adverse for the low-income groups than is typically believed. Much of the rise in income inequality, they argue, has been offset by a relative decline in the price index for the poor, who benefited most from the lower-priced imports from China. This underlines the importance of treating preferences as nonhomothetic for making policy inferences.

[13] The decline in transportation and communication costs is seen as one of the main reasons for the globalization wave that started in the 1980s. See IMF (1997) and O'Rourke and Williamson (1999) for a comprehensive survey on this and other determinants of globalization.

accordingly. Hence domestic producers face a welfare loss, which is represented by the loss of producer surplus equal to area *a.* By contrast, domestic consumers of the import good gain from lower import prices. They increase their consumption from Q_2 to Q_4, so the consumer surplus increases by the area *a*+*b*+*c*+*d*. The net welfare gain for the sector as a whole is represented by the area *b*+*c*+*d*. The decline in transportation costs has expanded trade and thereby generated additional welfare, despite the decline in domestic employment in the import-competing sector.

Figure 4: Partial equilibrium analysis of policy instruments



If the government wants to retain sectoral employment levels, it may consider paying a subsidy *S* to local producers. The value of the subsidy is represented by the area *a*+*b,* which equals the difference between p_D and p'_D times the initial level of domestic production. The subsidy effectively shifts the domestic supply curve outward to S_{Sub}. Due to the subsidy, producers are willing to supply the same amount of their goods as before (read: employ the same number of workers as before), despite the lower market price p'_D. Hence domestic producers in fact get the price p_D and supply quantity Q_1, which means they regain the lost producer surplus *a* while restoring initial employment levels.

Domestic consumers are not directly affected by the subsidy because the market price is still p'_D. But the government pays a subsidy of *a*+*b*, so the net cost of fully redressing the income

distribution effects of lower transportation costs is equal to area *b*. Nevertheless, the decline in transportation cost is still beneficial for the sector as a whole. Even after restoring initial production and employment levels by way of a subsidy, a net welfare gain remains of *c*+*d*.[14] This welfare gain reflects that the amount of trade is still larger than before even with the subsidy to domestic producers.

As an alternative, the government may introduce an import tariff of p_D - p'_D to keep domestic prices at their initial level p_D. Like in the case of the subsidy, domestic production (and employment) is restored at Q_1. But different from the case of the subsidy, imports are also reduced to their initial level of Q_1Q_2. The net cost of introducing a tariff is thus represented by the area *b*+*d*, which results from a gain of producer surplus of *a*, a gain in tariff revenue for the government of *c*, and a loss of consumer surplus of *a*+*b*+*c*+*d*.

Compared to the subsidy policy, an import tariff additionally transfers welfare from consumers to government and leads to larger welfare losses for the sector as a whole. While subsidies only create a production distortion, a tariff also creates a consumption distortion. This familiar result underlines the general idea that policy actions should create as few distortions as possible, while targeting the problem one wishes to tackle. Put differently, a subsidy is clearly a less costly policy compared to a protectionist measure like a tariff when production and employment levels have to be restored to their initial levels.

These effects are qualitatively the same when there would be external pressure to reduce import tariffs, say by the WTO. For instance, import tariffs may decline from $p_D - p^*$ to $p'_D - p^*$. The effects for producers and consumers would be the same as in our previous example for a decline in transactions costs, but now the government is probably constrained in its subsidy policy because it may suffer from a loss of tariff revenue. Given the reduced import tariff, government revenue would change from *c*+*e* to *f*+*e*+*g*, so the net change in the government budget is represented by the area *f*+*g*-*c*, which can be positive or negative depending on the size of the tariff cut and on the elasticities of supply and demand.

For the sector as a whole, the tariff cut naturally has a positive welfare effect (*b*+*d*+*f*+*g*) because it increases the volume of trade. The costs of restoring initial production and employment levels by giving a subsidy would incur a net cost of *b*+*f*, since the government

[14] It should be noted at this point that the partial equilibrium view simply ignores that the net cost of the subsidy has to be financed by taxing some other sector (or other consumers), which will have further implications for aggregate output and employment.

would forego part of its tariff revenues by propping up domestic production. Hence what remains of the sectoral welfare gain after a compensation of the producers by a subsidy is represented by the area $d+g$.[15]

This is different from the net welfare gain that results from the previously discussed compensated decline in the commodity price due to lower transportation costs ($c+d$). Which welfare effect is bigger again depends on the elasticities of supply and demand and on the size of the actual change of the commodity price. But up to this point, there is no need to worry about a full compensation of the losers from market liberalization: a net welfare gain appears to remain in any case.

What if we also consider the distortionary effects of taxation?

So far we have taken for granted that the government is willing to incur net outlays to compensate producers when subsidizing them (the partial equilibrium view), or that the compensation of the losers is nothing but an otherwise neutral reallocation of welfare among producers, consumers, and the government. But the key point is that compensating the losers by distortionary taxation will lead to welfare losses in very much the same way in which market liberalization leads to welfare gains. So a priori it is an open question which welfare effect will dominate under full compensation: the negative effect of taxation or the positive effect of market liberalization.

To bring our example somewhat more in line with reality, we therefore assume that the government has to observe a budget constraint when it wants to compensate the losers and by doing so uses distortionary, not lump sum taxes. Here we consider a tax on the consumption of the import good. As any introductory textbook shows, such a tax will shift the demand curve inward, and this shift creates a welfare loss.[16]

The situation is depicted in Figure 5 for a tax rate that equals p_D-p'_D. Consumers pay a tax-inclusive price of p_D, but producers receive the subsidy-inclusive price p'_D. Accordingly, sup-

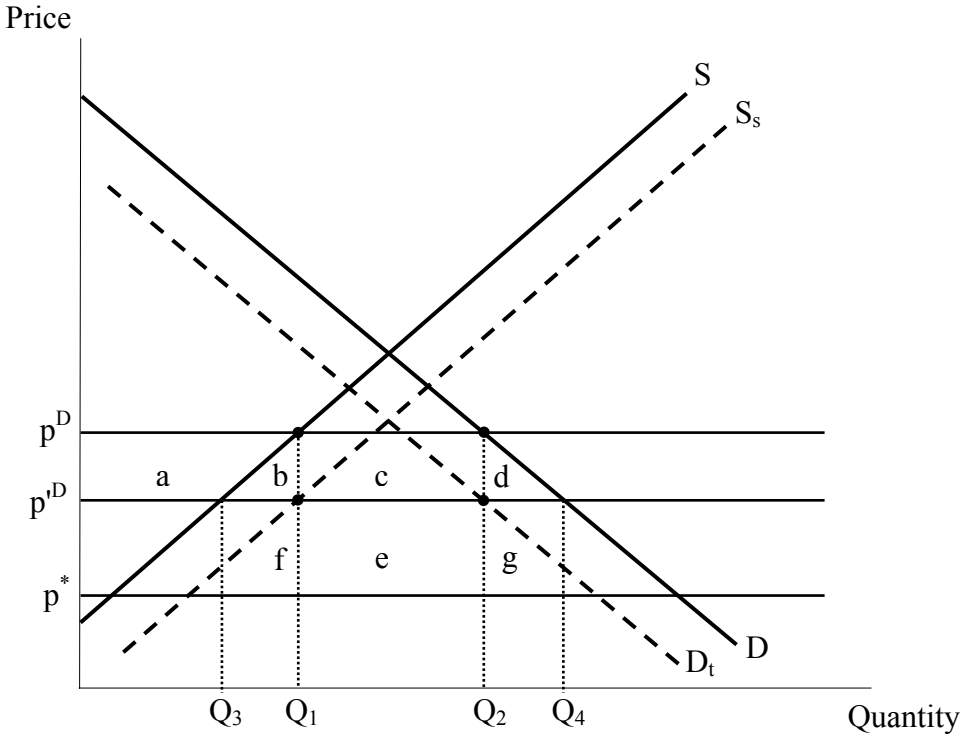
[15] For completeness' sake we note that using import tariffs instead to redress the income distribution effects – given the situation at hand a nonsensical policy option – would of course mean that the overall effect would be zero. Again, therefore, we see that the tariff instrument is societally more costly than an instrument that directly targets the problem.

[16] Government could also levy an import tariff to raise government revenue. For the total subsidy outlays to be recovered by tariff revenue, this would however imply a tariff-inclusive domestic price that lies above the initial price level p_d. We will not consider such a scheme of overcompensation here.

ply and demand remain at their original levels of Q_1 and Q_2, and their difference represents the level of imports. The net societal cost of paying the subsidy is again represented by *b*. The tax revenue equals *a*+*b*+*c*. The net societal cost of introducing the consumption tax is *d*, which reflects the reduced volume of imports due to the tax.

Subtracting the welfare loss due to the tax from the welfare gain that remains after the subsidy to producers (*b*+*c*+*d*), we see that an overall gain of *c* remains, which represents the gains from exchange, here in the form of tax revenue. But if the price cut had been due to a cut in import barriers, the net welfare effect of compensating the producers by a consumption tax would be zero conditional on the supply and demand elasticities assumed in Figure 5. This is because the welfare effect of a tariff cut is *b*+*d*+*f*+*g*, which reduces to *d*+*g* after implementing a subsidy scheme to producers. Additionally introducing a consumption tax implies a welfare loss of *d*+*g* because tariff revenue is also reduced by the consumption tax.

Figure 5: Partial equilibrium analysis of budget neutral policy instruments



In our example, these effects occur because the consumption tax is actually higher than would be needed to recover the outlays on subsidies. At least in theory, one could design a tax scheme such that it exactly yields an amount equivalent to *a*+*b*. As can be verified from the figure, this would imply a tax-inclusive consumer price smaller than p_D. A lower tax-inclusive consumer price would of course reduce the welfare costs of the tax instrument and at the same

time increase consumer welfare, so the net welfare gains of market liberalization would remain positive after compensating the losers with a subsidy.

But of course one could also imagine a less positive scenario. Consider an economy that at least partly relies on tariff revenue to finance its budget. With relatively inelastic supply conditions and relatively elastic demand conditions, this economy may easily end up with a net welfare loss if the consumption tax generates more revenue than necessary to pay for the subsidy. In that case, the area $d+g$ becomes larger than the area $f+b$. This highlights the importance for governments of knowing the exact situation before designing their redistributive policies. The question is, can they?

5. Information requirements and uncertainty

The previous sections have elaborated on the possibilities for governments to redress the income distribution effects of increased trade. The overall picture that emerges is that it is possible to restore the initial income distribution and that, provided an appropriate policy mix is chosen for the situation at hand, this can be accomplished without losing all of the initial gains from trade. In this section we focus on the information requirements for governments to determine such optimal policy mixes and on the importance of having accurate information in the first place.

We offer a simple mathematical digression that is reminiscent of the partial equilibrium situation of the previous section. Assuming linear supply and demand functions for the domestic sector, we have:

$$S_s^D = b(p^D + s) - a\,, \tag{1}$$

$$D_t^D = d - c(p^D + t)\,, \tag{2}$$

where a, b, c and d are positive constants and where s and t denote the specific rates of the production subsidy and the consumption tax, respectively. When these are zero, the standard demand and supply functions D and S follow; for positive subsidies and taxes, the functions correspond to D_t and S_t (see Figure 5).

The domestic price p^D equals the fixed world market price p^* plus transportation costs and/or import tariffs $\tau>0$. We will refer to τ as a general measure of a trade restriction, leaving it to the context whether it means transportation costs or import tariffs:

$$p^D = (1+\tau)p^*. \tag{3}$$

Import demand is a function of world market prices, conditional on trade restrictions and taxes and subsidies. Import demand is positive when the autarky price of the domestic economy exceeds $(1+\tau)\,p*$, which we assume:

$$\mathrm{Im}(p^*;\tau,t,s) = (d+a) - (c+b)(1+\tau)p^* - (c\,t + b\,s). \tag{4}$$

In order to assess reductions in τ and concomitant redistribution policies, we require a measure of welfare. In line with our graphical analysis in Section 4, welfare is defined as the sum of consumer surplus (CS), producer surplus (PS), and government revenue (GR):

$$W \;=\; CS \;+\; PS \;+\; GR. \tag{5}$$

Consumer surplus and producer surplus are given by $CS = D_t^D(.)^2 / 2c$ and $PS = S_s^D(.)^2 / 2b$. Government revenue is given by $GR = (t\,D_t^D - s\,S_s^D) + \tau p^* \mathrm{Im}(.)$, where the first term denotes the tax-subsidy part of the government budget and the second term the import tariff revenue part. Note that the second term of *GR* only appears when we interpret τ as import tariff, else it is zero.

Since we want to focus on redistributive government policy that is incepted as a response to a trade shock, we are first interested in the welfare effects in a situation without taxes and subsidies. Mathematically this implies that we take partial derivatives with respect to τ, s and t for all terms in (5) and evaluate outcomes for an initial situation of $\tau > 0$ and $s = t = 0$.

Relegating all derivations to the appendix, it is no surprise to find that the consumer surplus decreases and the producer surplus increases if τ falls: $d\,CS / d\tau < 0$ and $d\,PS / d\tau > 0$. The effect on government revenue is zero when τ denotes transportation costs and ambiguous if it denotes a fall in import tariffs. The ambiguous effect arises because imports go up, but the tariff rate goes down. Overall welfare increases when τ falls: $d\,W / d\tau < 0$. This is irrespective of the reason for the decline in τ.

The next step is to assume that the government wants to fully compensate the losses of its domestic producers due to the opening of the market (the decline in τ) without generating a budget deficit. Consequently, the government will set the production subsidy such that $d\,PS / d\tau + d\,PS / ds = 0$, hence $d\,s = -p^{*} d\tau > 0$ for $d\tau < 0$. The consumption tax is set such that $D_t^D dt - S_s^D ds = 0$, implying $dt = -p^{*} S_{s=0}^D / D_{t=0}^D d\tau > 0$ when *s* and *t* are initially zero. This expression however ignores the negative effects of the subsidy and the tax on tariff revenue. We therefore refer to this situation as limited budget neutrality.

We refer to full budget neutrality if the government also wants to neutralize the effects of the subsidy and the tax on tariff revenues, noting that it would imply setting a higher tax rate:

$$dt = -p^{*} \frac{S_{s=0}^D + b\tau p^{*}}{D_{t=0}^D - c\tau p^{*}} d\tau . \tag{6}$$

The above makes clear that to set subsidies and taxes optimally, governments require information on many aspects. For a start, the appropriate subsidy rate necessary to compensate domestic producers requires insight in the world market price and the effective change in τ, which may be difficult in case τ refers to transportation costs. When the government actually wants to design budget neutral policies, additional information is required on the parameters of the domestic supply and demand functions. For large countries able to influence world market prices, also information on demand and supply elasticities on the world market would be required.

All this is probably more than can be hoped for. Moreover, also the accuracy of the information is an important concern. To make this clear, suppose that the government's information on the initial trade shock is incorrect, assessing it to be $\varepsilon d\tau > d\tau$ (with $\varepsilon > 1$). Consequently, it will set the subsidy rate and concomitant tax rate too high, which will affect overall welfare. Table 1 lists alternative welfare outcomes conditional on the quality of information as regards the trade shock $d\tau$. The calculations underlying these results are presented in appendix B.

Table 1: Welfare effects after income compensation with distortionary taxation

	Decline in import tariff		*Decline in transportation cost*	
	Correct information	Incorrect information	Correct information	Incorrect information
Limited budget neutrality	positive	ambiguous	positive	ambiguous
Full budget neutrality	ambiguous	ambiguous	positive	ambiguous

When the government has correct information, a fall in transportation costs and subsequent tax-cum-subsidy income redistribution increases welfare unambiguously, irrespective of the type of budget neutrality. When import tariffs decline, however, welfare increases in the case of limited budget neutrality, but becomes ambiguous in the case of full budget neutrality. However, welfare effects become ambiguous when the government uses incorrect information to determine its redistributive policies. Income redistribution policies designed with incomplete information may thus turn positive welfare gains of market liberalization into welfare losses.

The effects highlighted in Table 1 are based on an initial situation without taxes and subsidies. If such distortions would be present as well, more ambiguity arises, also when the government uses correct information. Having taxes and subsidies right from the start does not change the way the government sets optimal subsidies, but the tax response to neutralize the effect on the budget of those subsidies is larger. This reduces the overall positive welfare effects in case of a fall in transportation costs, and leads to further ambiguity when a fall in import tariffs is concerned. More generally, the potential welfare costs of inaccurate information are increased: Ensuring welfare gains after compensating redistribution becomes harder when taxes and subsidies are already in place.

5. Conclusion

Trade is welfare improving but compensating its income distribution effects is less straightforward than economists typically admit. Trade can be made Pareto-optimal, but this requires that governments make the right choice regarding the policy package to be used and that the information on which governments base their decisions is correct and complete. If this is not

the case, an income redistribution scheme may nullify the original gains from trade or even worse. This is a real hazard, even when governments know that it is best to choose a tax-cum-subsidy scheme over other types of policy interventions.

These conclusions are derived from a highly stylized analysis that ignores many other real-world issues that are important for assessing the overall welfare and redistribution effects of free trade. For example, the number of trade partners involved, the size of a country and the collecting and disbursement costs of taxes and subsidies all matter for deciding on the optimal policy intervention. Since the main reason for the potential hazard of income redistribution for welfare is the completeness and reliability of information regarding demand and supply conditions, both on domestic markets as well as abroad, including these issues clearly strengthens the importance of having the right information. Our tentative conclusions are also supported by the multiple distortions that abound in modern economies, so it is probably not overly surprising that politicians more often than not consider market liberalizations as a hazardous affair.

Apart from the crude protectionism of vested interests, politicians may therefore also have a point from an overall welfare perspective. Since they know that from a political perspective any trade shock warrants income redistribution, the risk of ending up in a situation that is worse than before makes it economically sensible to avoid trade shocks. This is not to deny that there are also large potential gains of market liberalization. Probably the most important economic reason for trade liberalization is that it could involve dynamic gains, for instance pro-competitive effects or economic scale effects. However, assessing the dynamic gains requires even more detailed information to decide on optimal policy interventions than assessing the comparative static effects discussed here. Hence it is quite understandable that political decision makers refrain from sweeping market liberalization once efficiency is not the only concern that matters.

References

Broda, C., N. Limao, and D.E. Weinstein (2008). Optimal Tariffs and Market Power: The Evidence. *American Economic Review* 98(5): 2032–65.

Broda, C., and J. Romalis (2008). Inequality and Prices: Does China Benefit the Poor in America. Paper presented during ETSG 2008 meetings in Warsaw, Poland, 11–13 September 2008.

Corden, W.M. (1997). *Trade Policy and Economic Welfare*, second edition. Oxford: Oxford University Press.

Ebrill, L, J. Stotsky, and R. Gropp (1999). Revenue implications of trade liberalization. *IMF Occasional Paper No 180*. International Monetary Fund, Washington DC.

Deaton, A., and J. Muellbauer (1980). *Economics and Consumer Behavior*. New York: Cambridge University Press.

Dixit, A., and V. Norman (1980). *Theory of International Trade.* London: Cambridge University Press.

Dixit, A., and V. Norman (1986). Gains from trade without Lump-Sum Compensation. *Journal of International Economics* 21: 111–122.

Gordon, R., and W. Li (2005). Tax Structure in Developing Countries: Many Puzzles and a Possible Explanation. NBER Working Paper 11267. NBER, Washington, D.C.

Graaff, J. De V. (2008). Lump sum taxes. In S.N. Durlauf and L.E. Blume (Eds.), *The New Palgrave Dictionary of Economics*. Palgrave Macmillan, The New Palgrave Dictionary of Economics Online, Palgrave Macmillan, accessed on 04 November 2008.

Hoekman, B.M., and M.M. Kostecki (2001). *The Political Economy of the World Trading System*. Oxford: Oxford University Press.

Hunter, L.C. (1991). The Contribution of Nonhomothetic Preferences to Trade. *Journal of International Economics* 30: 345–58.

Hunter, L.C., and J.R. Markusen (1988). Per-Capita Income as a Determinant of Trade. In R. Feenstra (Ed.), *Empirical Methods for International Trade*. Cambridge, Mass.: MIT Press.

IMF (1997). World Economic Outlook: Globalization; Opportunities and Challenges. Washington, D.C.: International Monetary Fund.

Kemp, M., and H. Wan Jr. (1995). On lumpsum compensation. In M. Kemp (Ed.), *The gains from trade and the gains from aid*. New York: Routledge, 296–316.

Lerner, A. P. (1952). Factor Prices and International Trade. *Economica* 19(73): 1–18.

Magee, C.S.P., and S.P. Magee (2008). The United States is a Small Country in World Trade. *Review of International Economics* 16(5): 990–1004.

O'Rourke, K.H., and J.G. Williamson (1999). *Globalization and History: The Evolution of a Nineteenth-Century Atlantic Economy*. Cambridge, Mass.: The MIT Press.

Schott, P.K. (2001). Do Rich and Poor Countries Specialize in a Different Mix of Goods? Evidence from Product level U.S. Trade Data. *NBER Working Paper 8492*. NBER, Washington, D.C.

Sinn, G., and H.-W. Sinn (1992). *Jumpstart: the Economic Unification of Germany.* Cambridge, Mass.: MIT Press.

Wan, H. Jr. (1997). A note on compensation schemes. *The Japanese Economic Review* 48(2): 147–155.

Wong, K-Y. (1997). Gains from trade with lump-sum compensation. *The Japanese Economic Review* 48(2): 132–146.

APPENDIX

A. Dixit and Norman (1980) analysis

To see that trade can be made Pareto-efficient, suppose a competitive economy where consumers offer different endowments as inputs to producers. The overall endowments of the economy are denoted by the vector L. In autarky this leads to (a vector of) prices p^A, (a vector of) outputs x^A and (a vector of) consumption c^A. The rewards for the endowments are (the vector) w^A. Consequently, autarky value of production is $p^A x^A$, which equals total expenditures $p^A c^A$ and, in a competitive economy, total payments to the owners of endowments $w^A L$. Trade would lead to different prices, output and consumption than in autarky and these are given by the vectors p*, x* and c*, respectively. Also the rewards to endowments change: w*. Due to specialization patterns, owners of abundant endowments will be better paid, while owners of scarce endowments will lose.

If government desires to retain to the original income distribution, it should ensure that consumers pay the same prices as before (p^A) and earn the same factor income (w^A). Governments may do this by designing appropriate tax and subsidy schemes. If they can design these such that consumers' real income remains at pretade levels, yet generating a net government revenue, then trade can be made Pareto optimal. That is, governments have room for extra outlays without making anyone worse off.

To see that this is possible, the key issue is that the value of post-trade production after trade at post-trade prices is higher that the value of pretrade production at post-trade prices. Mathematically,

$$p^*x^* \geq p^*x^A = p^*c^A \tag{A1}$$

since $x^A=c^A$ in the pretrade situation. This follows from the nature of a competitive equilibrium, where prices and output are jointly determined to maximize profits. Hence, if any other combination of post-trade prices and output, for instance p* and x^A, would imply higher profits, then x* would not have been the post-trade equilibrium output vector in the first place. In terms of standard 2-goods production possibility frontier (ppf) diagrams: the p* is tangent to the ppf at x* and would cut it at any other value of x.

The tax and subsidy scheme essentially boils down to the government buying c^A on goods at p* from producers at home and abroad, selling these to consumers at prices p^A. The net revenue of this would be $(p^A - p^*) c^A$. Likewise, the government buys endowments from consumers at price w^A, selling these to producers at w^*. The net revenue of this would be (w^*-w^A) L. Consequently, total government revenue is:

$$(pA - p^*)\, cA + (w^*-wA)\, L = p^*x^* - p^*cA \tag{A2}$$

since $p^A c^A = w^A L$ and $w^* L = p^* x^*$. By virtue of (A1) the net revenue for government is therefore positive and trade can be made Pareto-efficient.

B. Derivations Mathematical Example

For the model depicted in Section 5, the expressions for consumer surplus, producer surplus and government revenue become:

$$CS = D_t^d(.)^2 / 2c = \left[(d - ct) - c(1+\tau)p^*\right]^2 / 2c \tag{B1}$$

$$PS = S_s^d(.)^2 / 2b = \left[(bs - a) + c(1+\tau)p^*\right]^2 / 2b \tag{B2}$$

$$\begin{aligned} GR = (tD_t^d - sS_s^d) + \tau p^* \,\mathrm{Im}(.) \quad = \quad & t(d - tc) + s(a - sb) - (tc + sb)(1+\tau)p^* \\ & + \tau p^* \left[(d + a) - (c + b)(1+\tau)p^* - (ct + bs)\right] \end{aligned} \tag{B3}$$

Taking the first derivative of these expressions with respect to τ:

$$dCS / d\tau = -p^* D_t^d(.) < 0;$$

$$dPS / d\tau = p^* S_s^d(.) > 0;$$

$$dGR / d\tau = p^* \,\mathrm{Im}(.) - \tau(c + b)p^{*2} - (tc + sb)p^*$$

where the effect on government revenue only occurs when τ denotes import tariffs. The change in overall welfare is obtained by adding these effects, yielding:

$$dW / d\tau \quad = \quad \begin{array}{ll} -p^* \,\mathrm{Im}(.) < 0 & (transportation) \\ -\tau(c + b)p^{*2} - (tc + sb)p^* < 0 & (tariff) \end{array}$$

To neutralize the negative effects of the decline in τ on producer surplus, government chooses s such that $(\partial PS / \partial \tau)d\tau + (\partial PS / \partial s)ds = 0$. This yields $S_s^d(.)\left[ds + p^* d\tau\right] = 0$ implying:

$$\mathrm{ds} = -\,\mathrm{p}^* \mathrm{d}\tau\,. \tag{B4}$$

This relationship holds irrespective of whether or not there are taxes and subsidies initially. The tax rate to be chosen to cover the outlays on subsidies requires $dGR = D_t^d\,dt - S_s^d\,ds = 0$ and hence

$$\mathrm{d}t = \mathrm{S}_\mathrm{s}^\mathrm{d}/\mathrm{D}_\mathrm{t}^\mathrm{d}\mathrm{d}s = -p^*\mathrm{S}_\mathrm{s}^\mathrm{d}/\mathrm{D}_\mathrm{t}^\mathrm{d}\mathrm{d}\tau\,. \tag{B5}$$

When τ involves import tariffs, government may also desires to take into account the effect of taxes and subsidies on tariff revenue. In that case, the budget neutral tax increase becomes:

$$\mathrm{d}t = -\mathrm{p}^* \frac{\mathrm{S}_\mathrm{s}^\mathrm{d} + b\tau p^* + sb}{\mathrm{D}_\mathrm{t}^\mathrm{d} - c\tau p^* - ct}\mathrm{d}\tau\,. \tag{B6}$$

When evaluated at *t=s=0* the optimal tax rates declines compared to (B6). The *sb* and *ct* terms vanish, while $\mathrm{S}_{\mathrm{s}=0}^\mathrm{d} < \mathrm{S}_\mathrm{s}^\mathrm{d}$ and $\mathrm{D}_{\mathrm{t}=0}^\mathrm{d} > \mathrm{D}_\mathrm{t}^\mathrm{d}$

The overall welfare effects, including the welfare effects of income redistribution policies, can be calculated as the outcome of:

$$\begin{aligned} dW \;=\; & \left(\partial CS/\partial\tau + \partial PS/\partial\tau + \partial GR/\partial\tau\right)d\tau \\ & + \left(\partial CS/\partial s + \partial PS/\partial s + \partial GR/\partial s\right)ds \\ & + \left(\partial CS/\partial t + \partial PS/\partial t + \partial GR/\partial t\right)dt \end{aligned}$$

Using B1–B3 to calculate the partial derivatives and applying B4 and B5 or B6 yield, after rearranging, the following outcomes.

Table B1: Welfare effects of income compensation with distortionary taxation, correct information case

	dW/dτ (τ is import tariff)	dW/dτ (τ is transportation cost)
Limited budget neutrality	$-(c\tau p^* + ct)\left(1 - \frac{S_s^d}{D_t^d}\right)p^* < 0$	$-\mathrm{Im}(.)p^* - ctp^*\left(1 - \frac{S_s^d}{D_t^d}\right) < 0$
Full budget neutrality	$-(c\tau p^* + ct)\left(1 - \frac{\mathrm{S}_\mathrm{s}^\mathrm{d} + b\tau p^* + sb}{\mathrm{D}_\mathrm{t}^\mathrm{d} - c\tau p^* - ct}\right)p^*$	$-\mathrm{Im}(.)p^* - ctp^*\left(1 - \frac{S_s^d}{D_t^d}\right) < 0$

To investigate the effects of inaccurate information on part of the government, suppose government assesses the initial trade shock as $\varepsilon d\tau$ with $\varepsilon>1$ instead of its actual value $d\tau$. Using tildes to indicate outcomes based on the wrong information, this implies $d\tilde{s} = \varepsilon ds > ds$ and $d\tilde{t} = \varepsilon dt > dt$. The welfare effects change according, implying ambiguous welfare effects for all cases.

Table B2: Welfare effects of income compensation with distortionary taxation, incorrect information case

	$dW/d\tau$ (τ is import tariff)	$dW/d\tau$ (τ is transportation cost)
Limited budget neutrality	$-(c\tau p^* + ct)\left(1-\varepsilon\frac{S_s^d}{D_t^d}\right)p^*$ $+(\varepsilon-1)(bs+b\tau p^*)$	$-\mathrm{Im}(.)p^* - ctp^*\left(1-\varepsilon\frac{S_s^d}{D_t^d}\right)$ $+(\varepsilon-1)bs$
Full budget neutrality	$-(c\tau p^* + ct)\left(1-\varepsilon\frac{S_s^d + b\tau p^* + sb}{D_t^d - c\tau p^* - ct}\right)p^*$ $+(\varepsilon-1)(bs+b\tau p^*)$	$-\mathrm{Im}(.)p^* - ctp^*\left(1-\varepsilon\frac{S_s^d}{D_t^d}\right)$ $+(\varepsilon-1)bs$

When evaluated at *t=s=0* the results in Tables B1 and B2 substantiate the information displayed in Table 1 in the main text.