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EXPLAINING THE VOLUME OF INTRAINDUSTRY TRADE: ARE INCREASING RETURNS NECESSARY?

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ABSTRACT

The recent theoretical literature has suggested that increasing returns to scale are necessary to account for the volume of intraindustry trade among developed economies. The present paper shows that such trade can arise quite naturally in a setting with constant returns to scale.

An example is developed with "perfectly-intraindustry goods," in which countries with identical endowments and arbitrarily small technical differences nonetheless trade substantial amounts of goods of identical factor intensity. This is extended to a case with factor price equalization, fully determinate trade and the possibility of substantial intraindustry trade. Finally, we develop the simplest possible model that can give a unified account of interindustry and intraindustry trade, while allowing a straightforward comparison with standard Heckscher-Ohlin results. A striking feature of the last example is that intraindustry trade attains a maximum at a point where countries have identical factor endowment ratios.

Increasing returns, in short, are not <u>necessary</u> to explain intraindustry trade.

Explaining the Volume of Intraindustry Trade: Are Increasing Returns Necessary?

Donald Davis[1]

I. Introduction

Why do countries trade? From the days of David Ricardo until quite recently, the principal explanation offered was: Comparative Advantage. The allied theoretical structures exhibit constant returns to scale.

In the last decade, there has been wide acceptance of an alternative explanation: Increasing Returns to Scale. Specialization and trade yield gains even in the absence of comparative advantage.

Comparative advantage is acknowledged to explain some trade: why Brazil exports coffee, and Argentina exports beef. However, it is held, comparative advantage fails to explain the bulk of trade among developed economies. As Helpman and Krugman write,

> trade patterns seem to include substantial two-way trade in goods of similar factor intensity. This 'intraindustry' trade seems both pointless and hard to explain from the point of view of a conventional trade analysis.[2]

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[1] The author is an Intern in the Division of International Finance and a PhD candidate in economics at Columbia University. This paper represents the views of the author and should not be interpreted as reflecting the views of the Board of Governors of the Federal Reserve System or other members of its staff. I would like to thank David B. Gordon, Doug Irwin, Eric Leeper and Jaime Marquez for comments and encouragement. Ronald Findlay and Jagdish Bhagwati made very helpful suggestions. Andre Burgstaller and Tatsuo Hatta were generous with their time and ideas. All remaining errors are mine.

[2] Helpman and Krugman (1985) p. 2. See also Ethier (1982) pp. 389-90 and Greenaway and Milner (1987) pp. 41-42.

The reason is that comparative advantage relies on differences among countries -- in factor endowments or technology -- to explain trade. A _prima facie_ case can be made that, among the countries under consideration, these differences are not large. Although typically unvoiced, the logical closure of the argument is: in this framework, the trade volume is large only if differences between countries are large.

Surprisingly, no formal proof of the last assertion has been offered. In fact, the assertion is false. Moreover, it fails in a setting intimately linked to the problem of intraindustry trade.

Section II poses a stringent test of the assertion: to explain trade in goods of identical factor intensity, among countries with identical endowments, when cross-country technical differences are arbitrarily small. We find that substantial intraindustry trade arises quite naturally in this setting.

Section III extends this to a case which features factor price equalization, fully determinate trade patterns, and the possibility of substantial intraindustry trade.

Section IV illustrates these ideas in the simplest setting that allows a unified account of interindustry and intraindustry trade, a case with three goods and two factors. A striking characteristic of this example is that intraindustry trade attains a maximum at a point where countries have identical factor endowment ratios. In fact, in a benchmark case, intraindustry trade attains a maximum when countries have identical endowments. The final section concludes.

II. Comparative Advantage and Trade in "Perfectly-Intraindustry Goods"

A. A Stringent Test

Comparative advantage, it is asserted, cannot account for the observed volume of trade in goods of similar factor intensity between similar countries. We pose a stringent test -- to explain trade in

- goods of identical factor intensity,
- among countries with identical factor endowments,
- when technical differences are arbitrarily small.

Intraindustry goods are commonly referred to as goods of similar factor intensity. So define "perfectly-intraindustry goods" as those which use identical factor proportions at all common factor prices. The isoquants of such goods differ by a Hicks-neutral shift. An important and special property is that the marginal rate of transformation between these goods is constant.

Consider a world with N goods and M factors, with no restriction on their relative number. There are two countries with identical factor endowments and homothetic preferences. Let i and j be perfectly-intraindustry goods. There are arbitrarily small Hicks-neutral technical differences across countries in production of goods i and j, with the differences non-uniform across goods. Since i and j are perfectly-intraindustry goods, the marginal rate of transformation between i and j is constant in each country. Since there are non-uniform technical differences between countries, these marginal rates of transformation must differ. Since trade equalizes goods prices, at least one country must specialize. Since preferences are homothetic, there must be trade.

B. Intuition and a Generalization

The intuition for our result is extremely simple, and suggests a straightforward generalization. Usually we would not expect trade patterns to be so sensitive to small technical differences. We expect that as we produce more and more of a good, the marginal opportunity cost in terms of any other set of goods rises. This is expressed in our typical rendition of the PPF as bowed-out. The opportunity cost rises because the contraction of other sectors does not release factors in exactly the proportion in which the expanding sector uses them (at constant factor prices). And so, to obtain factors in the proportion of the expanding sector requires that it bid up the price of factors used relatively intensively in that sector -- thus, a rising marginal opportunity cost.

Why don't the other sectors release factors in exactly the proportion required by the expanding sector at constant factor prices? The answer is most simply understood by considering the matrix of optimal technical coefficients, A(w). Each column of A(w) represents the optimal unit input coefficients for a single good. If the columns of A(w) are linearly independent, then it is impossible, by definition, to express any one column as a linear combination of other columns. That is, at constant factor prices (and so unchanged coefficients), it is literally impossible for the other sectors to release factors in exactly the proportion they are used in an expanding sector.

Now it is simple to understand why small technical differences can give rise to a large volume of trade in our case. By the definition of perfectly-intraindustry goods, columns i and j in our matrix A(w) differ by a scalar in each country. Thus if there are small technical differences across goods i and j that motivate some trade, one sector can release factors in exactly the proportion used in the other. There will be no rising marginal opportunity cost until at least one of the countries specializes. And so they must trade.

This suggests a tight link between the problem of explaining intraindustry trade and linear dependence in the columns of the A(w) matrix. As noted, the case of perfectly-intraindustry trade always leads to linear dependence in the columns of the A(w) matrix. But this suggests also that we look at another case in which there is always linear dependence: that in which there are more goods than factors.[3]

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[3] There is an additional analytical convenience that arises in considering the case in which goods outnumber factors. If the number of goods is equal to or less than the number of factors, any linear dependence in the columns of A(w) insures that the factor price equalization set will not have full dimension in factor space. However, when goods outnumber factors, even with linear dependence, the factor price equalization set may still have full dimension. This allows a simple mapping of factor endowments into trade patterns, as will be exploited below.

III. Intraindustry Trade With Factor Price Equalization

Consider a world with two countries. There are N goods and M factors, with N > M.[4] The countries share exactly M technologies, and N - M technologies differ.[5] The technical differences are assumed to be Hicks-neutral.

Consider the integrated equilibrium.[6] An obvious component of it is factor price equalization. For the technologies that differ, only the absolutely efficient technology is employed.[7] There exists a solution to the general equilibrium which establishes goods and factor prices, with corresponding patterns of factor allocation. We assume that when employing the integrated equilibrium techniques, the vectors of factor usage of the M goods with identical technologies are linearly independent.[8]

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[4] It is well known that the case with more goods than factors can give rise to indeterminacy in the pattern of trade [Samuelson (1953), Bhagwati (1972), Ethier (1984)]. The setting developed here has a fully determinate trade pattern along with factor price equalization.

[5] The case in which they share more than M technologies is easily accommodated, as shown below.

[6] The integrated equilibrium is the resource allocation that would result if goods and factors were both perfectly mobile. Samuelson (1949) first discussed the idea. Dixit and Norman (1980) coined the term "integrated equilibrium," and used the concept to give a transparent derivation of the factor price equalization set. It has since been used extensively by Helpman and Krugman (1985).

[7] The assumption of Hicks-neutral technical differences makes this determination unambiguous.

[8] This insures that our factor price equalization set has full dimension.

Now return to the two-country world. We want to construct the set of factor endowments consistent with replication of the integrated equilibrium. As noted, where technologies differ, only the efficient technology can be employed if we are to replicate the integrated equilibrium. Thus, each country must have sufficient factors to produce, using the integrated equilibrium techniques, the integrated equilibrium levels of output of the goods in which it has an absolute technical advantage. Taking these initial factor requirements as new vertices, the M technologies which are common to the two countries then define an M-dimensional cone, reflecting the integrated equilibrium techniques, for each of the two countries. Then, any division of the world factor endowment that lies within both cones insures that trade replicates the integrated equilibrium.[9] If the endowment lies strictly within each cone, there is diversification in production of all goods with common technologies; of course there is specialization in all goods in which technologies differ.

The possibility of explaining intraindustry trade in this setting is immediate.[10] No restrictions whatsoever have been

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[9] Cf. Chang (1979), Theorem 5, p.720.

[10] The essential insight exploited here was first noted, I believe, by J. Vanek and T. Bertrand in three terse paragraphs at the end of their 1971 article for the Kindleberger Festschrift. The point, though, seems to have been lost. It does not appear in the textbook treatments of Dixit and Norman (1980) or Woodland (1982), in the monograph by Helpman and Krugman (1985), in the surveys by Chipman (1987) in the New Palgrave or Jones and Neary (1984) in the Handbook of International Economics. While Ethier's (1984) piece in the Handbook cites the Vanek-Bertrand article,

placed on the factor intensities of the goods in which production is specialized. It is perfectly possible that these are goods of similar factor intensity. Since both countries consume the goods in equal proportions (homothetic preferences), there must be trade in these goods.[11] The factor-content version of the Heckscher-Ohlin theorem will hold.

An important special case is when the countries have identical factor endowment proportions (i.e. their endowment vectors differ by a scalar), and are within the M-dimensional cones. Of necessity, there is still trade in all goods in which technologies differ. As well, there is trade in the goods in which technologies are identical, except in the knife-edge case where the net factor content of trade in the goods in which technologies differ is zero.

If we relax the assumption that there are exactly M identical technologies (so allow more than M identical technologies), an element of indeterminacy in the pattern of trade of individual goods with identical technologies may reemerge.[12] The factor price equalization set becomes the

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and gives an extended account of the case of more goods than factors, no note is made of the critical role in this case played by the assumption of identical technologies.

[11] Note that, in principle, this implies neither more nor less specialization than that suggested by the increasing returns framework. Also, in this case, arbitrarily small transport costs do not eliminate trade. To alter the implied pattern of trade, transport costs must be large relative to technical differences.

[12] The indeterminacy is inessential, and will be eliminated by arbitrarily small transport costs.

intersection of the convex cones generated by the vectors of factor usage in the M' > M common technologies. As before, these vectors must reflect the integrated equilibrium techniques, and M of them must be linearly independent for full dimensionality. Trade in goods with technical differences continues to be fully determinate. The factor-content version of the Heckscher-Ohlin theorem continues to hold.

IV. A Unified Account of Interindustry and Intraindustry Trade: The Heckscher-Ohlin-Ricardo Model

This section develops the simplest possible model that gives a unified account of intraindustry and interindustry trade, while allowing a clear contrast with the standard factor proportions results. This requires a model with three goods: two to represent intraindustry goods, and one the other industry. For comparability with standard results, we require a model with two factors, capital and labor. We allow there to exist arbitrarily small cross-country technological differences.

The interaction of factor proportions and small technical differences in giving rise to the trade pattern leads us to call this the Heckscher-Ohlin-Ricardo model.

A. The Heckscher-Ohlin-Ricardo Model

There are three goods, X_1, X_2 and Y. The first two are perfectly-intraindustry goods, which means that for all factor price ratios they are produced under identical factor intensity.[13] This allows us to unambiguously make the assumption that the intraindustry goods are capital-intensive relative to Y. We assume that technologies are identical across countries in X_2

[13] In a separate paper, I extend the Heckscher-Ohlin-Ricardo model to a case in which the perfectly-intraindustry sector is a continuum of goods. It shows that the restriction in the present paper to analysis of trade patterns within the factor price equalization set does not prejudice the principal point of the possibility of substantial intraindustry trade based on relatively small technical differences.

and Y, with a small Hicks-neutral productivity difference in X_1, as reflected in:

Country One:

$$X_1 = AF(K_{X1}, L_{X1}) \qquad X_2 = F(K_{X2}, L_{X2}) \qquad Y = G(K_Y, L_Y)$$

Country Two:

$$X_1 = F(K_{X1}, L_{X1}) \qquad X_2 = F(K_{X2}, L_{X2}) \qquad Y = G(K_Y, L_Y)$$

where we assume $A > 1$.[14]

Let preferences be homothetic. Good X_2 is the numeraire.

B. The Integrated Equilibrium and World Factor Endowments

Let us begin by developing the integrated equilibrium. Since there is an absolute technical advantage in the production of good X_1, only the technology of country One can be used in production of this good. Since the marginal rate of transformation between our intraindustry goods is constant, positive production of both goods requires that $P_{X1} = 1/A$. The relative price P_Y emerges from the general equilibrium. This gives rise to factor intensities $k_{X1} \equiv k_{X2} > k_Y$, and establishes a factor price ratio w/r. The exact allocation of factors to the

[14] This combines elements of the ideas from Sections II and III. This case has more goods than factors, as needed here to get a non-trivial factor price equalization set. As well, we specify goods X_1 and X_2 as perfectly-intraindustry goods. The combination provides a tractable framework in which to explore the influence of factor endowments and small technical differences on the pattern of intraindustry and interindustry trade.

various production sectors is determined.

Now we study which divisions of world factor endowments are consistent with replication of the integrated equilibrium. It is evident that since only country One has access to the technology used in the integrated world for production of good X_1, One must have sufficient factors to produce the integrated equilibrium supply of X_1 using the integrated equilibrium technique. This is reflected by a vector from O_1 with slope k_{X1}, and length reflecting total factor usage in good X_1 [See Figure 1]. Taking this factor requirement as a new vertex for country One, the equilibrium techniques used in production of goods X_2 and Y give rise to diversification cones in these goods for the two countries. Any division of the world factor endowment that falls within the parallelogram generated by the intersection of these two cones allows replication of the integrated equilibrium. [See Figure 1]

C. The Pattern of Trade[15]

Our analysis of the pattern of trade begins in an area near O_2, where an isoincome line continues to be in the FPE box for all points between the factor intensity ratios [see Figure 2]. We

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[15] The format of the analysis in the following sections, and the statement of the standard factor proportions propositions are taken from the lucid account in Helpman and Krugman (1985), chapters two and eight. It should be kept in mind throughout that all statements regarding the pattern and volume of trade pertain only to the factor price equalization set. Analysis of trade patterns and intraindustry trade when factor prices are not equalized is deferred to the appendix.

examine the effects on trade patterns of movements along the isoincome line.

Within the FPE set, the factor content of consumption is the intersection of the diagonal and the isoincome line. So along the isoincome line, the consumption vector is frozen, country One produces all of the world's X_1, and there is reallocation of production of goods X_2 and Y.

Consider first if the endowment is at point A, on the vector with slope k_Y emanating from O_2. Country Two produces only good Y, which it exports for goods X_1 and X_2. This is the case of pure interindustry trade. As we move away from A, towards B, country Two begins to produce some X_2, but not yet enough for its own consumption. It still exports good Y for imports of X_1 and X_2.

Before we reach the diagonal, we reach a factor endowment ratio, at B, at which country Two just attains self-sufficiency in production of X_2. So, at B, country Two exports Y for imports of X_1. As yet, there is no intraindustry trade. We may refer to this as the case of partial interindustry trade.

As we move from B to C, country Two produces more of X_2 than it consumes, and so begins to export it. That is, the labor-abundant country is now exporting one of the capital-intensive goods. This occurs although it has no (absolute) technical advantage in that good, and the trade pattern is fully determinate.

When we reach C, each country is self-sufficient in good Y. However, country Two must import good X_1, which it pays for with exports of X_2. Here, when factor endowment ratios are identical, only intraindustry trade occurs. We call this the case of pure intraindustry trade.

As we move from C to D, country Two begins to import Y as well as X_1, and pays for them with exports of X_2. Thus country One is now the labor-abundant country, and exports one labor-intensive good and one capital-intensive good. Its exports of the capital-intensive good X_1 are driven by its technical advantage in this good.

At D, country Two produces only X_2, which it trades for its entire consumption of both Y and X_1. As is evident, there is substantial trade in both interindustry and intraindustry goods. Accordingly, I call this the case of heterogeneous trade.[16]

D. The Volume of Trade

We now derive the level curves of trade volume for each of the regions. It is analytically convenient to separate the effects of factor endowments on the volume of interindustry trade from the effects on intraindustry trade. Interindustry trade is twice the value of the good Y traded (it being paid for with exports of X_1 or X_2). Intraindustry trade, then, consists of the value of goods X_1 and X_2 traded against one another. Of course,

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[16] The four critical factor ratios define three regions of the FPE set. Denote the area bounded by the Y factor intensity line emanating from O_2 and the X_2 self-sufficiency line as Region I. From there to the diagonal will be Region II. And from the diagonal to the X_2 factor intensity line emanating from O_2 will be Region III. See Figure 2.

these definitions imply that half of interindustry trade is composed of "intraindustry goods." The derivations that follow, of course, hold only within the FPE set.

(1) The Volume of Interindustry Trade

Helpman and Krugman (1985, p. 23) noted that in the standard Heckscher-Ohlin setting with factor price equalization, the level curves for volume of trade are parallel to the diagonal of the box diagram, with increasing volume of trade as we move from the diagonal. This is entirely sensible, as the net factor content of trade is constant along these surfaces, and the volume of trade can be measured by the value of inputs in traded goods.

A similar procedure does not work for the Heckscher-Ohlin-Ricardo model, since trade in intraindustry goods occurs with zero net factor content. Instead, within the FPE set, the lines parallel to the diagonal represent a constant value of interindustry trade [see Figure 3]. The simplest way to see this is to note that within the FPE set, the net factor content of trade is fixed along a line parallel to the diagonal. There is a unique amount of Y that can be traded within the FPE for amounts of X_1 and/or X_2 that attains this net factor content. The value of these factors then measure the volume of interindustry trade, which is constant. In the special case where the endowments lie in Region I, all trade is interindustry trade, and so the parallel lines do give a constant volume of trade.

(2) The Volume of Intraindustry Trade

Now we look at the determinants of the volume of intraindustry trade. It is simplest if we consider this first in the case of pure intraindustry trade, i.e. when the endowment is on the diagonal. Inside the FPE set, and with homothetic preferences, expenditure shares on the goods are fixed and equal across countries. Along the diagonal, Y is not traded. Thus the only trade is Two's exports of X_2 for imports of X_1 from One. Balanced trade implies, then, that we can measure the value of trade as twice the value of Two's consumption of X_1 (since it produces no X_1). Thus the volume of trade rises linearly with Two's income, so long as this is consistent with being in the factor price equalization set. Thus, considering for the moment only the diagonal, the volume of intraindustry trade within this equilibrium reaches its maximum at the interior boundary of the FPE set. With symmetric preferences over intraindustry goods and unit elastic substitution, this would imply that intraindustry trade along the diagonal is maximized when the countries have identical factor endowments.

Now we investigate the volume of intraindustry trade off of the diagonal. Recall that the volume of intraindustry trade is defined here as the value of direct exchange of goods X_1 and X_2. We have already noted that in Region I there is no intraindustry trade. So we turn to region II. We are interested in finding the level curves for intraindustry trade. In Region II, we can measure intraindustry trade as twice the value of country Two's excess supply of X_2. Since within Region 2, country Two's excess supply of X_2 is fixed on a line parallel to the X_2 self-sufficiency line, these must be the level curves of intraindustry trade in this region. Finally, we turn to Region III. Here intraindustry trade consists of exports of X_2 from country Two in exchange for imports of X_1. Along an isoincome line, imports of X_1 are fixed, and these can only be paid for by exports of X_2. Thus the isoincome line in Region III must itself be the level curve for the volume of intraindustry trade. [See Figure 4]

A direct consequence of the foregoing analysis is that within the FPE set, the value of intraindustry trade attains a maximum when countries have identical endowment intensities. The proof is straightforward. Its geometric sense can be appreciated by examining Figure 1. We have already noted that the level curves for intraindustry trade are parallels to the X_2 self-sufficiency factor ratio, with increasing volume of trade as we move toward the diagonal. Since, necessarily, $k_Y <$ slope of X_2 self-sufficiency < ratio of world endowments, it follows that intraindustry trade reaches a maximum at the interior intersection of the diagonal and the FPE set. That is, within the FPE set, intraindustry trade is maximized at a point where the countries have identical factor intensities.

As a benchmark, when preferences are symmetric linear homogeneous Cobb-Douglas, intraindustry trade attains a maximum when countries have identical endowments.

(3) Aggregate Volume of Trade

Finally we integrate the two perspectives -- interindustry and intraindustry -- to derive level curves for total trade volume [see Figure 5]. Recall that within Region I, all trade is interindustry trade, so the level curves are parallel to the diagonal, by the reasoning given earlier. In Region II, the level curves for total trade volume correspond to the isoincome lines in that region. The proof is simple. In Region II, country Two is exporting goods X_2 and Y for imports of X_1. With prices fixed, a move along the isoincome line leaves imports of X_1 unchanged. This implies directly that the endowment shifts that raise exports of one must reduce exports of the other in an equal amount. That is, within Region II, endowment shifts along an isoincome line lead to a direct tradeoff in volume between intraindustry and interindustry trade. The level curves for total volume of trade in Region III do not have as simple an explanation, although the basic tradeoff is clear. Recall that in Region III, level curves for interindustry trade are along parallels to the diagonal, while those for intraindustry trade correspond to isoincome lines. The level curves for total trade can be shown to depend on the world endowment ratio, the factor intensity in the X_2 sector, the expenditure shares on each good and the factor price ratio. In any case, the level curves must have a slope greater than that of the isoincome lines (which have slope -w/r).

E. Contrast With Standard Factor Proportions Results

We now contrast the results of the Heckscher-Ohlin-Ricardo model with the standard results. The Heckscher-Ohlin model yields a simple prediction on the pattern of trade: a country exports the good that uses intensively its relatively abundant factor of production. An important corollary is that countries with identical factor endowment ratios do not trade. When there are more goods than factors, the model still predicts that the net factor content of exports reflects relative factor abundance. The caveat is that in this case, the direction of trade in a particular good is not determinate.

The predictions of the Heckscher-Ohlin-Ricardo model share some of these properties, although with important qualifications. In some cases, the predictions diverge strongly. The weaker condition that the net factor content of trade is predicted by relative factor abundance continues to hold fully in the new setting. However, there is an ambiguity in the stronger assertion. The problem is that now there are two capital-intensive goods, X_1 and X_2. It is quite possible that the labor abundant country exports one of the capital-intensive goods. Note, though, that unlike the case of more goods than factors with identical technologies, this has nothing to do with indeterminacy in the pattern of production. Trade is fully determinate here. It can arise from two possibilities. First, if One is the labor abundant country, but has an absolute (so comparative) advantage in production of good X_1, it produces the world supply of that good, so must export it. This corresponds to trade patterns in Region III (see Figure 2). Second, even if One is the capital abundant country, since it must produce the entire world supply of X_1, its factor endowment net of this may make it the "labor abundant" country in respect to production of the two goods produced with common technologies. Labor abundant country Two would then export capital-intensive good X_2. This occurs in Region II (see Figure 2). Nonetheless, the net flow of capital-intensive goods continues to reflect factor abundance. In strong contrast to the standard Heckscher-Ohlin framework, here even countries with identical endowment intensities may engage in substantial trade.

The standard Heckscher-Ohlin model yields two important predictions regarding the relation between factor endowments and the volume of trade.[17] The first is that, cet. par., the greater the difference in factor endowment ratios, the greater the volume of trade. The second is that (in a sense to be made precise) relative country size has no effect on the volume of trade.[18]

By contrast, in the Heckscher-Ohlin-Ricardo model, these propositions need not hold. These predictions continue to hold exactly as a prediction of interindustry trade. However, when we measure the total volume of trade, including intraindustry trade, the effects of endowment shifts on trade volume depend crucially

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[17] The world volume of trade is defined as the sum of exports across countries.

[18] See Helpman and Krugman (1985), section 1.5.

on the region in which the endowments lie. If we interpret an increase in the difference in factor endowment ratios as a movement away from the diagonal along an isoincome line, then greater differences in endowment ratios raise trade volume when in Regions I or III (see Figure 2). However, such differences in endowment ratios have no impact on trade volume in region II. In this region, the rise in interindustry trade is fully offset by a fall in intraindustry trade. If we interpret a change in relative country size as a movement parallel to the diagonal, then relative country size leaves the volume of trade unchanged in Region I. However, in Regions II and III, country size does matter. In a benchmark case in which preferences are linear homogeneous Cobb-Douglas, greater equality of country size raises the volume of trade. This is driven wholly by a rise in intraindustry trade.

A striking contrast between the predictions of the standard analysis and that in the Heckscher-Ohlin-Ricardo model is that the standard model predicts that countries with identical factor intensities do not trade. In the present model, such countries have no interindustry trade. However, intraindustry trade reaches a maximum at a point where countries have identical endowment intensities.

V. Conclusion

The explanation of why countries trade has experienced a shift of paradigm. There has been wide acceptance that the principal motive for trade among developed countries is -- not comparative advantage -- but increasing returns to scale.

A decisive element in the shift was the claim that theories relying on comparative advantage could not explain the volume of intraindustry trade. However, a crucial step in the argument -- an assertion that differences between countries must be large for the trade volume to be large -- was left implicit and unproven.

In fact, the claim is false. And it fails in a setting intimately linked to the problem of intraindustry trade. This was demonstrated in a stark example: we accounted for substantial trade in goods of identical intensity, among countries with identical endowments, and with arbitrarily small technological differences. We then extended this to a framework which allows for factor price equalization, determinate trade patterns, and the possibility of substantial intraindustry trade.

This was illustrated in the simplest model that can give a unified account of intraindustry and interindustry trade. In the case considered, intraindustry trade attained a maximum at a point where countries had identical factor intensity ratios.

Increasing returns, in short, are not <u>necessary</u> for an explanation of intraindustry trade.

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The Integrated Equilibrium

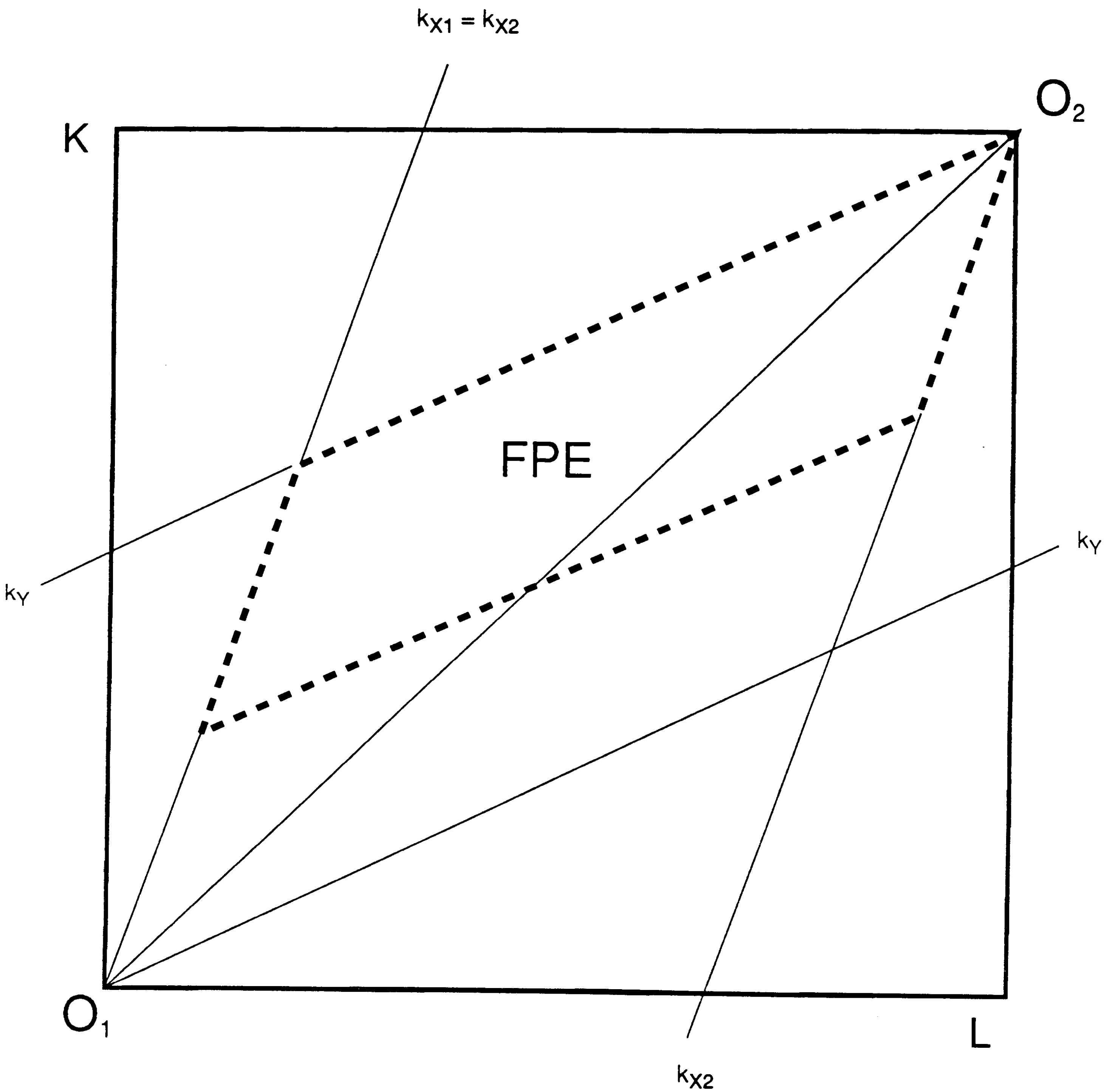

Figure 1

The Pattern of Trade

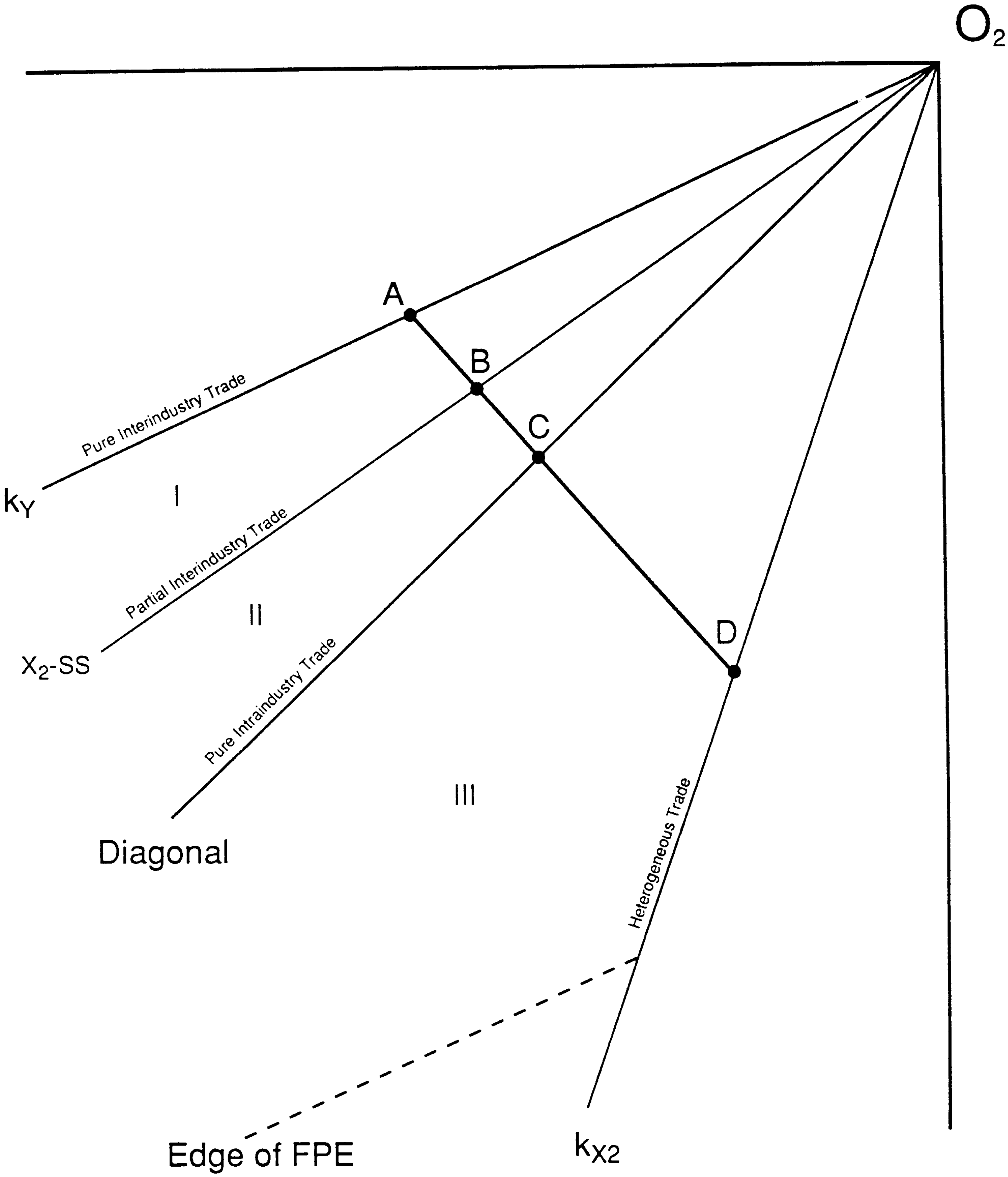

Figure 2

Level Curves for Volume of Interindustry Trade

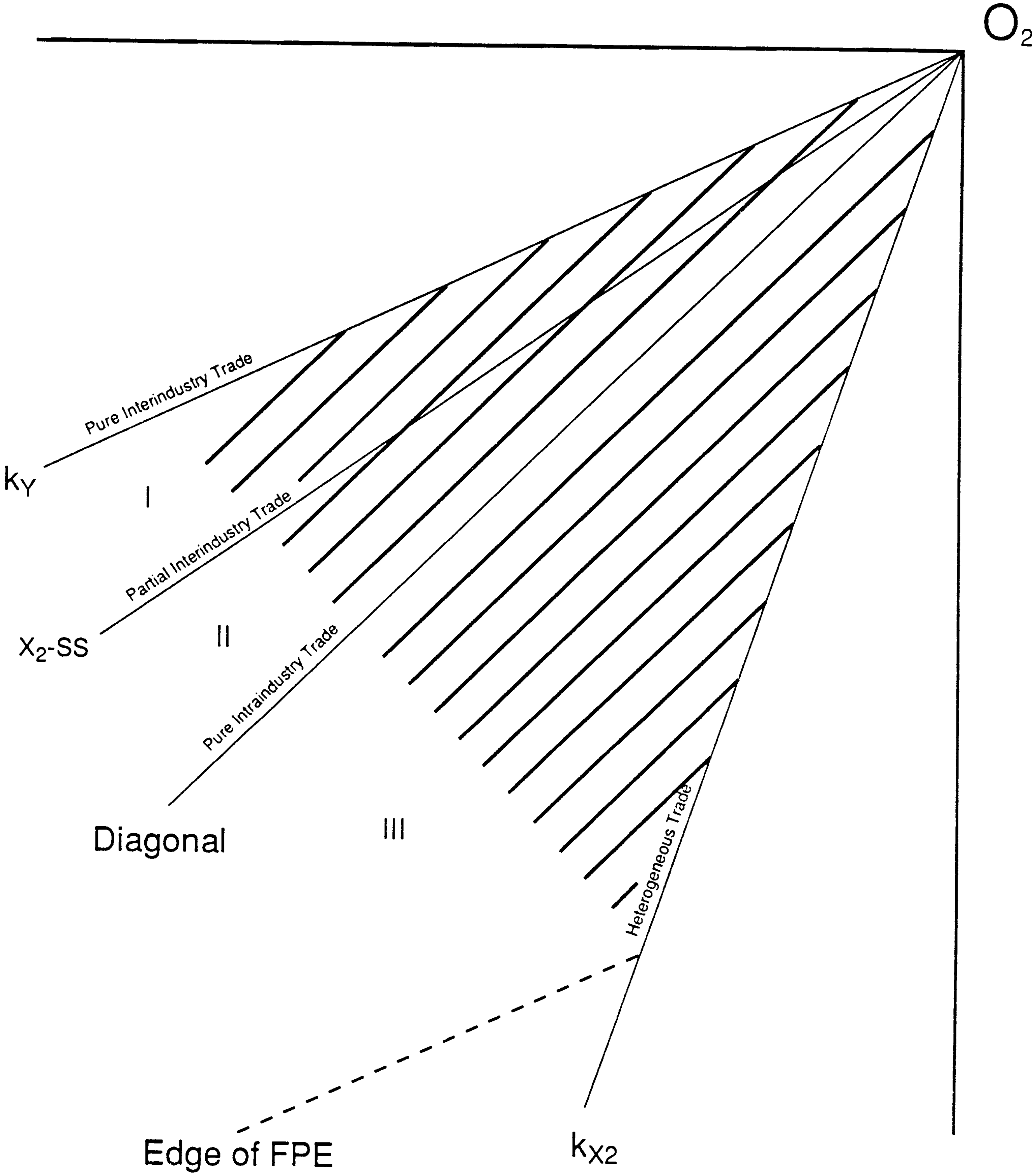

Figure 3

Level Curves for Volume of Intraindustry Trade

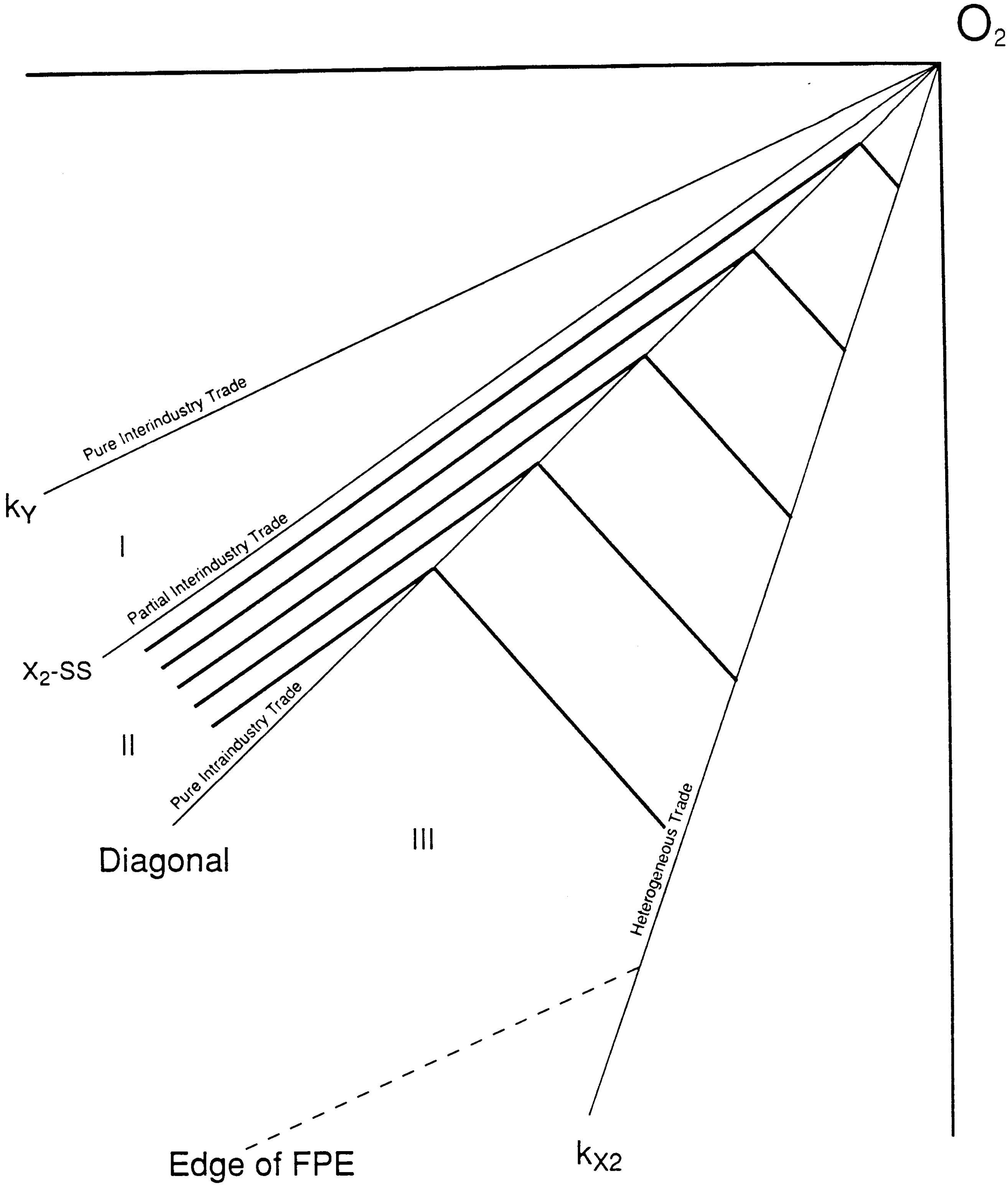

Figure 4

Level Curves for Total Volume of Trade

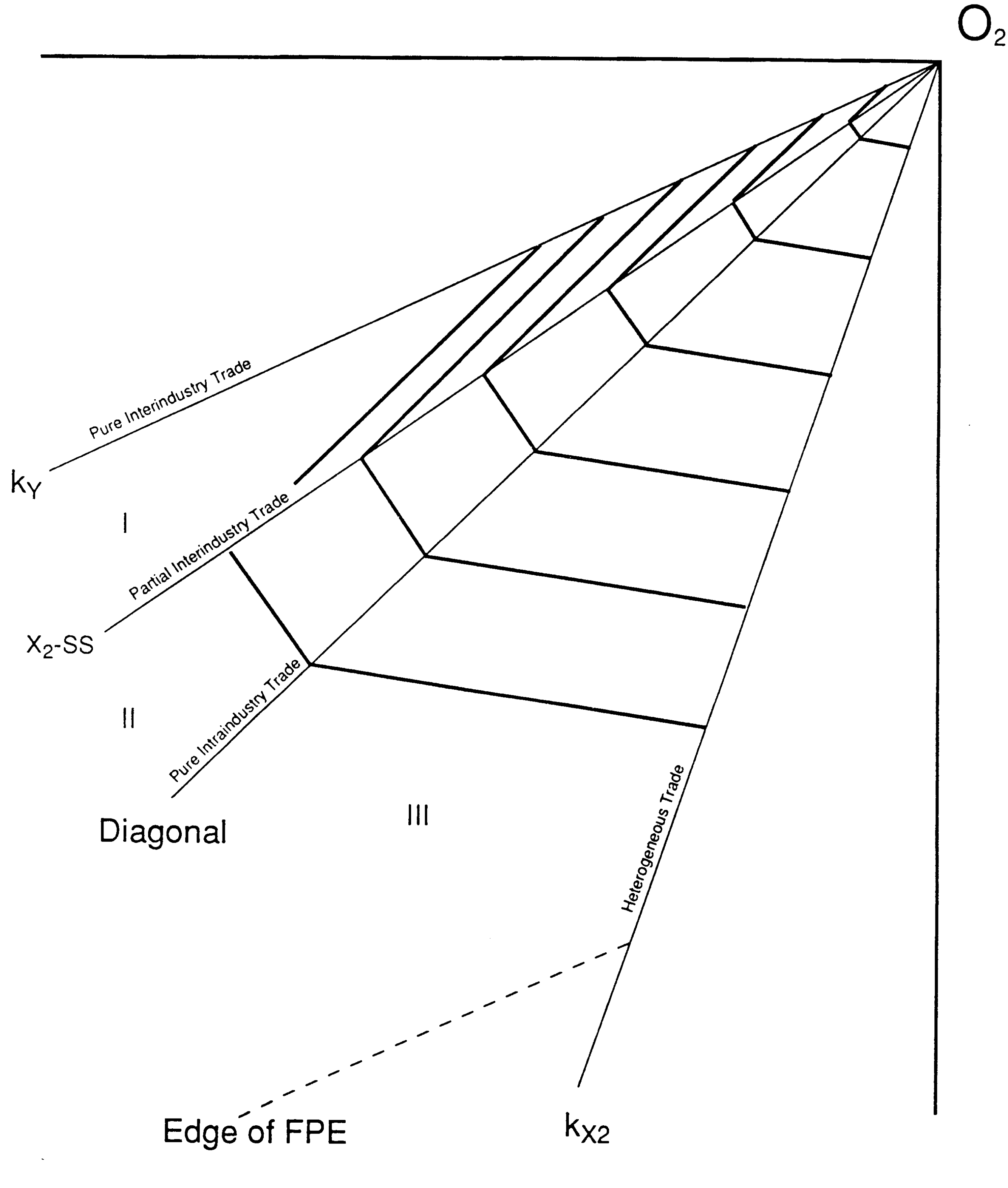

Figure 5

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