WHY HASN'T TRADE GROWN FASTER THAN INCOME?

INTER-INDUSTRY TRADE OVER THE PAST CENTURY

Joseph E. Gagnon and Andrew K. Rose

ABSTRACT

Over the past century, the ratio of international trade to GDP has not grown substantially for most major OECD economies. We conjecture that growth in intra-industry trade has been offset by a decline in inter-industry trade. Inter-industry trade may have declined either because of biased growth in factor inputs so that factor proportions have become more similar, or because preferences have become more similar with rising per capita income.

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I: Introduction

It is commonly asserted that the world is highly integrated and rapidly
becoming more so. Indeed, it is well known that trade has grown faster than
income since the second world war (e.g., Krugman and Obstfeld (1988), pp 1-2).
In this paper, we discuss long-run trends in international trade flows.
Although the ratio of exports plus imports to GDP (hereafter, the "trade
ratio") has grown for many economies during the post-war period, we note that
the trade ratio does not typically display a strong trend *over the past
century*. This fact (previously noted by Grassman (1980) among others)
motivates our theoretical analysis. We point out that a model which incor-
porates both inter-industry trade and intra-industry trade need not display
any long-run trend in the trade ratio.

In our analysis, *intra*-industry trade refers to trade in similar goods
that require similar proportions of factor inputs. *Inter*-industry trade
refers to trade motivated by differences in factor proportions or preferences
across countries, as popularized by Eli Heckscher and Bertil Ohlin. We argue
that inter-industry trade may have declined in importance for one or both of
two reasons: a) factor proportions have grown more similar across countries as
physical and human capital have increased relative to land and labor; and b)

non-homothetic preferences lead to a growing similarity in preferences across countries as per capita income increases. Both mechanisms can lead to a decline in the trade ratio unless they are offset by an increase in intra-industry trade.

In addition to resolving the apparently mysterious long-run behavior of the trade ratio, we also believe that a better appreciation of the charac-teristics of international trade during the late nineteenth century is important in understanding the intellectual development of the inter-industry theory of trade advocated by Heckscher and Ohlin. It is commonly argued that Heckscher-Ohlin trade theory cannot explain key features of international trade, such as the large and quickly growing trade between similar countries in similar products (e.g., Helpman and Krugman (1985)). However, the Heck-scher-Ohlin theory was of greater relevance in the past, when more trade was motivated by differences in factor proportions or preferences.

Empirical evidence on long-run trends in the trade ratio is contained in the section which follows. Section III presents a theoretical discussion of potential sources of the decline in inter-industry trade. Our conclusions are summarized in a brief final section.

II: Empirical Evidence on Trends in International Trade

Despite the *recent* increasing importance of international trade flows in many countries, there is little evidence that international trade has grown faster than output over the last century. Figures 1 through 14 contain time-series plots of the trade ratio for fourteen different OECD countries, where the trade ratio is defined as the ratio of nominal exports and imports to GDP. (Our data, documentation, and programs are available upon request; most of the
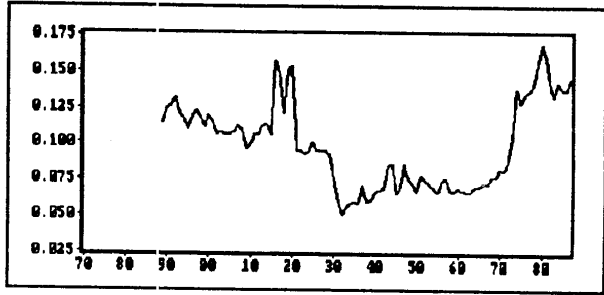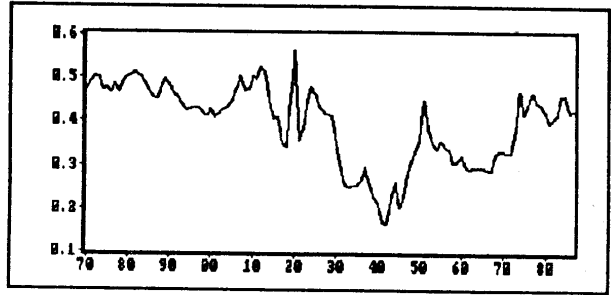
Figure 1: American Trade Ratio
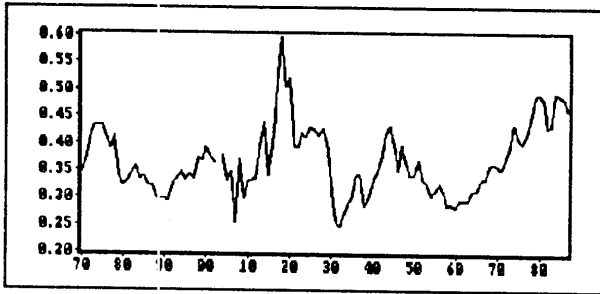
Figure 2: British Trade Ratio
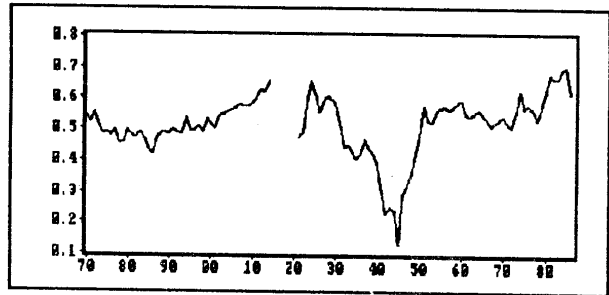
Figure 3: Canadian Trade Ratio
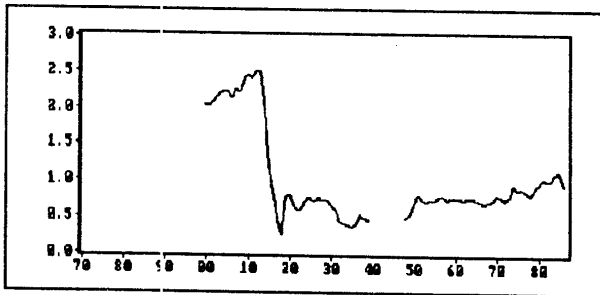
Figure 4: Danish Trade Ratio

Figure 5: Dutch Trade Ratio
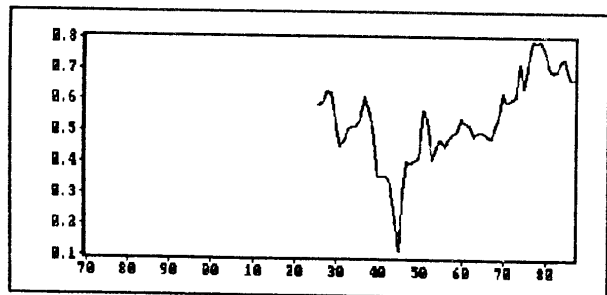
Figure 6: Finnish Trade Ratio
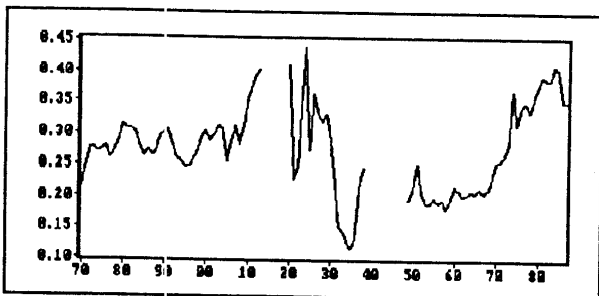
Figure 7: French Trade Ratio
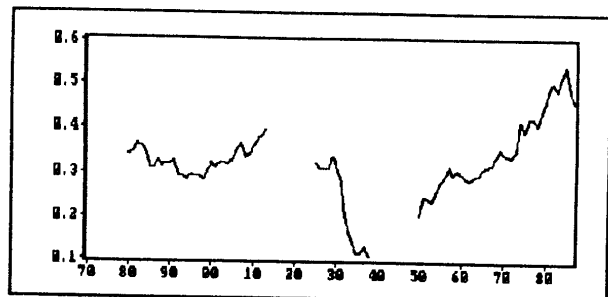
Figure 8: German Trade Ratio
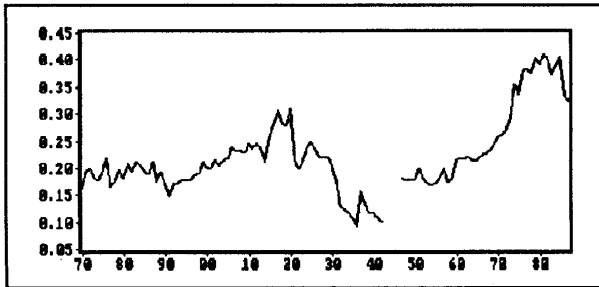
Figure 9: Italian Trade Ratio
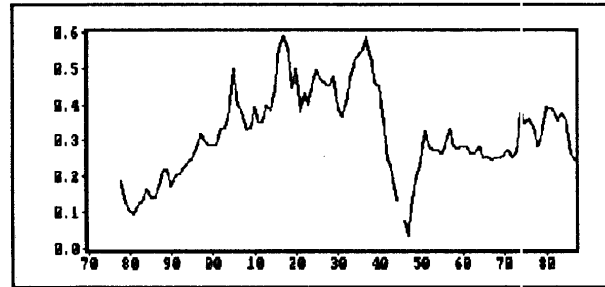
Figure 10: Japanese Trade Ratio
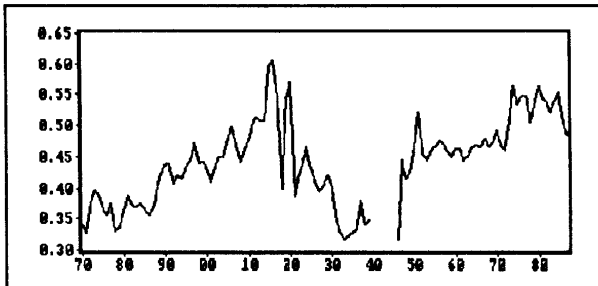
Figure 11: Norwegian Trade Ratio
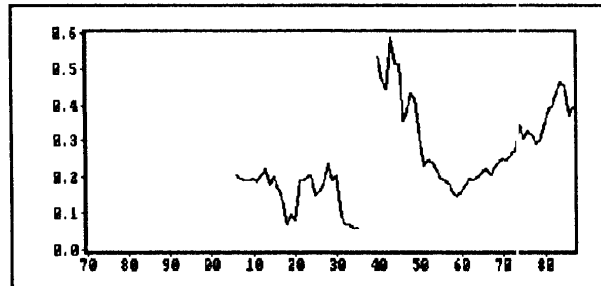
Figure 12: Spanish Trade Ratio
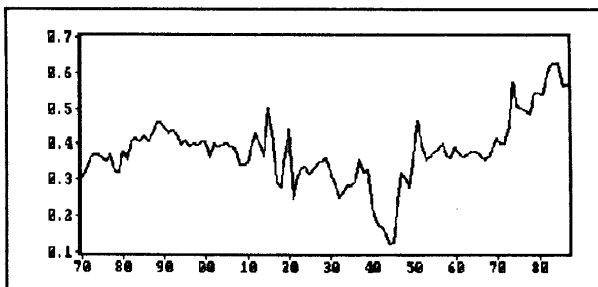
Figure 13: Swedish Trade Ratio
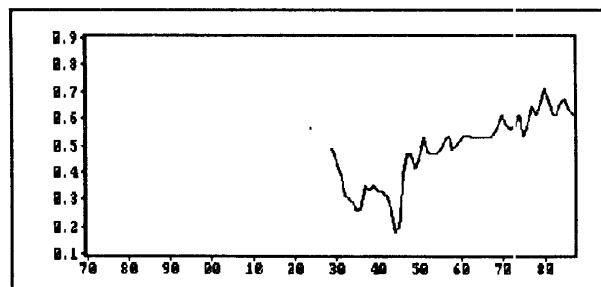
Figure 14: Swiss Trade Ratio

data are taken from Mitchell (1980).) A striking feature of the plots is the apparent lack of any long-run trend.

We examine the ratio of nominal merchandise exports and imports to nominal GDP for two reasons.[2] It seems appropriate to use economic value

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[2]It would be desirable to examine total trade in goods and services rather than just trade in merchandise. Unfortunately, there is little data on trade in services before World War II. In 1986 merchandise trade accounted for almost 90 percent of total trade in goods and services for the United States, Germany, and Japan, according to OECD *National Accounts*.

rather than physical volume data, since the economic question of interest to
us concerns the relationship between the value of goods and services actually
traded and total economy-wide value added (i.e., GDP). Also, it is difficult
to obtain reliable price indices for exports, imports and GDP for the sample
in question.[3] We note in passing that the trade ratio clearly is not an ideal
measure of the openness of an economy; the focus of this paper is the magni-
tude of international trade flows, rather than openness.[4]

Table I contains estimates of the average growth rates of the trade
ratio and the average propensity to import. These estimates have been
multiplied by 100 for ease of interpretation as percentages; t-statistics are
included in parentheses. Also contained in Table I are regression-based

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[3]There has been no discernible trend in the ratio of the wholesale price
index to the consumer price index in the United States over the past 100
years. Since wholesale goods are mainly tradable, while many consumer goods
are not, there is no *prima facie* evidence of a long-run trend in the trad-
able/non-tradable price ratio. Beenstock and Warburton (1983) provide a more
detailed discussion of this point.

[4]Grassman (1980) argues that the trade ratio also may be a biased
measured of openness because government spending (as a fraction of GDP) has
increased over the past century. Grassman suggests adjusting the denominator
of the trade ratio to exclude government spending. It is not clear that this
is helpful; such a trade ratio of an open economy would change if the govern-
ment decided to nationalize an industry, even if this did not affect either
trade flows or GDP. Moreover, governments clearly influence international
trade flows, either directly (e.g., current American military expenditures in
Europe) or indirectly (e.g., by domestic purchases of exportable goods such as
defense and agriculture).
     In any case, the trade ratio measures actual rather than potential
trade; it may be low despite the fact that the elasticity of trade flows with
respect to small perturbations in the terms of trade is large. Consider two
countries with identical tastes and identical Ricardian production functions.
There will be no reason for such countries to engage in international trade,
even if there are no barriers to trade (such as tariffs or transportation
costs) so that the economies are perfectly open. However, an exogenous shock
to the production function of one of the economies would lead to substantial
trade flows.

Table I: Descriptive Statistics for Trend Growth in Trade Ratios

	Average Growth Rate	Average Growth Rate of Ave. Prop. to Imp.	Estimated Growth Rate (excl. wars)
Canada	.2%	.1%	-.5%
(t-statistic)	(.2)	(.1)	(.5)
Denmark	.4	.3	1.6
	(.4)	(.2)	(1.6)
Finland	.2	.4	3.1
	(.1)	(.2)	(1.5)
France	.7	.7	.7
	(.5)	(.4)	(.5)
Germany	-.1	-.5	-.1
	(.1)	(.6)	(.1)
Italy	.1	-.4	.2
	(.1)	(.3)	(.2)
Japan	.7	-.1	1.9
	(.4)	(.0)	(.9)
Netherlands	-1.1	-1.3	2.1
	(.5)	(.6)	(1.1)
Norway	.4	.3	.6
	(.5)	(.3)	(.8)
Spain	-2.1	-2.0	-.5
	(.9)	(.7)	(.2)
Sweden	.5	.5	1.8
	(.4)	(.3)	(1.5)
Switzerland	.4	.3	1.5
	(.2)	(.1)	(.8)
UK	-.1	-.1	.5
	(.1)	(.1)	(.6)
USA	.2	.1	.1
	(.2)	(.1)	(.0)

estimates of the average growth rate of the trade ratio. In column 3, the OLS estimate of the constant term (multiplied by 100) and the Newey-West t-statistic are reported from a regression of the change of the log of the trade ratio on a constant and dummies for each year of both world wars.

The statistics in Table I effectively corroborate the impression conveyed by the plots, namely that there is little evidence of long-run growth in the trade ratio. Judged at conventional levels of statistical significance, none of the trade ratios has exhibited trend growth. As more sophisticated time-series techniques (e.g., non-linear state-space methods) do not lead to different conclusions, it seems reasonable to conclude that there have not been strong trends in the trade ratios of these fourteen countries over the past century.

The lack of a strong drift in the trade ratio is all the more surprising in light of the numerous factors that might have led to substantial increases in the importance of trade. Worthy of particular mention are: 1) declines in protectionism (due in part to the establishment of GATT); 2) declines in transportation costs; 3) advances in communications technology; 4) increased liquidity of the international financial system (and the establishment of central banks); and 5) increased barriers to labor mobility.[5]

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[5]On the other hand, some researchers have proposed that there are factors that tend to reduce the importance of trade. Indeed, only a generation ago it was widely believed that international trade tended to stagnate or decline in importance secularly. Hicks (1953) argues that exogenous technological change was biased towards trade creation in the nineteenth century, but has been biased against trade in the twentieth century. Kuznets (1959) uses a century of data for ten countries to argue that there is little evidence of a long-run trend in the trade ratio; he asserts that a variety of factors affect the trade ratio, including technological developments that affect internal and external transportation costs at different rates and the changing sizes of various countries. Haberler (1964) characterizes the 1950s as "the first time in almost a hundred years [that] world trade has grown faster than world production" and argues that this was a result of two factors: rapid output

III: **Two Theoretical Explanations**

While inter-industry trade is motivated by differences in factors of production or preferences across countries, intra-industry trade is motivated by economies of scale in the production of differentiated products. Hirschman (1945) presents evidence that intra-industry trade was much less important than inter-industry trade during the three decades prior to World War II. Since World War II, many researchers have documented a secular rise in intra-industry trade; Deardorff (1984) provides a survey. The conjecture of this paper is that there are forces leading to a secular decline in inter-industry trade. This section presents two non-mutually-exclusive hypotheses that may account for this phenomenon. Given the offsetting movements in its components, the aggregate trade ratio may rise, fall, or stagnate over the long run.

Inter-industry trade shrinks if countries tend to grow more similar in their effective factor proportions over time. There are several reasons to expect growing similarity in factor proportions. If natural resources were once a major source of differences in factor proportions, technology that conserves resources also reduces the size of trade based on resource differences.[6] More generally, in a world where some factors are exogenously determined (e.g. land and labor) and other factors can be endogenously augmented (e.g. physical and human capital), growth of the augmentable factors relative

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growth and the removal of trade barriers; see also Cooper (1964). Finally, it has been argued that the loss of forced trade with colonies after liberation tends to reduce the trade ratio, especially because former colonies sometimes choose development strategies involving import substitution. A similar argument may apply to countries that become communist.

[6]Maddison (1987) documents a declining ratio of energy inputs to GDP for a group of OECD countries.

to the exogenous factors is likely to make factor proportions more similar

across countries. That is, equal rates of investment in capital-rich and

capital-poor countries--over and above the (exogenous) rate of growth of the

labor force--will be associated with a growing similarity of factor propor-

tions across these countries.

It is easy to show that in a world with two countries, two factors of

production, and two goods, a growing similarity of factor proportions leads to

a lower trade ratio. The proof is constructed geometrically. In Figure 15,

the production possibility set of coun-
try 1 (which is relatively well-endowed
with the factor that is used intensively
in the production of good X), is given
by aa; I_0 and I_1 are representative in-
difference curves. In the absence of
trade, production and consumption occur
at A, where the production frontier is
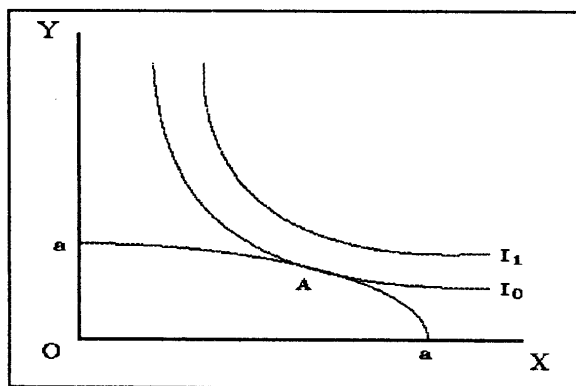
Figure 15: Autarky Equilibrium

tangent to the indifference map. The price ratio that supports this equi-

librium is given by the slope of the tangent to the indifference curve at A.

Once country 1 is opened to trade, consumption and production need not

occur at the same point. For any given international price ratio, the optimal

production point for country 1 occurs where the production frontier has the

same slope as the price ratio. A tangent drawn to the production frontier at

this point provides the budget line. The optimal consumption point is the

point of tangency of the budget line with the indifference map.

Figure 16 includes the production frontiers of both country 1 and

country 2, which is relatively better endowed with the factor used intensively

Figure 16: Initial Trade Equilibrium

Figure 17: Factor Convergence

in the production of good Y. For simplicity, both country 1 and country 2 are assumed to have identical homothetic preferences. In equilibrium, each country faces the same price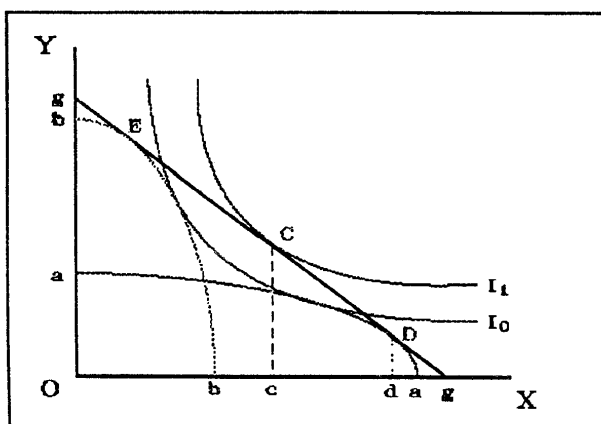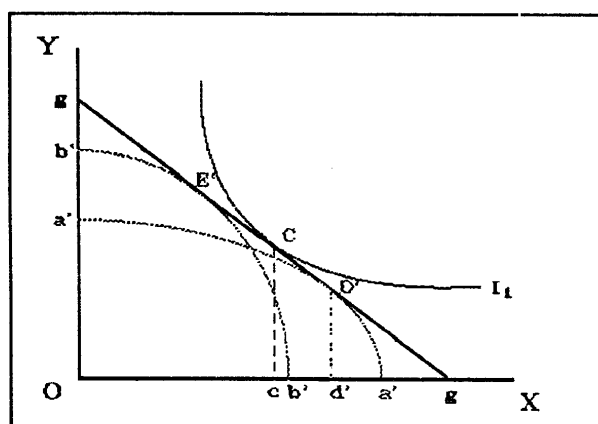 ratio, and the value of exports sold by each country equals the value of imports bought by the other. Without loss of generality, it is possible to construct the production frontiers such that both countries have the same total income given by the budget line gg. Since the representative consumers have identical preferences, both countries consume at point C. Production occurs at D for country 1 and E for country 2. The ratio of total trade to total production for country 1 is given by twice the ratio of the distance from c to d to the distance from 0 to g. The trade ratio for country 2 is identical.

Now consider reallocating the factor endowments of country 1 and country 2 so as to make the countries more similar, but still of equal size, as depicted in Figure 17.[7] If the countries retain the common budget line gg,

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[7]It would be more realistic to consider expanding both countries' produc-
tion frontiers at the same time that they become more similar. However, under
the assumptions of constant returns to scale in production and homothetic
preferences, it is permissible to rescale the diagram by any constant multi-
ple.

they will also retain the consumption point C. Country 2's production point, E', must now be closer to C because of the reduced slope of the new production frontier; similarly with country 1's production point, D'. Total trade, and the trade ratio, shrinks.

An alternative hypothesis that can explain the decline in inter-industry trade is the existence of non-homothetic preferences. Hunter (1988) and Hunter and Markusen (1988) show in a static framework that non-homothetic preferences are both theoretically and empirically important in North-South trade. If poor countries have faster per capita growth than rich countries, preferences become more similar across countries over time as the gap in per capita income closes. Even if poor countries are not growing faster than rich countries, the net effect of growth is likely to make the representative indifference curves of rich and poor countries more similar.[8]

To focus on nonhomotheticity, we consider two countries with identical production possibility sets.[9] Country 1 has a larger population than country 2, however, so that its per capita income is lower. Individuals in each country have identical preferences. At low levels of income, preferences are skewed toward the "staple" good X. At high levels of income, preferences are skewed toward the "luxury" good Y. Because of the difference in per capita

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[8]Following Hunter (1988), this result can be derived theoretically from a Cobb-Douglas utility function with a minimum subsistence level for the staple good, e.g. $U[x,y] = (x-x_0)^\beta y^{1-\beta}$, where x_0 is the subsistence level of good X.

[9]When non-homothetic preferences are combined with different production possibility sets, the effect of growth on the trade ratio may be strengthened or weakened, depending on the nature of specialization in production. If the poorer country is almost completely specialized in the production of the staple good, then growing similarity of preferences may even increase the trade ratio. We believe that such a scenario is unrealistic, especially since growth that yields more similar preferences is likely to yield more similar production possibilities.
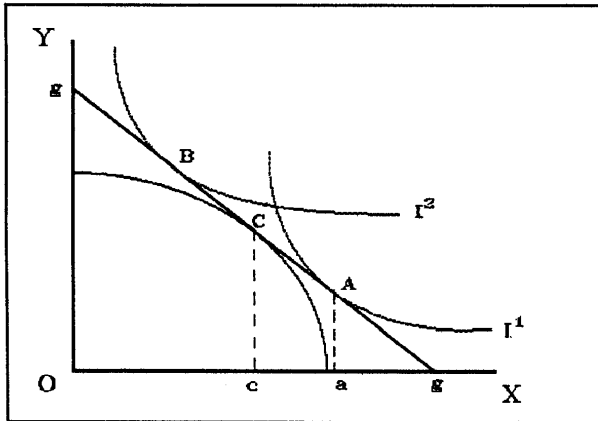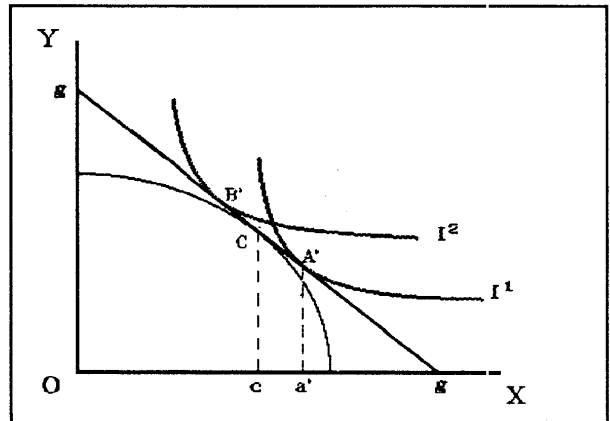
Figure 18: Non-Homothetic Preferences

Figure 19: Convergence of Preferences

income, the representative indifference curves of country 1 and country 2 are not identical. In Figure 18, the equilibrium budget line is tangent to each country's indifference contours at consumption points that are consistent with balanced trade. Production occurs at C in both countries; consumption is at A in country 1 and at B in country 2. Since both countries have equal production and there is balanced trade, the trade ratio is equal across countries.

Now suppose that growth leads indifference curves to become more similar across countries. By reducing the skewness of country 1's preference for X and country 2's preference for Y in a symmetrical manner, Figure 19 shows that the trade ratios for both countries drop. It is also the case that the trade ratio drops when only one country's indifference curves shift, provided that they shift in the direction of the other country's.

IV: Conclusion

International trade is increasingly dominated by trade between similar countries in similar products; intra-industry trade seems to account for a growing share of international trade. In this paper, we have argued that the

declining importance of inter-industry trade may approximately offset the growth of intra-industry trade, so that the aggregate ratio of exports plus imports to GDP need not show any trend. We also have suggested two reasons why inter-industry may have declined in importance: a) factor proportions have grown more similar across countries as physical and human capital have increased relative to land and labor; and b) non-homothetic preferences lead to a growing similarity in preferences across countries as per capita income increases.

We have not presented evidence that would allow us to discriminate between our hypotheses and other explanations for the decline of inter-industry trade. Indeed, we believe that such tests will prove elusive for at least three reasons. First, there is much disagreement over the exact breakdown between inter- and intra-industry trade, even though intra-industry trade is increasing in importance by most definitions. Second, it is very difficult to determine how much of a country's industrialization is due to government policies that discourage imports of manufactures and how much is due to fundamental changes in factor proportions and preferences brought about through population growth and investment. Third, technological progress itself may change the shape of production frontiers in a manner that is very difficult to measure. Nevertheless, we believe that our proposed explanations for the decline of inter-industry trade are plausible and useful additions to the theory of international trade.

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