MEASURING THE RESTRICTIVENESS

OF INTERNATIONAL TRADE POLICY

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Preface

Karl Marx said that man was born free but is everywhere in chains. International trade, by contrast, has never been unfettered and remains significantly restricted, globalisation notwithstanding. For students of the subject, this poses problems of theory, policy, and measurement. Measurement is the Cinderella of this trio, because theorists have paid little attention to the measurement of trade restrictions, leaving practitioners to make do with *ad hoc* solutions.

In this book we present an approach to the problem of measuring trade restrictiveness which we have developed over the past fifteen years. Whereas the standard theory of index numbers applies to prices, output or productivity, we develop new index numbers which apply directly to policy variables. Our theoretical work builds on the standard theory of policy reform in open economies and extends it in a number of directions. We also illustrate how our indices can be applied, under a variety of simplifying assumptions, and show that they make a big difference to the assessment of trade restrictiveness. The book thus attempts to present our results in a way which will appeal to both of our potential audiences: to convince our theoretically-minded colleagues that the problem is an important one and that our answer is the correct one; and to give practitioners an analytical base and some practical tools for applying our ideas.

Like all authors we hope that every reader will read the book carefully from beginning to end. However, recognising that life is short and books are long, let us give some recommendations for more selective readings. Those who want a non-technical introduction to the book should read Chapters 1 and 2 and look at some of the empirical results in part C, especially Chapter 14. Theorists and graduate students will want to concentrate on Part B. Here, Chapters 4 and 5 are the analytic core of the book, presenting the two principal indices we propose. They are sandwiched between chapters which deal with the theory of trade policy reform. Chapter 3 summarises the standard results in the field, while Chapter 6 extends it in new directions, showing how the effects of trade policy on welfare and market access can be expressed in terms of the mean and variance of the tariff distribution. Chapters 7 and 8 detail the additional complications which arise for theory and measurement when trade is restricted by quotas as well as tariffs. Chapter 9 extends our indices to economic environments other than the competitive small open economy, while Chapter 10 shows how they relate to other ways of aggregating trade restrictions.

Finally, those interested mainly in applications will want to skim Part B for background and concentrate on the empirical work in Part C. This applies our approach to a range of issues, including the trade restrictiveness of domestic distortions and the use of a computable general equilibrium model to calculate the measures of trade restrictiveness we propose. While these applications show the potential of our indices in applied work, the principal contribution of our approach is conceptual. To take an analogy from better-known index numbers, the Konüs true cost-of-living index has not supplanted fixed-weight consumer price indices in practice. In the same way, we do not expect that our approach will put an end to the calculation of trade-weighted indices of average tariffs. However, we hope that readers of this book will come away with a clearer understanding of their deficiencies and of the circumstances when they can be expected to approximate the theoretically ideal indices we present.

Many individuals have contributed in person to our thinking on these issues. In addition to those mentioned elsewhere, we would like to thank Patrick Honohan, Ian Jewitt, Ron Jones and

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Portions of this book have appeared in different forms in a number of journals, including *Econometrica*, the *International Economic Review*, the *Journal of International Economics*, the *Review of Economic Studies*, the *Review of International Economics*, and the *World Bank Economic Review*, as well as in collected works edited by Ron Jones and Anne Krueger (*The Political Economy of International Trade*, published by Basil Blackwell) and by Bob Baldwin (*Empirical Studies of Commercial Policy*, published by the University of Chicago Press). We are grateful to the editors and referees of these books and journals for invaluable comments and also to the publishers for permission to reprint excerpts here.

In addition to our home universities, Boston College and University College Dublin, a number of institutions have provided stimulating research environments and substantive support during the writing of this book. Some of the chapters originated as components of a World Bank project. Refik Erzan and Will Martin at the World Bank, with the support of Ron Duncan and Ravi Kanbur, provided indispensable moral and material sustenance for our efforts. Jim Anderson wishes to thank the Institute for International Economic Studies at the University of Stockholm. Peter Neary's work was made possible by a Visiting Research Professorship at the University of Ulster at Jordanstown in Northern Ireland and his more recent work on the project forms part of the International Economic Performance Programme of the Centre for Economic Performance at the London School of Economics, funded by the UK Social Science Research Council, and of the International Trade and Investment Programme of the Institute for the Study of Social Change at University College Dublin. He also wishes to thank the Social Science Research Council of the Royal Irish Academy and the European Community's Human Potential Programme under contract HPRN-CT-2000-00069 [EGEMTPS]. Finally, the Centre for Economic Policy Research helped to circulate early versions of all our papers and also financed many of the workshops at which a number were presented. The hospitality and support of all these bodies is gratefully acknowledged but they should not be held responsible for any of the views expressed.

PART A: THE PROBLEM

Chapter 1: Introduction

The influence of a country's trade policy on its economic well-being is one of the most widely-debated topics in economics. Yet, the prior question of how the stance of trade policy should be measured has received very little attention in the past. Typically, this is done in practice using a variety of *ad hoc* measures such as the trade-weighted average tariff, the coefficient of variation of tariffs or the non-tariff-barrier coverage ratio. But all these measures lack any theoretical foundation and are subject to theoretical and practical drawbacks. Some researchers, such as Papageorgiou et al. (1991), have constructed subjective measures of trade restrictiveness. These have the advantage of incorporating important local considerations but they are inherently difficult to compare across different countries or time periods.

The problem of how the restrictiveness of trade policy should be measured is not so severe in the textbook world where trade barriers take a single and well-defined form. But in most real-world situations, especially in developing countries, actual systems of trade intervention are pervasive and highly complex. This poses a challenge for analysts and policy-makers alike. In the face of a bewildering array of tariffs and quantitative restrictions, it is extremely difficult to assess the true orientation of a country's overall trade policy or to evaluate the thrust of a package of policy changes which encourage trade in some product lines but discourage it in others.

Traditional analysis provides little guidance on how to aggregate restrictions across different markets. This makes it difficult to evaluate proposals for trade liberalization which form part of a stabilization package or to assess the progress made in moving towards less restricted trade. A further reason for seeking a framework within which trade policies can be compared consistently is of analytical as well as practical importance. Since ultimately the case for free trade is a scientific hypothesis, theoretically sound but potentially false, some measure of trade restrictiveness is necessary if satisfactory tests of the impact of trade on growth and economic performance are to be possible.[1]

This book describes an approach we have developed which provides theoretically satisfactory yet practically implementable procedures for measuring the restrictiveness of trade policy. Two relatively recent developments have made this approach possible. At a theoretical level, the normative theory of international trade has been formalized in a systematic way and extended to take account of varieties of trade policy other than tariffs.[2] And, at a practical level, the rapid increase in availability of cheap computing power has made possible the implementation of models with a disaggregated structure which comes closer than ever before to the complexity of real-world protective structures. Later in the book, we describe how the approach we propose can be implemented on a personal computer. First, we examine the conceptual problem in more detail, show how different aspects of trade policy regimes can be incorporated into a single measure, the Trade Restrictiveness Index, and review some of the theoretical extensions and applications of this Index.

Figure 1.1 About Here

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[1] Leamer (1988b) and Edwards (1992) propose and implement tests along these lines, adopting the Heckscher-Ohlin explanation of trade patterns as a maintained hypothesis. Krishna (1991) and Pritchett (1996) review this and other approaches to measuring openness and trade restrictiveness.

[2] Dixit (1986) and Anderson (1988 and 1994) provide overviews of work in the field.

The simplest context in which measuring trade restrictiveness arises is when tariffs are the only form of trade policy. Figure 1.1 illustrates the market for a single good whose world price (assumed given) is π^* and whose home import demand curve is $m(\pi)$. Domestic producers and consumers face a price which is raised by the tariff to π^0. Adopting a partial equilibrium perspective for the moment, the deadweight loss, or cost of protection, is measured by the Marshallian triangle *ABC*. As for the restrictiveness of trade policy, in this one-good context it can obviously and unambiguously be measured by the height of the tariff, the distance *BC*. However, once we move beyond the simple one-good case, it is not immediately clear what is meant by the restrictiveness of trade policy, far less how we might go about measuring it. Just as in Figure 1.1, it is not the same as the welfare cost of protection, though we will see that one natural way to measure trade policy restrictiveness uses that welfare cost as a benchmark. The next chapter presents a mainly diagrammatic analysis of an extended two-good example which introduces these issues, and prepares the way for the general theoretical treatment in Part B of the book.

Chapter 2: Measuring Trade Policy Restrictiveness: A Non-Technical Introduction

What do we mean by a measure of "trade policy restrictiveness"? In principle, we mean some scalar index number which aggregates the trade restrictions that apply in a number of individual markets. Whether a particular index number formula is satisfactory depends on the uses to which the measure of restrictiveness is to be put. Some indices are fully satisfactory for one purpose but quite misleading for another. Other indices, lacking a clear theoretical foundation, are not satisfactory for any purpose. In this chapter we provide an intuitive introduction to our index in relation to its purpose and discuss how other indices used for the same purpose fall short.

The main focus of this book is on the Trade Restrictiveness Index, or TRI, an index which aggregates trade restrictions while holding constant the level of real income. This is the natural aggregate to use in studies which attempt to link growth in income to measures of a country's trade policy stance. It would not make sense to "explain" income growth in terms of a measure of trade policy which itself varies with income. The TRI is also the natural index to use in evaluating a country's progress towards trade liberalization, for example, in the context of the World Bank's Structural Adjustment Loans. Since loan conditionality is predicated on the assumption of a link between trade policy and income growth, it is desirable to measure the two concepts independently.

The book also discusses a different measure of trade restrictiveness which is appropriate for other purposes. In a trade negotiations context, where foreign exporters are concerned with domestic market access, it makes sense to aggregate trade restrictions in a way which holds constant the volume of imports rather than real income. An index of this type is discussed informally below and considered formally in Chapter 5.

Before considering how an ideal measure of trade restrictiveness might be constructed, we review the measures which have been used in practice to aggregate across tariffs. (We postpone consideration of quotas until Chapter 7.) These include different measures of average tariffs and alternative measures of tariff dispersion, such as the standard deviation and coefficient of variation of tariffs. We illustrate the properties of these measures and contrast them with those of our alternative welfare-based measure in a very simple context, a linear two-good partial-equilibrium model. In subsequent chapters we will see how our measure can be applied in much more general contexts.

2.1 The Trade-Weighted Average Tariff

Especially when data are particularly poor, it is not unknown for analysts to compute the simple (i.e., unweighted) average of tariff rates across different commodities. However, this measure has obvious disadvantages: it treats all commodities identically, and it is sensitive to changes in the classification of commodities in the tariff code. Clearly, tariffs should be weighted by their relative importance in some sense. The simplest and most commonly-used method of doing so is to use actual trade volumes as weights. This leads to the *trade-weighted average tariff*, τ^a:

$$\tau^a \quad \equiv \quad \frac{\Sigma\, m_i t_i}{\Sigma\, m_i \pi_i^*} \qquad \textbf{(1)}$$

where t_i is the specific tariff on good i, m_i is its import volume and π_i^* its world price. This index is very easy to calculate: it equals total tariff revenue, $\Sigma\, m_i t_i$, divided by the value of imports at world prices, $\Sigma\, m_i\pi_i^*$. The average tariff can be rewritten as a weighted average of tariff rates:

$$\tau^a \quad = \quad \Sigma\, \omega_i^* \tau_i\,, \qquad\qquad \omega_i^* \quad \equiv \quad \frac{m_i \pi_i^*}{\Sigma\, m_j \pi_j^*}\,, \tag{2}$$

where τ_i (equal to t_i/π_i^*) is the *ad valorem* tariff rate on good *i*. Note that the weights ω_i^* are valued at world prices π_i^* rather than at domestic prices π_i.

Despite its convenience, the trade-weighted average tariff runs into difficulties immediately. As the tariff on any good rises, its imports fall, so the now higher tariff gets a *lower* weight in the index. For high tariffs this fall in the weight may be so large that the index is *decreasing* in the tariff rate. (Recalling that the numerator of τ^a is tariff revenue, a necessary condition for this is that the tariff rate is on the wrong side of the Laffer Curve.) More subtly, tariffs have greater effects on both welfare and trade volume when they apply to imports in relatively elastic demand; but it is precisely these goods whose weights fall fastest.

Figure 2.1 About Here

Figures 2.1 to 2.3 illustrate these considerations in a linear two-good example. Each panel of Figure 2.1 depicts the domestic market for one of the goods, whose home import demand curve is $m_i(\pi_i)$, $i=1,2$. For ease of exposition, the world prices of the two goods, π_1^* and π_2^*, are normalised at unity. Domestic producers and consumers face the tariff-inclusive prices π_i^0, represented by *QC* for good 1 and *QD* for good 2. As drawn, the import demand curve for good 1 is more elastic than that for good 2, whereas good 1 has a lower tariff than good 2. So, in this example, tariff rates and import demand elasticities are negatively correlated. The trade-weighted average tariff, obtained by weighting the two tariff rates by the imports (valued at world prices) of the two goods, *AO* and *OF*, is indicated by τ^a.

Figure 2.2 About Here

Next, consider a change in trade policy which leads to the situation illustrated in Figure 2.2. The two import demand functions are the same but the configuration of tariff levels is reversed: now, the correlation between demand elasticities and tariff levels is positive rather than negative. In the left-hand panel, imports of the more elastic good 1 are almost eliminated, so its high tariff receives a very low weight in the average tariff. In the right-hand panel, the low tariff on the low-elasticity good 2 receives a high weight. As a result, the calculated average tariff (again denoted by τ^a) is low, considerably lower than that in Figure 2.1. Yet, it seems intuitively obvious that trade is more restricted in Figure 2.2 than in Figure 2.1, since both welfare and the volume of trade have fallen. (Given the partial equilibrium perspective of this chapter, the deadweight loss or welfare cost of protection resulting from the two tariffs is measured by the sum of the Marshallian triangles *BAH* and *EFJ*. The volume of trade equals *AF* in both figures.) The index has thus moved in the wrong direction, since its value has fallen even though trade is now more restricted.

Figure 2.3 About Here

The comparison between Figures 2.1 and 2.2 is extended and illustrated from a different perspective in Figure 2.3. For the same demand functions as before, Figure 2.3 plots the trade-weighted average tariff as a continuous function of the tariff rates on the two goods.[3] Clearly, for similar tariff rates, the trade-weighted average tariff performs reasonably well. In the special case of identical tariff rates (along the diagonal of the three-dimensional surface), the index number problem disappears. However, for non-uniform tariffs, the trade-weighted average tariff gives a very misleading indication of the magnitude and even of the direction of change in trade policy. The most striking feature of Figure 2.3 is that the trade-weighted average tariff actually *declines* in τ_1, the tariff rate on the higher-elasticity good 1, when τ_1 is high and τ_2 is low.

2.2 Alternative Weights: Current or Free-Trade? Imports or Production?

We have seen the difficulties caused by using current import volumes to construct trade-weighted average tariffs. In response, some authors have suggested using instead the import volumes which *would* prevail in free trade as weights. This view is well expressed by Loveday (1931), quoted with approval by Leamer (1974): "The theoretically perfect weighting system would be the one under which each commodity were given a coefficient equivalent to the value which it would have in international trade of a free trade world."

Figure 2.4 About Here

But is this indeed the "theoretically perfect weighting system"? Figure 2.4 illustrates the behaviour of the trade-weighted average tariff in our example when free-trade import volumes are used as weights. Since free-trade import levels for the two goods have been (arbitrarily) set

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[3] The demand function slopes are 1.2 for good 1 and 0.3 for good 2. The tariff rates τ_1 and τ_2 equal {1.5, 5.0} and {3.0, 1.0} in Figures 2.1 and 2.2 respectively.

equal to each other, the behaviour of the index is predictable: it increases linearly and symmetrically in the two tariff rates. But we have already seen that both import volumes and welfare fall faster as the tariff on the higher-elasticity good 1 is increased. Using free-trade weights avoids the most obvious defect of using current trade weights in that the resulting index is always increasing in each individual tariff rate. But otherwise it does not seem to measure trade restrictiveness very satisfactorily.

A further consideration is that the use of free-trade weights poses a major practical problem: the free-trade import volumes are not directly observable. In principle they can be estimated (Leamer shows how this may be done) and even imperfect estimates would avoid the difficulty that weights based on actual import volumes are biased downwards by tariffs. Nonetheless, the need to estimate the weights means that the informational requirements of this index are just as great as those of the "true" indices which we discuss below: a complete model of import demand must be specified and estimated.

The choice between actual and free-trade import weights is identical in principle to that between Paasche (current-weighted) and Laspeyres (base-weighted) indices in any other branch of economics. In practice, some plausible compromise between the two (such as their geometric mean, the Fisher Ideal index) is often used. However, a central theme of the economic approach to index numbers (see, for example, Pollak (1971) and Diewert (1981)) is that the choice between alternative index-number formulae should primarily be based not on informal issues of plausibility but on the extent to which they approximate some "true" or benchmark index, which answers some well-defined economic question. We will return to this theme in Section 2.4 below and address it more formally in Chapter 4.

Many other weighting schemes have been proposed, but none has a superior theoretical foundation and all suffer from practical disadvantages. One possibility, discussed by Leamer (1974), is to use world exports. These have two advantages: like domestic imports, data on them are easily available; and, unlike imports, they are much less likely to be influenced by domestic tariffs. However, this virtue reflects a basic problem with using any external variables as weights: they take no account of the special features of the country being studied.

Other possible sources of weights are domestic consumption or production levels. However, these also exhibit some odd features. Production shares give zero weight to tariffs on non-competing imports; while consumption shares, like import shares, may be low for high tariffs precisely because they restrict trade so much. Finally, note that the implications of either consumption or production shares cannot be illustrated in Figures 2.1 and 2.2, since these figures as drawn are consistent with an infinite range of consumption and production levels. Thus the high tariff on good 1 in Figure 2.2 (which causes a large drop in imports and a considerable welfare cost) might get a low weight if sector 1 is less important than sector 2 in domestic consumption or production.

2.3 Measures of Tariff Dispersion

One implication of the previous two sections is that the problem of constructing a satisfactory aggregate tariff measure increases with the dispersion of tariff rates. This has led many practitioners to supplement weighted averages of tariff rates by measures of tariff dispersion to try and get a full picture of the restrictiveness of a tariff system.

Just as we discussed already in the context of average tariffs, a key issue in choosing between different measures of tariff dispersion is which weights, if any, should be used. In the absence of any theoretical basis for using measures of dispersion, the unweighted standard deviation or coefficient of variation of tariffs is often used. But this has little to recommend it. In our two-good example, the unweighted standard deviation depends symmetrically on the two tariff rates, thus failing to give any indication that trade is more restricted by increases in the tariff on the high-elasticity good 1. The same is true if any fixed set of weights, such as the levels of free-trade imports, is used. This suggests that current import shares should be used as weights in calculating the standard deviation of tariffs.

Figure 2.5 About Here

However, using current imports as weights leads to additional problems, as Figure 2.5 illustrates. When the low-elasticity good 2 has the higher tariff, the import shares do not vary much and so the trade-weighted standard deviation is approximately linear in the individual tariff rates. By contrast, when the high-elasticity good 1 has the higher tariff, its import share falls more rapidly and so the trade-weighted standard deviation rises at a decreasing rate in τ_1 and even declines for sufficiently high values of τ_1. This behaviour gives exactly the wrong impression of the restrictiveness of the tariff structure, which is greatest when τ_1 is high. For example, the import-weighted standard deviation of tariffs is higher for the parameter values of Figure 2.1 than for those of Figure 2.2, suggesting once again that trade is more restricted in the former case, whereas intuitively this is not so. These undesirable features are only partly avoided by using the coefficient of variation rather than the standard deviation of tariffs. The behaviour of the coefficient of variation can be inferred from Figures 2.3 and 2.5: it is very flat for all the parameter values shown, except for very high values of τ_1, when it increases rapidly, reflecting the fact that the average tariff is declining even more rapidly than the standard deviation. Once again, this behaviour does not give a satisfactory depiction of the degree of trade restrictiveness.

Over and above the performance of the standard deviation of tariffs in this particular example, there are two general problems with using any measure of tariff dispersion as an indicator of trade restrictiveness. First, it implicitly assumes that a reduction in dispersion represents a reduction in trade restrictiveness. There are reasons, to be discussed in Section 3.4 and Chapter 6, why this may be true in some cases. However, as we shall see, it is not a general presumption. Second, it is not clear how a measure of tariff dispersion can be combined with a measure of average tariffs. If both move in the same direction, there is a presumption that trade restrictiveness has unambiguously risen or fallen (although we have just noted the qualifications which must be made in interpreting changes in tariff dispersion). But this is no longer true if the two measures move in opposite directions. More generally, there is no satisfactory rule for combining the measures of average and dispersion to yield a scalar measure which might, even in principle, be comparable across countries or across time.

2.4 The Welfare-Equivalent Uniform Tariff

The discussion so far shows the problems with purely statistical measures such as the trade-weighted average tariff or the standard deviation of tariffs. All, in the memorable phrase of Afriat (1977), provide "answers without questions". Since they do not start from any explicit criterion of trade policy restrictiveness, their merits can be evaluated only on intuitive *ad hoc* grounds. And even on such grounds they do not correspond to measures of restrictiveness in any reasonable sense. A more formal approach, starting from an explicit concept of trade policy restrictiveness, is required.

The two central themes of this book are, first, that measures of trade policy restrictiveness should start from a formal criterion against which restrictiveness is measured; and second, that a natural criterion for an economist to adopt is the effect of the structure of trade policy on national welfare. As we will see in Section 2.5 and in later chapters, our approach can easily be adapted to allow for other criteria, but the welfare-theoretic perspective is a natural starting point and so it is the one with which we begin. It leads to an index number of tariffs which we call the "TRI uniform tariff" or the "welfare-equivalent uniform tariff".

Figures 2.6 and 2.7 About Here

It is straightforward to see how this perspective leads to an alternative measure of trade policy restrictiveness in the example given earlier. Figures 2.6 and 2.7 repeat the tariff configurations of Figures 2.1 and 2.2 respectively. Taking welfare as the standpoint, the appropriate way of answering the question "How do we measure trade restrictiveness?" is to ask: what is the *uniform* tariff which, if applied to both goods, would be equivalent to the actual tariffs, in the sense of yielding the same welfare loss. The answer to this question in Figure 2.6 is a tariff equal to *OK*: the increase in the tariff on good 1 from *OC* to *OK* yields a welfare loss equal to the area *ABba*, which, by construction, equals the welfare gain of *FEef* arising from the reduction in the tariff on good 2 from *OD* to *OK*. The same applies in Figure 2.7 with appropriate modifications: the uniform tariff *OK* now implies a reduction of the tariff on good 1 and an increase in that on good 2. Evidently, the welfare-equivalent uniform tariff is higher in Figure 2.7 than in Figure 2.6, in accordance with the intuitive presumption that trade is more restricted in Figure 2.7. A corollary is that, in both cases, the welfare-equivalent uniform tariff is closer to the actual tariff on the high-elasticity good 1: this accords with the intuition that a high tariff on that good is more restrictive than a high tariff on good 2.

Figure 2.8 About Here

Figure 2.8 plots the welfare-equivalent uniform tariff as a function of the tariff rates on the two goods. Like the trade-weighted average tariff in Figure 2.3, this index coincides with the actual tariff rates when they are equal to one another along the diagonal of the three-dimensional surface. But, unlike the trade-weighted average tariff, it has satisfactory properties at other points too. It is always increasing in each individual tariff rate; and it responds more rapidly to increases in the tariff on the high-elasticity good 1.

These properties can be confirmed formally by deriving an explicit formula for the welfare-equivalent uniform tariff. Among the side-benefits of the resulting algebra, we can show that the approach extends to any number of goods. To solve for the welfare-equivalent uniform tariff, write the linear import demand function for good *i* as:

$$m_i = \alpha_i - \beta_i \pi_i \qquad \textbf{(3)}$$

where β_i is the price-responsiveness of imports of good *i* (i.e., the slope of the import demand curve for good *i* relative to the *vertical* axes in Figures 2.1 and 2.2). Now, recall that with linear demands the welfare loss L_i from a tariff at rate τ_i on good *i* equals $(\tau_i \pi_i^*)^2 \beta_i / 2$. Hence the total welfare loss on all goods is $L = \Sigma L_i$ and so the welfare-equivalent uniform tariff τ^Δ is defined implicitly by the equation:

$$\Sigma\,\{\tau^{\Delta}\pi_i^*\}^2\,\beta_i \quad = \quad \Sigma\,\{\tau_i\pi_i^*\}^2\,\beta_i\,. \tag{4}$$

The right-hand side is the actual welfare loss from an arbitrary set of tariffs $\{\tau_i\}$; while the left-hand side is the hypothetical welfare loss from a uniform tariff rate τ^{Δ}. Equating the two and solving for τ^{Δ} gives the welfare-equivalent uniform tariff:

$$\tau^{\Delta} \quad = \quad \left\{\Sigma\,\omega_i\tau_i^2\right\}^{1/2}, \qquad \omega_i \quad \equiv \quad \frac{\{\pi_i^*\}^2\beta_i}{\Sigma\,\{\pi_j^*\}^2\beta_j}\,. \tag{5}$$

Note the differences from the formula for the trade-weighted average tariff τ^a in equation (1): τ^a is a weighted *arithmetic* mean of the tariff rates whereas τ^{Δ} is a weighted *quadratic* mean of the tariff rates; and, crucially, the weights used in constructing τ^a depend on the *levels* of imports, m_i, whereas those used in constructing τ^{Δ} depend on the *marginal import responses*, the β_i.

The weights in (5) can alternatively be written in terms of the elasticity of import demand for each good, evaluated at world prices, $\varepsilon_i \equiv \pi_i^*\beta_i/m_i$:

$$\omega_i \quad = \quad \epsilon_i\,\omega_i^*\,, \tag{6}$$

where the ω_i^* weights are those used in (2) to construct the trade-weighted uniform tariff. Differentiating equation (5) and (6) shows that, as required, the welfare-equivalent uniform tariff is increasing in each tariff rate, and by more so the greater the elasticity of import demand for the good in question.

The fact that the welfare-equivalent uniform tariff is related to the total welfare cost of the tariff structure gives it a firm theoretical basis. But does it mean that the welfare-equivalent uniform tariff is just another welfare index, i.e., that it conveys the same information as the cost of protection measure? To see that this is *not* the case, we rewrite the welfare cost as follows:

$$L \quad = \quad \Sigma \ L_i \quad = \quad \Sigma \ \{\tau_i \pi_i^*\}^2 \beta_i / 2 \quad = \quad (\tau^\Delta \pi^*)^2 \beta / 2 \,, \qquad \textbf{(7)}$$

where π^*, defined as $[\Sigma\{\pi_i^*\}^2]^{½}$, is a quadratic mean of world prices; and β, defined as $\Sigma(\pi_i^*)^2\beta_i/\Sigma(\pi_i^*)^2$, may be interpreted as the "aggregate price-responsiveness of imports". Inspection of this equation shows that the welfare-equivalent uniform tariff τ^Δ bears the same relationship to the aggregate welfare loss L as each individual tariff rate bears to the welfare loss in its own market. The two measures L and τ^Δ are closely linked, but they measure distinct concepts. Of course, the details of this derivation rely heavily on the linear partial-equilibrium specification of our example. However, we will see in Chapter 4 that our general index of trade restrictiveness is also related in an appropriate manner to the true cost of protection.

2.5 The Import-Volume-Equivalent Uniform Tariff

In trying to measure the restrictiveness of a tariff system, it is natural for an economist to consider the equivalent uniform tariff which would yield the same level of welfare, and this is the benchmark on which we concentrate in this book. However, for some purposes and audiences, other benchmarks such as employment, output or import volume may also be of interest. We will return to this topic in more detail in Chapter 5. In the present example, it is straightforward to illustrate the behaviour of an index which equals the uniform tariff that yields a constant volume of imports (measured at world prices). Such an index was used by the Australian Vernon Committee (Commonwealth of Australia, 1965) and its properties were investigated by Corden (1966). We may call it the "import-volume-equivalent uniform tariff" or the "Mercantilist TRI uniform tariff" ("MTRI" for short), since it recalls the concerns of Mercantilist writers with the balance of trade. Its behaviour in the two-good example is illustrated in Figure 2.9.

Figure 2.9 About Here

The key feature of Figure 2.9 is that the MTRI uniform tariff is linear in both tariff rates but increases more rapidly in τ_1, the tariff on the more elastic good. Moreover, the Mercantilist index behaves somewhat similarly to the welfare-equivalent uniform tariff but very differently from the *ad hoc* indices considered earlier in this chapter.

To derive an explicit expression for the import-volume-equivalent uniform tariff, note that it is defined implicitly by the equation:

$$\Sigma\, \pi_i^*\left[\alpha_i - \beta_i(1+\tau^\mu)\pi_i^*\right] \quad = \quad \Sigma\, \pi_i^*\left[\alpha_i - \beta_i(1+\tau_i)\pi_i^*\right]. \qquad \textbf{(8)}$$

The right-hand side is the total value of imports given an arbitrary set of tariffs $\{\tau_i\}$; while the left-hand side is the value of imports which would be generated by a uniform tariff rate τ^μ. Equating the two and solving for τ^μ gives the import-volume-equivalent uniform tariff:

$$\tau^\mu \quad = \quad \Sigma\, \omega_i \tau_i\,. \qquad \textbf{(9)}$$

This has the same linear form as the trade-weighted average tariff τ^a, but the same weights as the welfare-equivalent uniform tariff, τ^Δ.[4]

2.6 Conclusion

In this chapter we have used a simple two-good linear example to introduce the issues which

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[4] It is also identical to equation (5) in Corden (1966), except that we ignore intermediate inputs, so Corden's v_i parameters (giving the share of value added in the domestic output of sector i) are set equal to one.

arise in measuring the restrictiveness of trade policy. We have seen that the most commonly used measure, the trade-weighted average tariff, has many undesirable features. Most strikingly, it is likely to be decreasing in tariffs on highly elastic goods. This more obvious defect is overcome by using alternative weights, such as consumption, production or the level of imports that would obtain in free trade. However, indices based on these weights have their own difficulties and none of them has any firm theoretical basis. Finally, measures of dispersion such as the standard deviation of tariffs have an intuitive appeal since the problems of average tariff measures are more acute the less uniform is the tariff system. But such measures themselves have only a tenuous relationship to trade restrictiveness in our example. And even if this were not so, there is no way of combining them with a measure of average tariffs to obtain an overall measure of trade policy restrictiveness.

All these problems with *ad hoc* or purely statistical measures of trade policy restrictiveness reflect a lack of clarity about what is being measured. The approach we propose in this book is to start with an explicit criterion against which trade policy restrictiveness is to be measured. Appropriate indices can then be derived from these criteria and we have illustrated in this chapter how this can be done in two cases. The most natural criterion from an economist's perspective is that of welfare. This leads to the welfare-equivalent uniform tariff, constructed to yield the same welfare loss as the actual (and typically non-uniform) tariff structure. An alternative criterion, with more appeal in a trade negotiations context, is that of the volume of imports. This leads to the import-volume-equivalent or Mercantilist uniform tariff, constructed to yield the same import volume (at world prices) as the actual tariff structure. We have seen that these measures have much more satisfactory properties and that, at least in our special example, they behave similarly to each other but very differently from the *ad hoc* indices. In the remainder of the book we turn to show how these simple insights can be extended to more realistic contexts.

Appendix: The Geometry of the Trade-Weighted Average Tariff

It may be helpful to see how the trade-weighted average tariff can be located in the two-panel diagrams such as Figures 2.1 and 2.2. Specialising equation (1) to the two-good case, the trade-weighted average tariff becomes:

$$\tau^a \equiv \frac{t_1 m_1 + t_2 m_2}{\pi_1^* m_1 + \pi_2^* m_2} \qquad \textbf{(10)}$$

With world prices normalised to one, this can be rewritten in terms of tariff rates:

$$\tau^a \equiv \frac{\tau_1 m_1 + \tau_2 m_2}{m_1 + m_2} \qquad \textbf{(11)}$$

This in turn can be manipulated to equal:

$$\tau^a \equiv \tau_1 + \frac{(\tau_2 - \tau_1)\, m_2}{m_1 + m_2} \qquad \textbf{(12)}$$

Now repeat the same steps, expressed not in terms of symbols but of distances in Figure 2.10, which repeats the essential features of Figure 1:

$$\tau^a \equiv \frac{OC.AO + OD.OF}{AF} = OC + \frac{CD.OF}{AF} \qquad \textbf{(13)}$$

The final step is to locate the points *N* and *L* in Figure 2.10. The coordinates of these points are the import volume of one good and the tariff rate of the *other* good. The straight line joining points *N* and *L* intersects the vertical axis at *G*. It is now easy to show that the distance *OK* denotes the trade-weighted average tariff. By similar triangles, *CL*/*BL*=*CG*/*BN*. This implies that *OF*/*AF*=*CG*/*CD*. Substituting into (13) gives:

$$\tau^a = OC + CG = OG \tag{14}$$

which proves the required result.

PART B: TRADE POLICY REFORM AND THE TRI

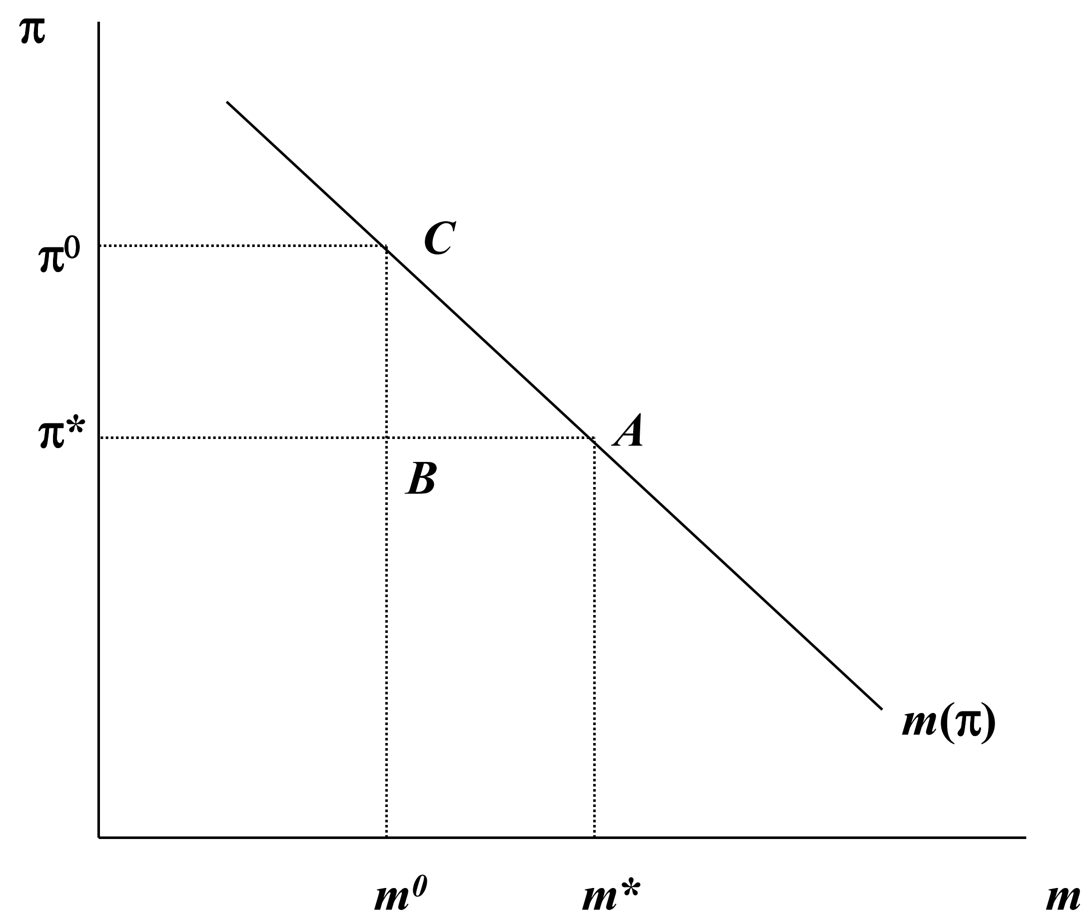

Figure 1.1: Trade Policy Restrictiveness and the Cost of Protection

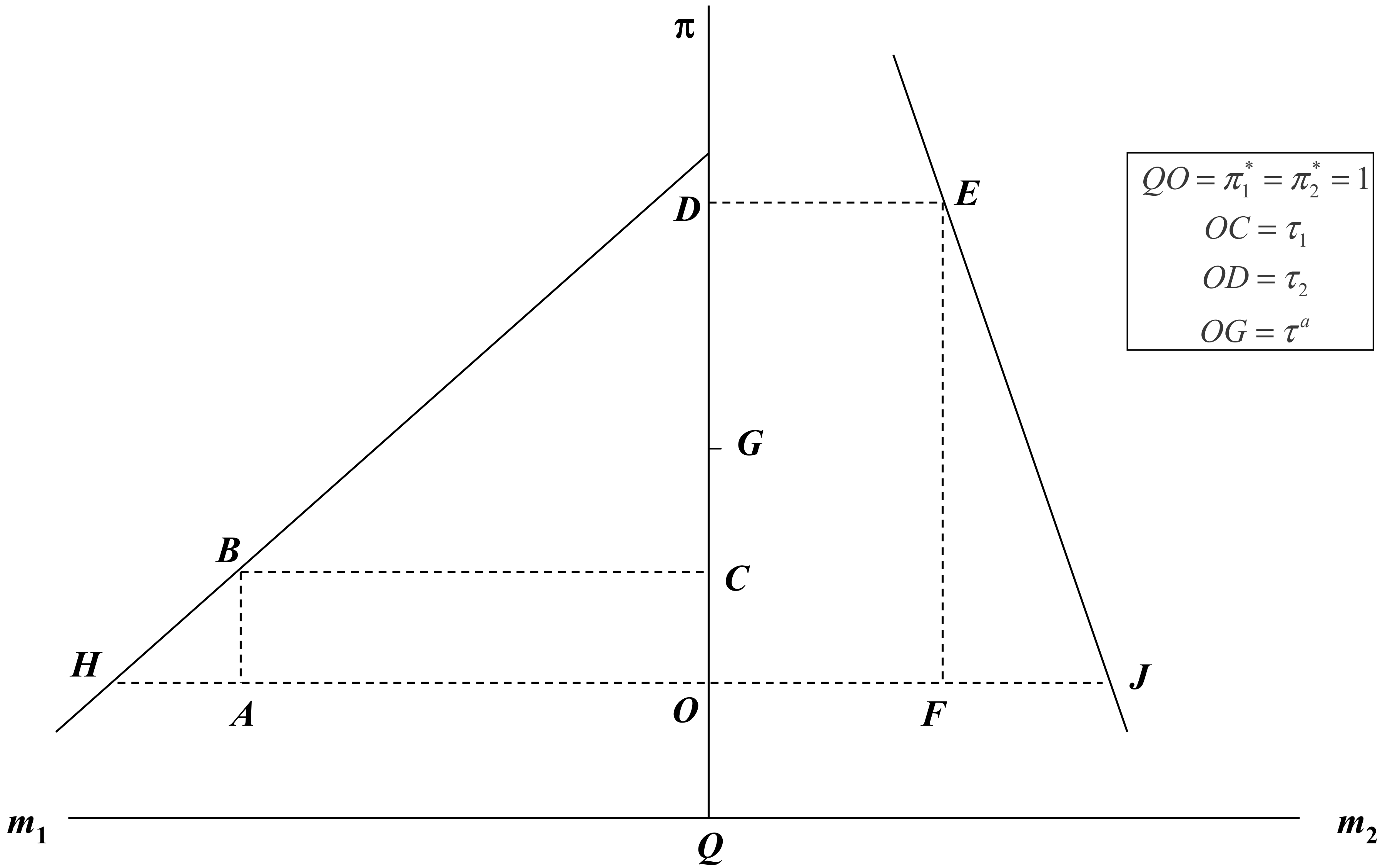

Figure 2.1: The Trade-Weighted Average Tariff:
Tariff Rates and Import Demand Elasticities Negatively Correlated

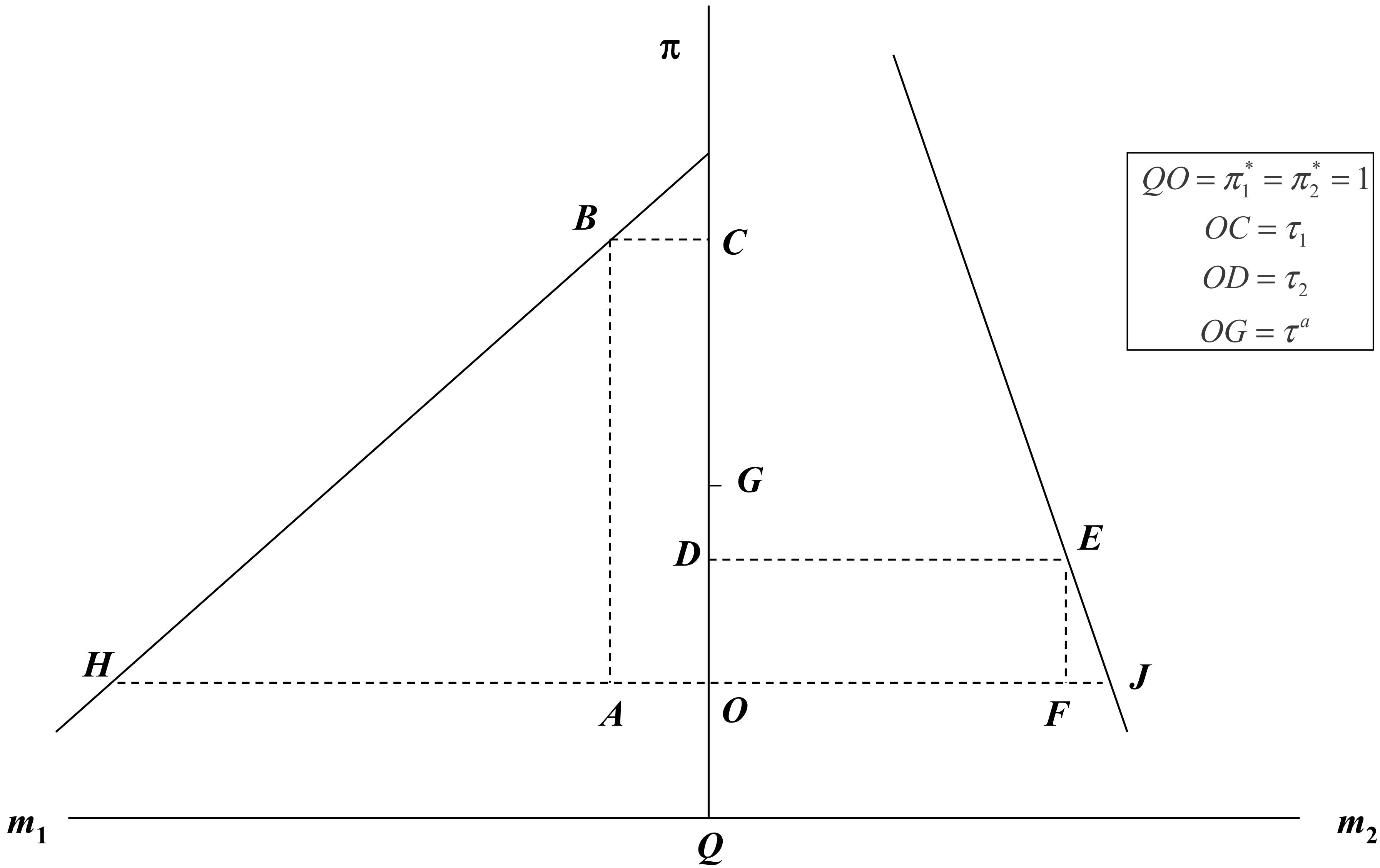

Figure 2.2: The Trade-Weighted Average Tariff :
Tariff Rates and Import Demand Elasticities Positively Correlated

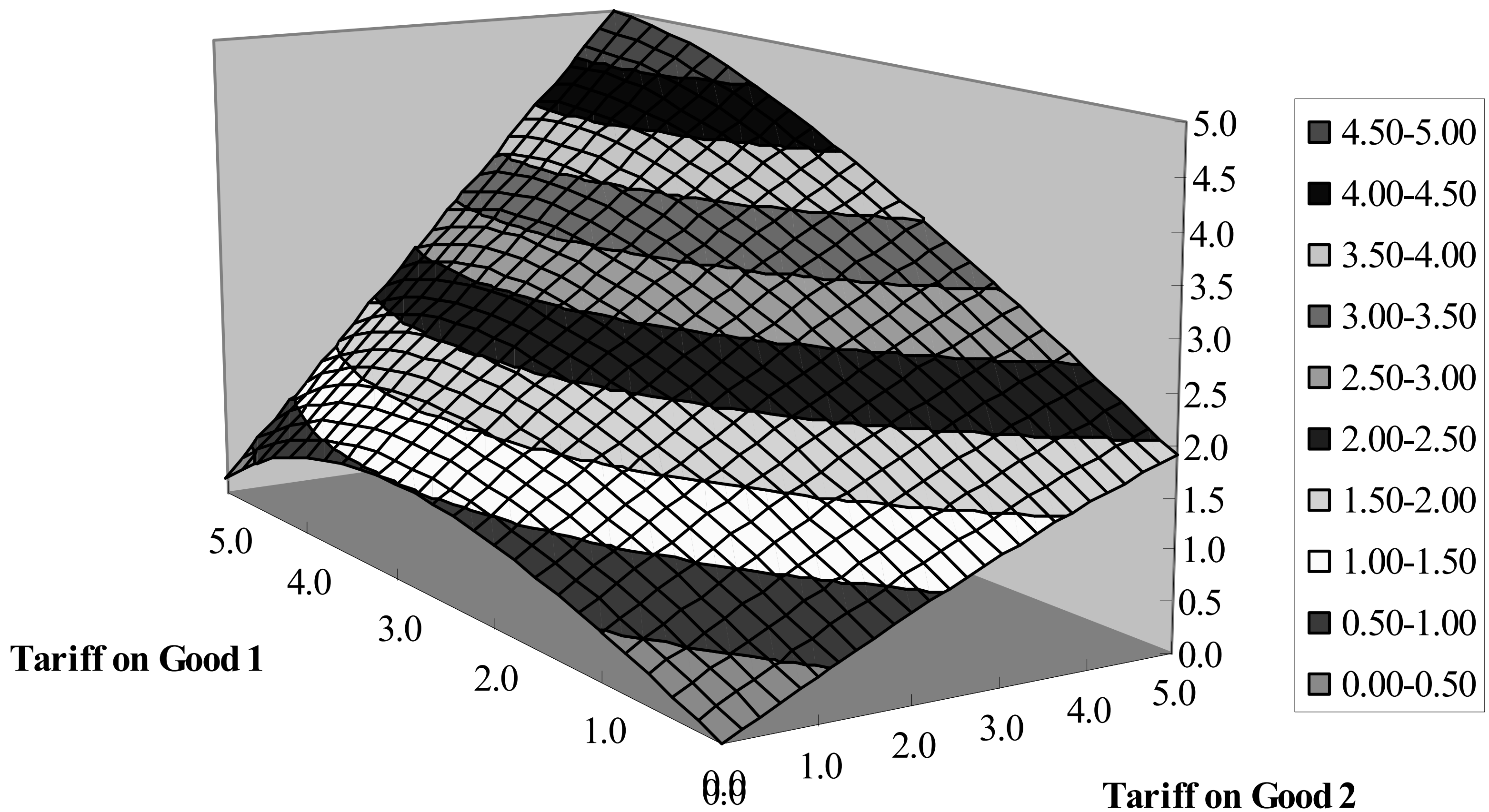

Figure 2.3: The Trade-Weighted Average Tariff

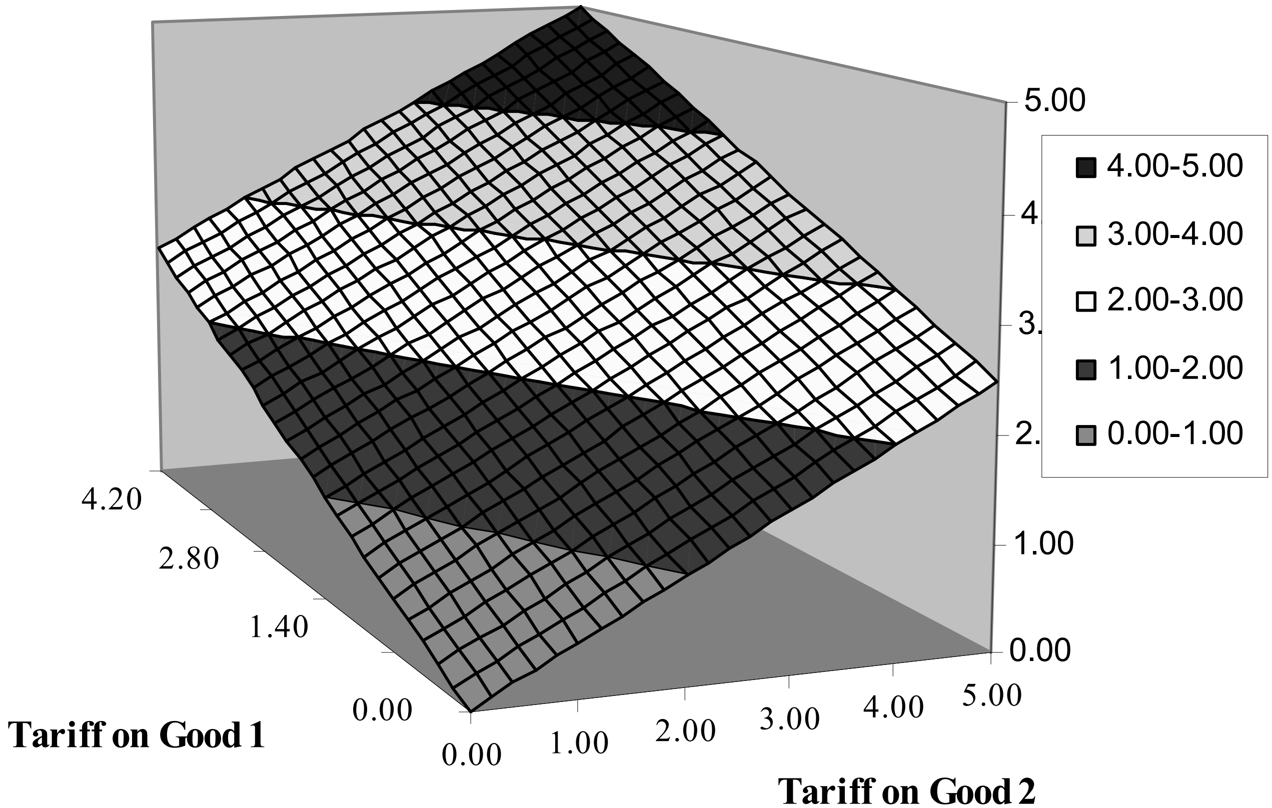

Figure 2.4: The Average Tariff Weighted by Free-Trade Imports

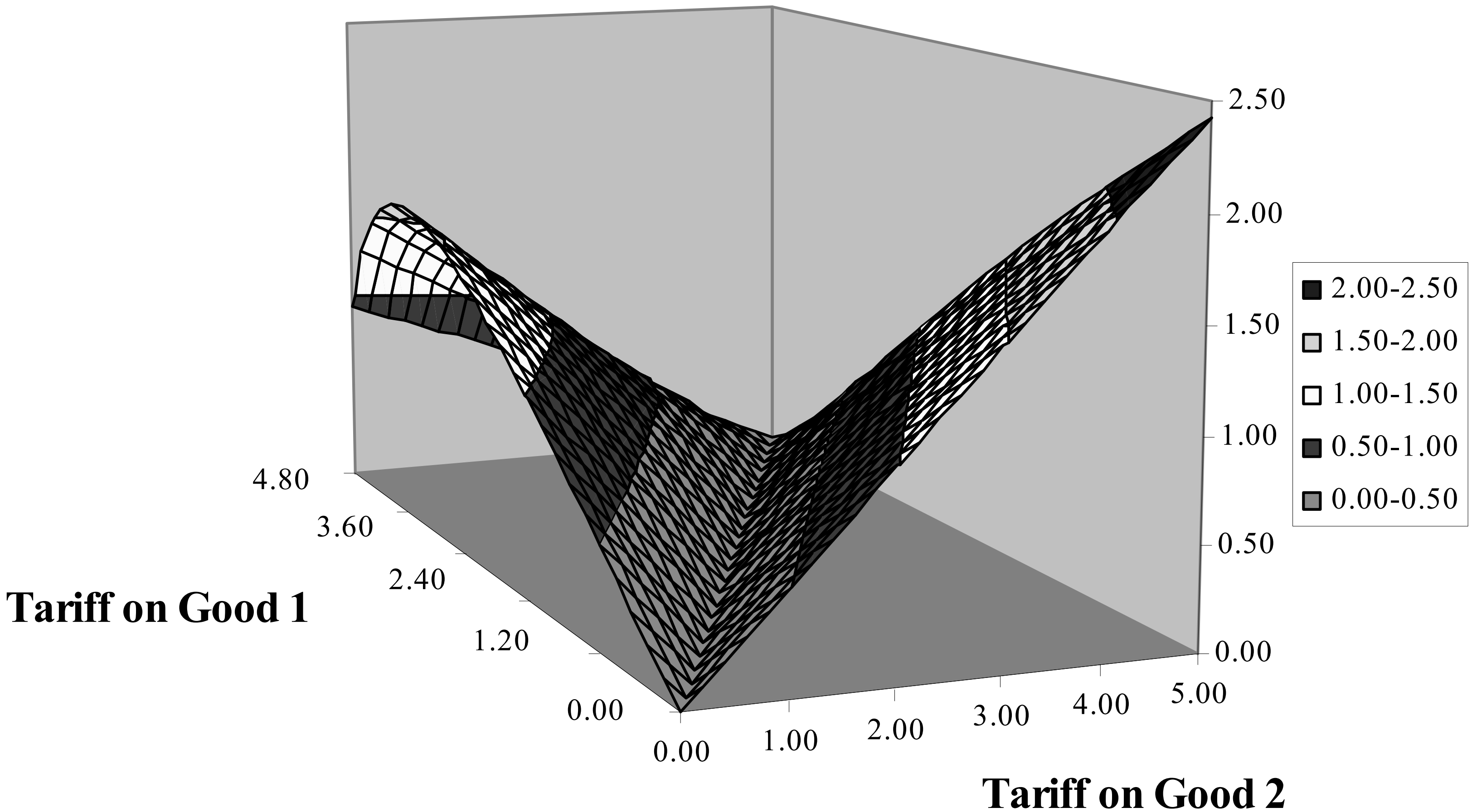

Figure 2.5: The Trade-Weighted Standard Deviation of Tariffs

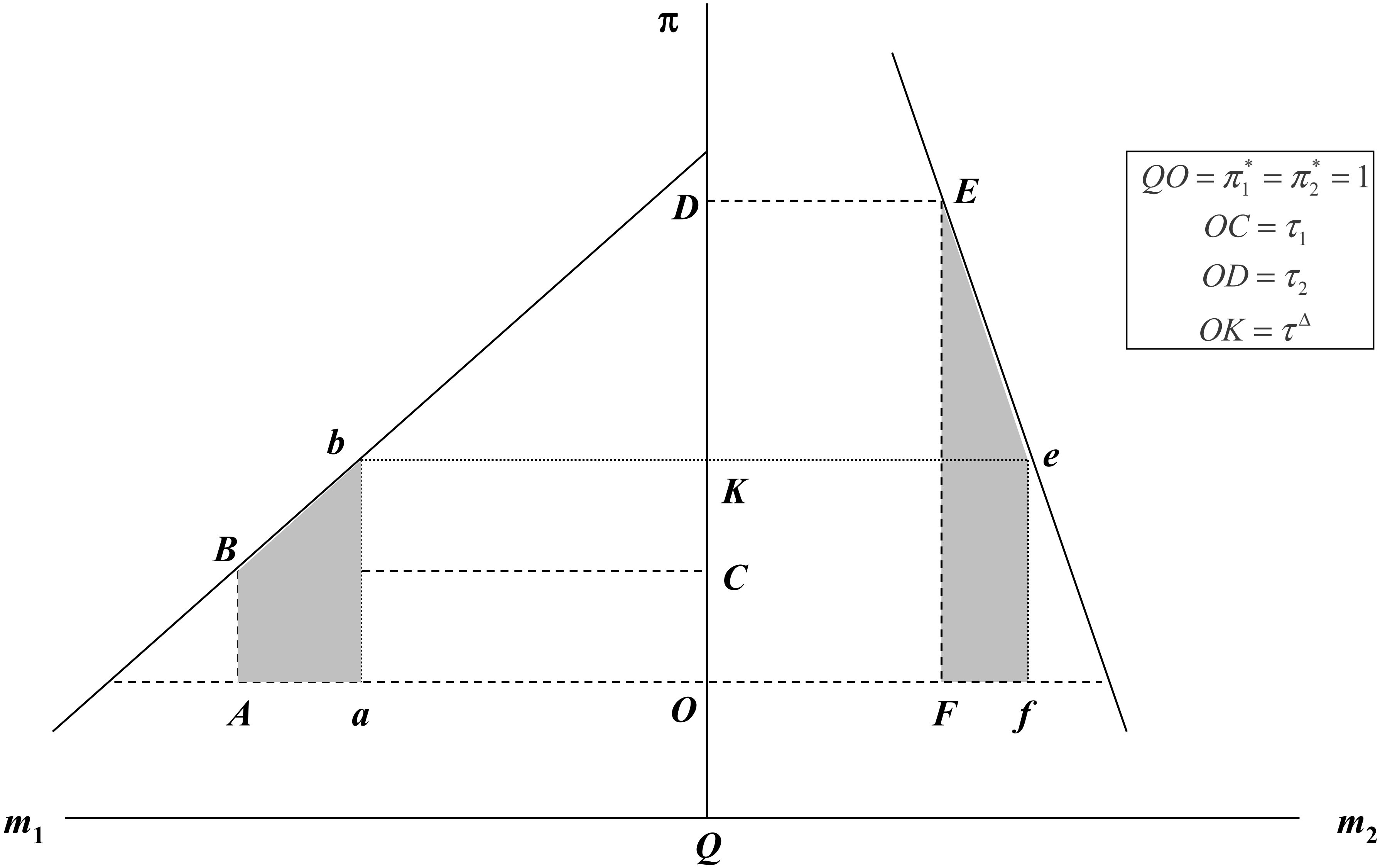

Figure 2.6: The TRI or Welfare-Equivalent Uniform Tariff: Tariff Rates and Import Demand Elasticities Negatively Correlated

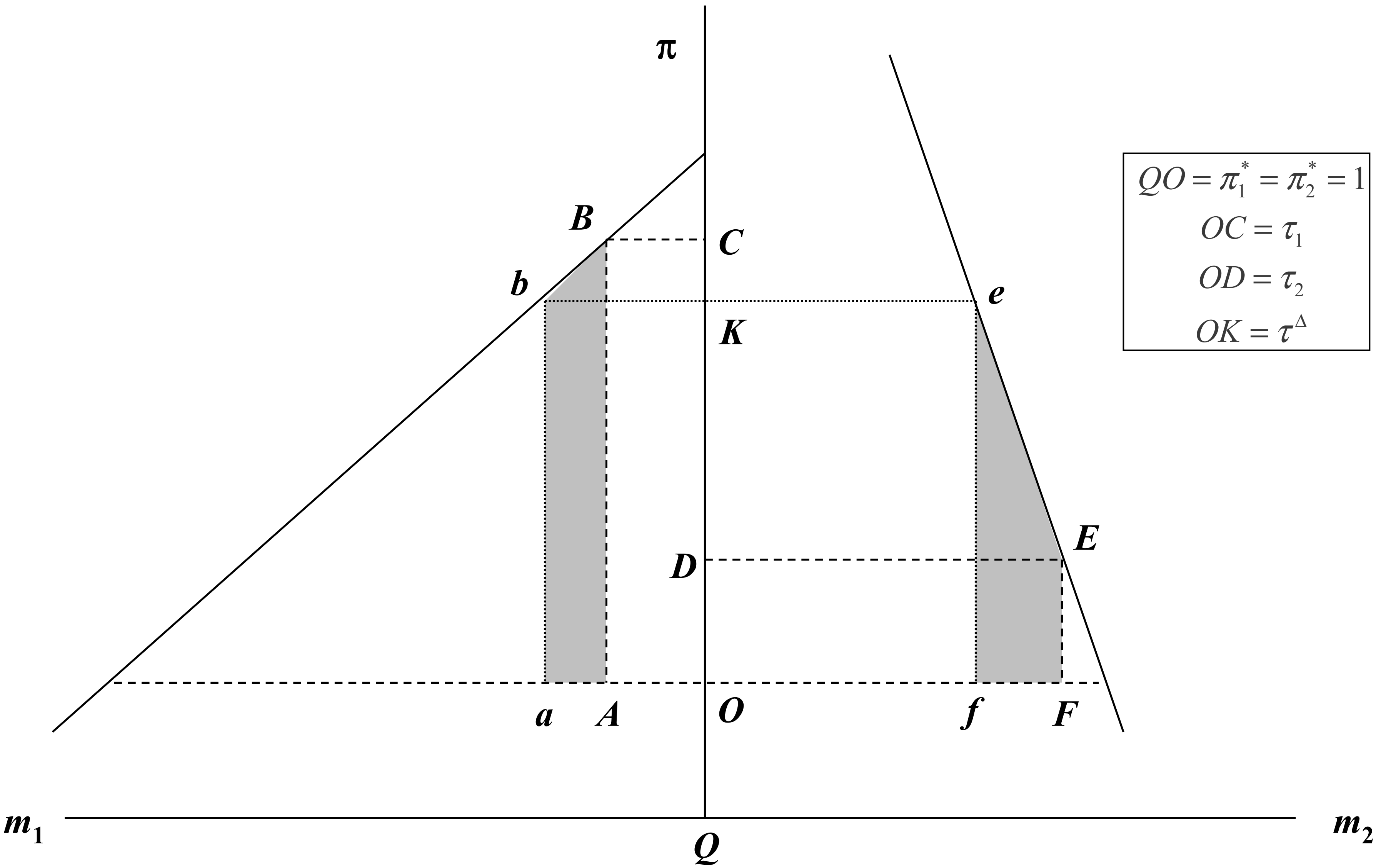

Figure 2.7: The TRI or Welfare-Equivalent Uniform Tariff : Tariff Rates and Import Demand Elasticities Positively Correlated

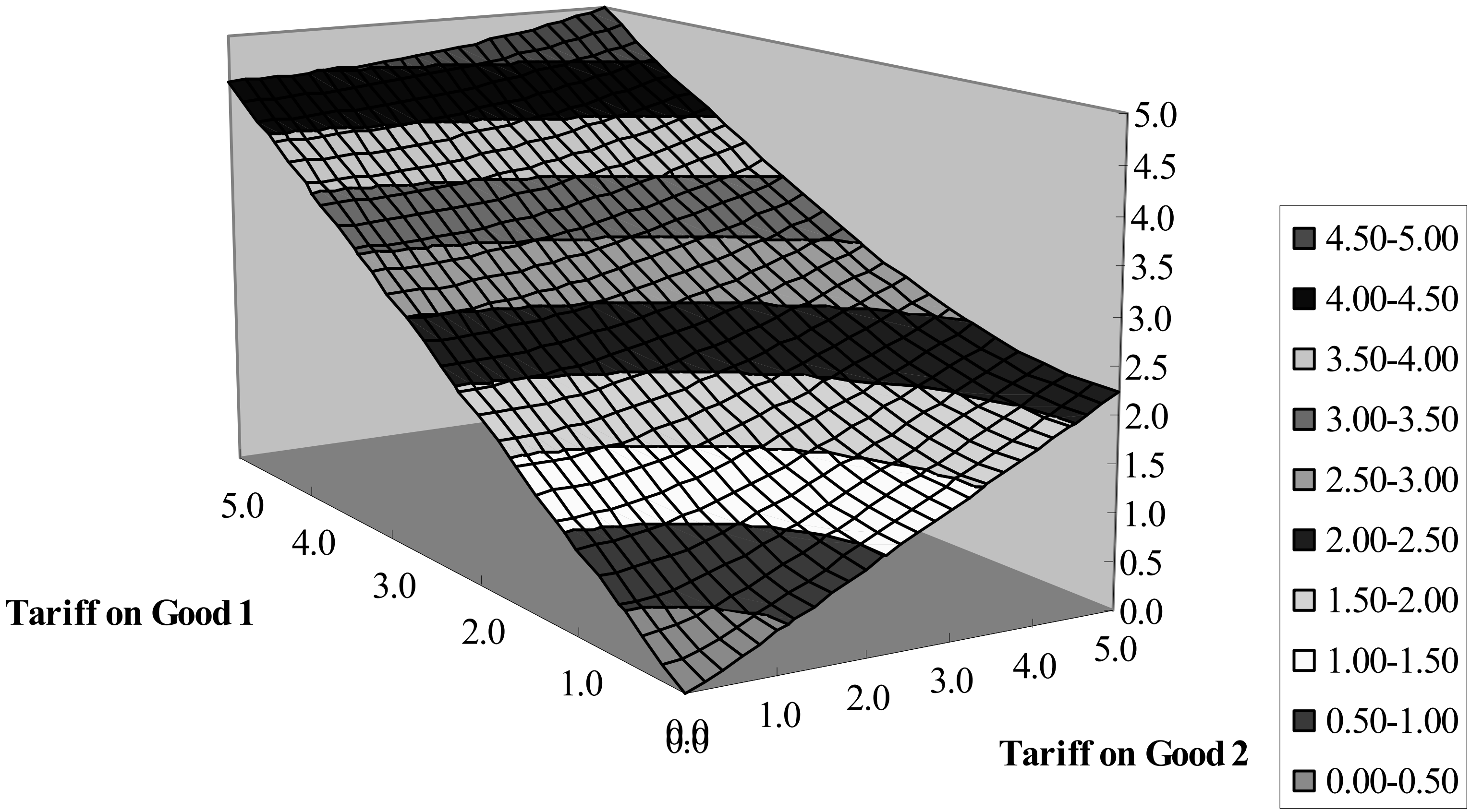

Figure 2.8: The TRI or Welfare-Equivalent Uniform Tariff

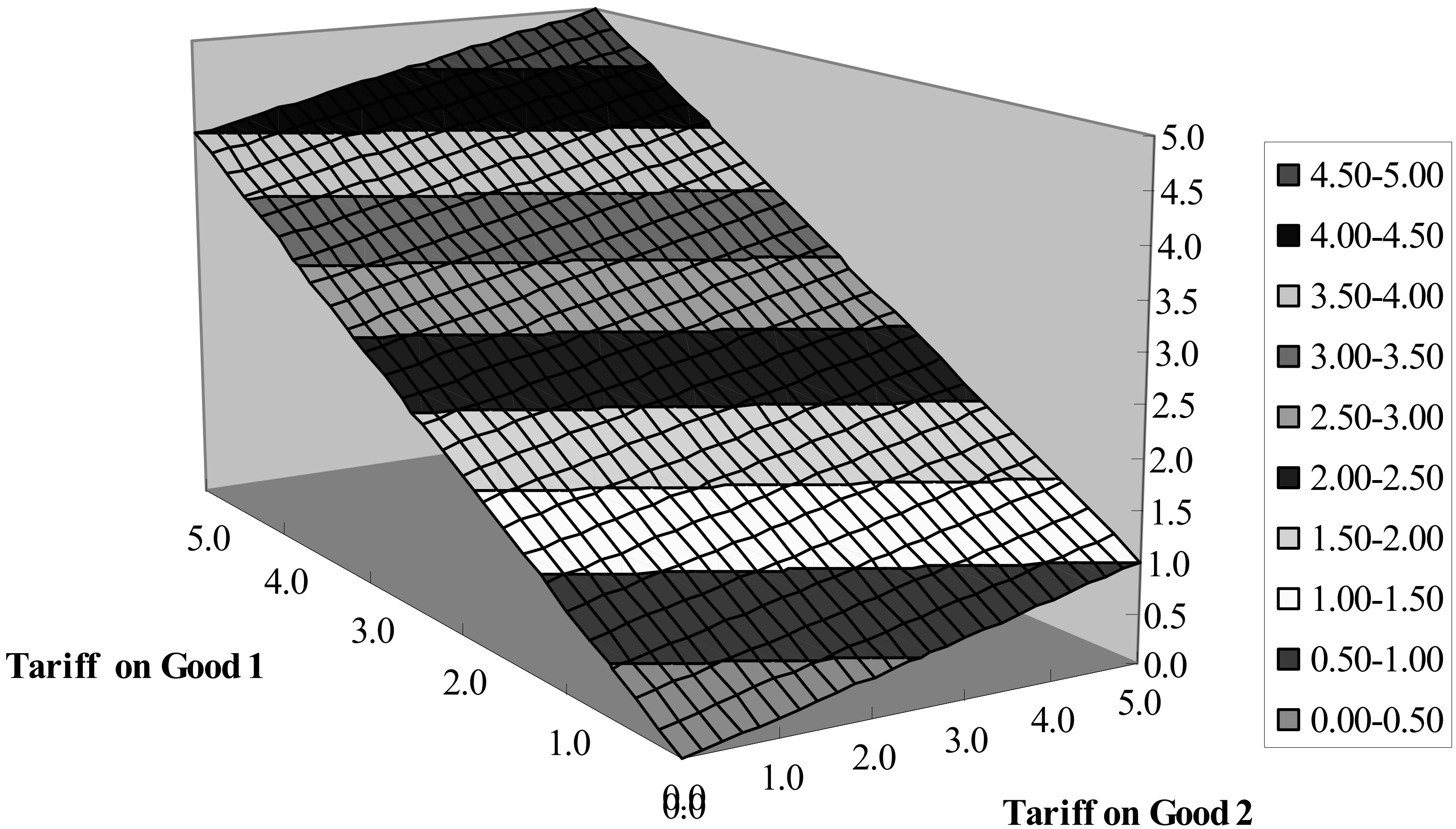

Figure 2.9: The MTRI or Import-Volume-Equivalent Uniform Tariff

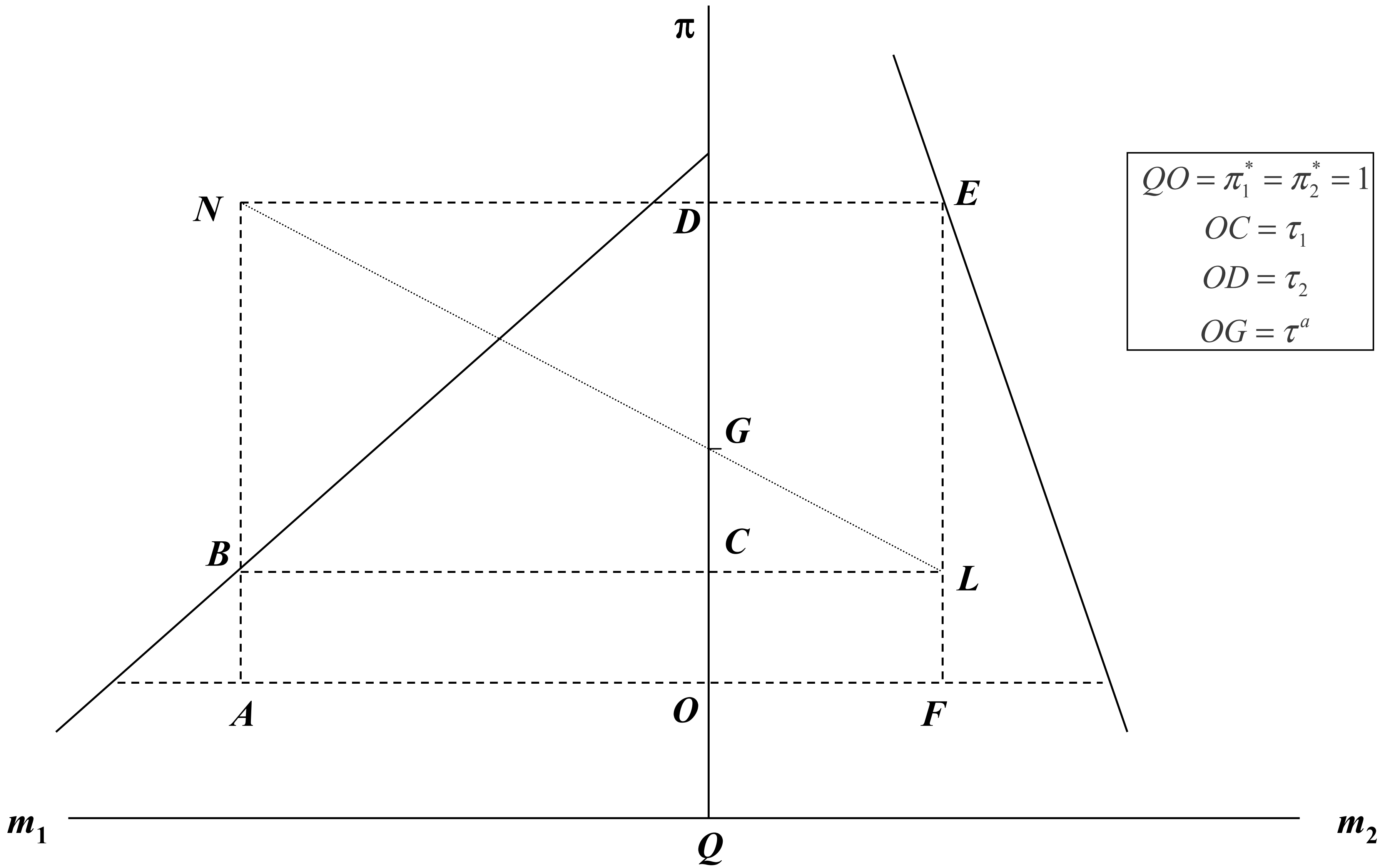

Figure 2.10: Locating The Trade-Weighted Average Tariff