# TRADE ORIENTATION
# MEASUREMENT AND CONSEQUENCES

### Holger C. Wolf[*]

## ABSTRACT

New trade theory and endogenous growth models have revived the debate on the static and dynamic implications of trade orientation. Alas, a decade of models has produced more ambiguity than clarity, placing a premium on empirical work. Unfortunately, existing indices of trade orientation invite substantial criticism. In the first part of the paper we construct a new measure, based on the difference between actual trade and the trade levels predicted by a factor endowments model. In the second part, we use the index to examine the link between trade orientation and economic growth.

## SÍNTESIS

La nueva teoría de comercio internacional y los modelos de crecimiento endógeno han revitalizado el debate sobre las consecuencias estáticas y dinámicas de la orientación del comercio internacional. Desafortunadamente, una década de modelos han dado lugar a mayor ambigüedad que claridad, lo que privilegia el trabajo empírico. Asimismo, los índices que existen sobre el enfoque, mayor o menor apertura y/o intervención, del comercio internacional concitan una crítica substantiva. En la primera parte de este trabajo, elaboramos una nueva medición, basada en la diferencia entre el comercio internacional real y los niveles de intercambio comercial internacional previstos en términos de un modelo de dotación de recursos. En la segunda parte, utilizamos el índice para examinar el vínculo entre la orientación del comercio internacional y el crecimiento económico.

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## 1. INTRODUCTION

Do outwardly oriented countries grow faster? Only half a decade ago, most mainstream economists would have answered in the affirmative. Since then, new trade theory and endogenous growth models have cast doubts on the classical predilection for free trade: temporary protection for industries with unexploited learning by doing potentials may yield permanent growth advantages; strategic subsidies may influence location choices with lock-in effects, liberalization between highly and less developed economies may enhance the growth potential of the richer at the expense of the poorer country *etcetera*.[1]

The theoretical ambiguity motivates the continued attention devoted to empirical studies of the trade orientation-growth link. Yet measurement of trade orientation has proved surprisingly difficult: the indicators proposed to date exhibit low if not negative correlations, rendering an objective choice difficult: *"the hope that a reasonably straightforward (...) measure can produce a 'correct' ranking of countries has always been treated skeptically, and, disappointingly, rightly so"* (Pritchett 1991: 33).

In the first part of this paper we construct a new measure of trade orientation for the three years 1975, 1980 and 1985. The approach builds on earlier work:[2] trade orientation is measured as the deviation of actual trade from a hypothetical non-distorted level, specified here as the predicted value of a (broadly defined) relative factor endowment model. The value of the derived indicator depends critically on the ability of factor endowments to explain trade. Our results suggest that differences in relative endowments are indeed highly significant determinants of trade flows. Of course, lacking an objective measuring gauge, yet another distortion index would provide little value added. To achieve product

[1] See Feenstra (1990), Grossman and Helpman (1991), Rivera-Batiz and Romer (1991a), Young (1991), *inter alia*.

[2] See in particular Leamer (1984, 1988).

and whether sizeable changes in the index have been associated with systematic changes in trade performance. In the second part of the paper, we employ the distortion index to examine the link between trade and growth.

## 2. MEASURING TRADE ORIENTATION

We begin with an overview of the approaches to measuring trade distortion and the existing literature. We then turn to a discussion of the approach used in this paper and a description of the data before presenting the estimation results.

### 2.1. Approaches to measuring trade distortion

Trade orientation indices fall into three broad groups: trade shares, direct measures of intervention and deviations of trade quantities and prices from some equilibrium level. All three approaches are subject to substantial criticism.[3]

A first rough estimator of trade orientation is provided by the unadjusted trade share $\frac{X + M}{GNP}$. Since the measure ignores country size and development stage effects, it is likely to at best present a poor indicator of trade orientation. A variant of this approach hence adjusts for a set of relevant factors by using the residual of a regression of the unadjusted trade intensities on the postulated determinants as distortion estimate (e.g. Chenery and Syrquin (1989)). While an improvement, the measure suffers from the inherently arbitrary choice of controls and the lack of a measuring gauge for assessing whether the residuals truly reflect trade orientation or the orthogonal part of some further excluded determinants.

The second group focuses directly on measures taken to influence trade, including tariff rates, measures of non-tariff barriers, effective rates of protection and coverage ratios. Direct measures suffer from two fundamental problems, mismeasurement and aggregation bias. Actual intervention may bear little relation to published regulations: in the case of Brazil, the import weighted statutory tariff level at 40 percent far exceeds the collected share of 6 percent.[4] Even if published and implemented measures would coincide, the interpretation of aggregate rates remains difficult: depending on the variability of tariff rates and demand and supply elasticities, equal average tariff rates or coverage ratios may entail starkly different allocative consequences. Furthermore, informal evidence

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[3] See e.g. Balassa and Balassa (1984), Bhagwati (1979, 1986), Bruton (1989), Corden (1987), Finger and Olechowski (1987), Leamer (1988), Singer (1987), Pritchett (1991).

[4] World Bank (1990). Pritchett and Sethi (1992) find no evidence for a linear relation between legal and actual barriers in a detailed three country study.

entail starkly different allocative consequences. Furthermore, informal evidence suggests and increasing importance of 'soft', barriers, reducing the information content of explicitly externally oriented measures.

The third group of indices examines trade quantities and prices relative to some 'norm' to back out distortions. Price measures are based on the hypothesis that trade distortion alters prices so that a ranking of price deviations -conditional on structural factors- replicates the ranking of trade distortions (Agarwala (1983), Aitken (1992), Dollar (1992)). The alternative approach attempts to back out information about trade orientation from quantities (Leamer (1984, 1988)). If trade in the absence of distortion is explained by an observable set of factors, the residual of a regression of actual trade on these factors provides a proxy for the orthogonal part of the distortion.[5]

Interpreting price based measures raises the same aggregation problem encountered by direct measures: equal differences between domestic and world prices in different sectors are unlikely to have identical effects on factor allocations. Meaningful aggregation again requires knowledge of own and cross elasticities unlikely to be available. The last measure, by virtue of being based on actual allocation, avoids the aggregation problem but, being based on a particular researcher's preference for a particular 'correct' model, again has to confront the charge of arbitrariness.

While all three approaches thus suffer from significant shortcomings, estimating distortions based on the divergence of actual trade quantities from their undistorted level carries two significant advantages. First, as the non-distorted model needs to be estimated, the goodness of fit of this estimation provides a natural criterion to assess the quality of the index. Second, by directly focusing on the variable of ultimate interest, the approach cuts through the otherwise intractable aggregation problem plaguing the direct and price measures.

## 2.2. Evidence

The empirical literature on trade distortion has become quite sizeable, ranging from informal groupings (e.g. World Bank (1987)) to precise numerical estimates along the alternatives delineated above. As all of these measures attempt to capture trade orientation, one would expected a fair degree of positive correlation. Alas, the hope is misleading: *"alternative objective measures of outward orientation (...) are completely uncorrelated across countries"* (Pritchett (1991: 3)).

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[5] A related measure calculates the world production frontier and estimates distortion as the difference between the efficient tangency point and the actual production/trade pattern. (Skoorka (1991a, 1991b).)

Tables 1 to 3 provide some further information. We divided each of the most popular reported indices into five equal sized groups, ranked from the least distorted (1) to the most distorted (5). The results for overall trade and manufacturing are reported in Tables 1 and 2, ranked according to the overall mean. The visual impression suggests a wide disparity even on this highly aggregated level.[6] Indeed, for one third out of the 118 countries reported, the maximum rank difference equals 4, i.e., the country has been classified *both* as belonging to the least *and* as belonging to the most distorted.[7] A further forty three countries exhibit a maximum rank differential of three. In contrast, only two countries fall into the same category for all indices, with a further eleven exhibiting a difference of only one rank.

Table 3 reports the average rank difference from the mean of all indices, providing a metric for the distance of a measure from the average. Quite noticeably, the measures based on relative factor endowments are 'outlier' both in respect to overall and to manufactures trade. Of course, this does not permit a quality judgement by itself; potentially, the other measures could be consistently off. As Leamer himself argues, there are however good grounds to be skeptical regarding the interpretation of his openness measures. A particularly serious problem is posed by the much higher degree of disaggregation of trade flows compared to endowment data used in his analysis. As long as (physical and human) capital is not completely malleable between the trade categories within the time periods considered, regressions of disaggregated trade flows on aggregated inputs will yield gross underestimates of exports for those goods in which the country under consideration possesses specialized human and physical capital. The residuals would then proxy these excluded product specific factor inputs rather than trade orientation, rendering the measure inappropriate for assessing the trade orientation -growth linkage. Leamer (1988: 41) shares some of these doubts by concluding that *"As I examine these results, I am left with a feeling of skepticism [...] I see tastes (Japan's coffee), omitted resources (Iceland's fish), and historical accidents (Switzerland's watches). I am not sure that I see trade barriers"*.

In conclusion, then, the market for trade orientation indices has not yet produced a clear favorite. The policy-based measures are likely to miss a substantial part of the distortions, the model-based approaches to date suffer from interpretation difficulties endangering their usefulness as distortion measures. Where to go from here? One recently popular approach makes a virtue out of the lack of consistency, treating different estimators as largely independent

[6] The disparity may be somewhat misleading as the indices comprise both measures of outright distortion and of outward orientation, which are typically but not always negatively related. However, leaving out measures 3 and 8 does not materially alter the picture of wide divergence.

[7] South Korea provides a case in point, being a favorite example in arguments for liberal trade policies (World Bank (1987)) as well as for sophisticated intervention (Sachs (1987)).

information of various 'aspects' of distortion and suggesting that robustness of findings across alternative measures reveals the sturdiness of the examined link (Edwards (1991), Harrison (1991)). Given the wide variance in classification documented above, some skepticism towards this approach seems indicated: if results are invariant to whether the ASEAN countries are ranked as being among the most *or* as being among the least distorted, the finding may well be 'robust' yet one may question its interpretation.

## TABLE 1

### TRADE DISTORTION INDICES: OVERALL

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Mean |
|---|---|---|---|---|---|---|---|---|---|---|
| Malta | 2 | | | 1 | 1 | | | | | 1.3 |
| Papua New Guinea | 1 | 1 | 1 | 2 | 2 | | | | | 1.4 |
| South Africa | | | | 1 | 2 | | | | | 1.5 |
| Korea | 2 | 2 | 1 | 3 | 1 | 1 | | | 1 | 1.6 |
| Singapore | 1 | 1 | 1 | 1 | 2 | | 1 | 2 | 4 | 1.6 |
| Malaysia | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 4 | 3 | 1.7 |
| Canada | 1 | | | 1 | 2 | | 4 | 1 | | 1.8 |
| Jordan | 1 | 3 | 2 | 3 | 1 | | | | 1 | 1.8 |
| Saudi Arabia | | 1 | 1 | | | | 5 | 1 | | 2.0 |
| Gambia | 1 | | | 4 | 1 | | | | | 2.0 |
| Togo | 1 | | | 4 | 1 | | | | | 2.0 |
| Taiwan | | | | 3 | 1 | | | | | 2.0 |
| Thailand | 3 | 4 | 2 | 1 | 1 | 1 | 2 | 3 | 2 | 2.1 |
| Hong Kong | 1 | 1 | 2 | 1 | 4 | | 1 | 5 | | 2.1 |
| Nepal | 4 | 2 | 1 | 1 | 3 | | | | | 2.2 |
| Ireland | 1 | | | 3 | 1 | | 1 | 5 | | 2.2 |
| Iceland | | | | 3 | 2 | | 2 | 2 | | 2.3 |
| Tunisia | 3 | 3 | 4 | 2 | 2 | 1 | | | 1 | 2.3 |
| Mexico | 5 | 1 | 3 | 1 | 3 | 2 | | | 1 | 2.3 |
| Kuwait | 5 | 1 | 1 | | | | | | | 2.3 |
| Mauritius | | | | 3 | 1 | | | | 3 | 2.3 |
| Mali | 2 | | | 3 | 2 | | | | | 2.3 |
| Costa Rica | 2 | 4 | 1 | 1 | 4 | | 2 | 4 | 1 | 2.4 |
| Ivory Coast | 1 | 2 | 2 | 5 | 1 | 3 | 1 | 4 | | 2.4 |
| Barbados | 4 | 1 | 1 | 3 | 3 | | | | | 2.4 |
| Sri Lanka | 2 | 4 | 3 | 1 | 3 | 2 | 3 | 1 | 3 | 2.4 |
| Indonesia | 1 | 2 | 4 | 2 | 4 | 3 | 3 | 1 | 2 | 2.4 |
| Chad | | | | 4 | 1 | | | | | 2.5 |
| Norway | 2 | | | 2 | 2 | | 2 | 3 | 4 | 2.5 |
| Spain | | | | 1 | 3 | | 3 | 3 | | 2.5 |
| Burma | | | | 1 | 4 | | | | | 2.5 |
| Israel | | | | 3 | 1 | | 2 | 4 | | 2.5 |
| United States | 2 | | | 1 | 1 | | 4 | 4 | 3 | 2.5 |
| Cameroon | 1 | 4 | 2 | 5 | 1 | 1 | 5 | 1 | 3 | 2.6 |
| Jamaica | 1 | 1 | 2 | 4 | 4 | 4 | | | 2 | 2.6 |

Table 1 (cont.)

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Mean |
|---|---|---|---|---|---|---|---|---|---|---|
| Malawi | 2 | 2 | 5 | 3 | 3 | 1 | | | 2 | 2.6 |
| Ethiopia | | | | 4 | 2 | | 4 | 1 | | 2.6 |
| Cyprus | 4 | 2 | 3 | 2 | 2 | | 4 | 2 | 2 | 2.6 |
| Netherlands | 1 | | | 2 | 3 | | 1 | 5 | 4 | 2.7 |
| Belgium | 1 | | | 4 | | | 1 | 5 | 3 | 2.7 |
| Fiji | 3 | | | 2 | 2 | | 4 | | 4 | 2.7 |
| Ecuador | 2 | 4 | 3 | 3 | | | 4 | 1 | | 2.8 |
| Portugal | 3 | | | 1 | 2 | | 5 | 3 | | 2.8 |
| Haiti | 2 | 1 | 3 | 3 | 5 | | | | | 2.8 |
| Zimbabwe | 3 | 2 | 5 | 5 | 1 | | | | 1 | 2.8 |
| United Kingdom | 5 | | | 2 | 2 | | 3 | 4 | 1 | 2.8 |
| Senegal | 2 | 3 | 2 | 4 | 2 | | 4 | | | 2.8 |
| Kenya | 2 | 4 | | 4 | 1 | 2 | | | | 2.8 |
| Morocco | 3 | 4 | 3 | 3 | 2 | | 3 | 2 | | 2.9 |
| Italy | 5 | | | 1 | 1 | | 2 | 5 | 4 | 3.0 |
| Pakistan | 3 | 5 | 4 | 1 | 2 | 4 | 3 | 3 | 2 | 3.0 |
| Philippines | 4 | 3 | 4 | 2 | 3 | 2 | 4 | 2 | 3 | 3.0 |
| Austria | | | | 2 | 3 | | 3 | 4 | 3 | 3.0 |
| CAR | 3 | 4 | 2 | 4 | 2 | | | | | 3.0 |
| Bangladesh | 4 | 5 | 3 | 1 | 3 | 5 | 4 | 1 | 1 | 3.0 |
| Niger | 3 | | | 5 | 1 | | | | | 3.0 |
| Congo | 1 | 3 | 5 | 5 | 1 | | | | | 3.0 |
| Surinam | 3 | 3 | | 3 | 3 | | | | | 3.0 |
| Guatemala | 5 | 1 | 1 | 3 | 5 | | | | | 3.0 |
| Algeria | 2 | 2 | 4 | 5 | 3 | | | | 2 | 3.0 |
| Colombia | 5 | 5 | 4 | 1 | 1 | 2 | 5 | 2 | 3 | 3.1 |
| Turkey | 4 | 5 | 4 | 2 | 3 | 3 | 2 | 3 | 2 | 3.1 |
| India | 2 | 5 | 4 | 2 | 3 | 3 | | | 3 | 3.1 |
| Sweden | 3 | | | 4 | 3 | | 2 | 4 | 3 | 3.2 |
| Dominican Republic | 3 | | | 4 | 4 | | 3 | 3 | 2 | 3.2 |
| Venezuela | 4 | 3 | 3 | 2 | 5 | | | | 2 | 3.2 |
| Madagascar | 3 | 4 | 4 | 3 | 2 | | | | | 3.2 |
| Benin | 2 | 5 | 5 | 3 | 1 | | | | | 3.2 |
| New Zealand | 3 | | | 2 | 5 | | 1 | 5 | | 3.2 |
| Oman | 5 | 1 | 1 | 4 | 5 | | | | | 3.2 |
| Trinidad and Tobago | 5 | 4 | 3 | 2 | | | 1 | 5 | 1 | 3.3 |
| Guyana | 1 | 1 | 5 | 3 | 5 | | | | 5 | 3.3 |
| Botswana | | | | 4 | 2 | | | | 4 | 3.3 |
| Uruguay | 5 | | 2 | 1 | 4 | 4 | | | 4 | 3.3 |
| Australia | 3 | | | 4 | 1 | | 5 | 2 | 5 | 3.3 |
| Finland | 4 | | | 3 | 2 | | 2 | 4 | 5 | 3.3 |
| Luxembourg | | | | 1 | 4 | | | | 5 | 3.3 |
| Brazil | 3 | 5 | 3 | 2 | 3 | 3 | 5 | 3 | | 3.4 |
| Switzerland | 4 | | | 4 | 2 | | 2 | 5 | | 3.4 |
| Panama | | | | 4 | 2 | | 5 | 2 | 4 | 3.4 |
| Nicaragua | 5 | | | 2 | 5 | | 4 | 1 | | 3.4 |
| Zaire | 2 | 2 | 3 | 5 | 5 | | | | | 3.4 |
| Syria | 4 | 3 | 5 | 1 | 4 | | | | | 3.4 |

Table 1 (cont.)

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Mean |
|---|---|---|---|---|---|---|---|---|---|---|
| Greece | | | | 3 | 3 | | 4 | 2 | 5 | 3.4 |
| Chile | 5 | 2 | 2 | 2 | 3 | 5 | | | 5 | 3.4 |
| Somalia | | 3 | 1 | 5 | 5 | | | | | 3.5 |
| Swaziland | | | | 4 | 3 | | | | | 3.5 |
| Paraguay | 5 | 5 | 2 | 4 | 4 | | | | 1 | 3.5 |
| Germany (West) | 4 | | | 2 | 4 | | 2 | 5 | 4 | 3.5 |
| France | 5 | | | 2 | 3 | | 3 | 4 | 4 | 3.5 |
| Nigeria | 2 | 2 | 2 | 5 | 5 | 5 | | | | 3.5 |
| Lesotho | | | | 3 | 4 | | | | | 3.5 |
| Sudan | 3 | 5 | 1 | 5 | 4 | | | | | 3.6 |
| Burkino Faso | 4 | 5 | 4 | 4 | 1 | | | | | 3.6 |
| Peru | 5 | 5 | 4 | 1 | 3 | 4 | 5 | 2 | | 3.6 |
| Honduras | | | | 4 | 5 | | | | 2 | 3.7 |
| Egypt | 1 | 4 | 3 | 5 | 5 | 3 | 5 | 2 | 5 | 3.7 |
| Zambia | 2 | 3 | 5 | 5 | 3 | | | | 4 | 3.7 |
| Japan | 5 | | | 3 | 2 | | 3 | 4 | 5 | 3.7 |
| Denmark | 4 | | | 3 | 4 | | 1 | 5 | 5 | 3.7 |
| Uganda | 3 | 2 | 5 | 4 | 5 | | | | | 3.8 |
| Yemen | 5 | 2 | 5 | 4 | 4 | | | | | 4.0 |
| Burundi | 3 | 3 | 5 | 5 | 4 | | | | | 4.0 |
| Gabon | | | | 5 | 3 | | | | | 4.0 |
| El Salvador | 4 | | | 4 | 5 | | 4 | 3 | | 4.0 |
| Argentina | 5 | 4 | 2 | 3 | 5 | 5 | 5 | 3 | | 4.0 |
| Mauritania | | | | 5 | 3 | | | | | 4.0 |
| Iran | 5 | 5 | 5 | 2 | 4 | | | | | 4.2 |
| Sierra Leone | 4 | 2 | 5 | 5 | 5 | | | | | 4.2 |
| Mozambique | | 3 | 5 | 4 | 5 | | | | | 4.3 |
| Ghana | 4 | 3 | 3 | 5 | 5 | 5 | | | 5 | 4.3 |
| Tanzania | 4 | 4 | 5 | 5 | 4 | 5 | | | | 4.5 |
| Iraq | | | | 4 | 5 | | | | | 4.5 |
| Guinea | | | | 5 | 4 | | | | | 4.5 |
| Liberia | | | | 5 | 4 | | | | | 4.5 |
| Bolivia | | | | 5 | 5 | 4 | | | | 4.7 |
| Rwanda | 4 | | | 5 | 5 | | | | | 4.7 |
| Angola | | | | 5 | 5 | | | | | 5.0 |

Explanations:
1: Pritchett (1991): Trade Intensity Ratio.
2: UNCTAD (1988): Average Tariff Rate.
3: UNCTAD (1988): Coverage Ratio for NTB.
4: Dollar (1992): Price Level Distortion.
5: Dollar (1992): Price Level Variability.
6: World Bank (1987): Price Distortion.
7: Leamer (1988): Openness Indicator.
8: Leamer (1988): Distortion Indicator.
9: Skoorka (1991): Allocative Distortion.

# TABLE 2

## TRADE DISTORTION INDICES: MANUFACTURING

| | 1 | 2 | 3 | 4 | 5 | Mean |
|---|---|---|---|---|---|---|
| Niger | 1 | | | | | 1.0 |
| Mali | 1 | | | | | 1.0 |
| Togo | 1 | | | | | 1.0 |
| Malta | 1 | | | | | 1.0 |
| Gambia | 1 | | | | | 1.0 |
| Papua New Guinea | 2 | 1 | 1 | | | 1.3 |
| Singapore | 1 | 1 | 2 | 1 | 2 | 1.4 |
| Saudi Arabia | | 1 | 1 | 3 | 1 | 1.5 |
| Haiti | 1 | 1 | 3 | | | 1.7 |
| Korea | 1 | 2 | 2 | | | 1.7 |
| Nigeria | 1 | 2 | 2 | | | 1.7 |
| Hong Kong | 1 | 1 | 1 | 1 | 5 | 1.8 |
| Jordan | 1 | 4 | 1 | | | 2.0 |
| Jamaica | 2 | 2 | 2 | | | 2.0 |
| Malaysia | 2 | 1 | 2 | 1 | 4 | 2.0 |
| Somalia | | 3 | 1 | | | 2.0 |
| Iceland | | | | 3 | 1 | 2.0 |
| Barbados | 3 | 1 | 2 | | | 2.0 |
| Canada | 1 | | | 4 | 1 | 2.0 |
| Oman | 4 | 1 | 1 | | | 2.0 |
| Belgium | 1 | | | 1 | 5 | 2.3 |
| Mexico | 4 | 1 | 2 | | | 2.3 |
| Ireland | 1 | | | 1 | 5 | 2.3 |
| CAR | 2 | 4 | 1 | | | 2.3 |
| Senegal | 3 | 3 | 1 | | | 2.3 |
| Norway | 2 | | | 2 | 3 | 2.3 |
| Kuwait | 5 | 1 | 1 | | | 2.3 |
| Guyana | 1 | 1 | 5 | | | 2.3 |
| Zaire | 2 | 2 | 3 | | | 2.3 |
| Ivory Coast | 2 | 2 | 2 | 2 | 4 | 2.4 |
| Indonesia | 1 | 2 | 4 | 4 | 1 | 2.4 |
| Ethiopia | | | | 3 | 2 | 2.5 |
| Costa Rica | 2 | 4 | 1 | 3 | 3 | 2.6 |
| Sri Lanka | 3 | 4 | 2 | 3 | 1 | 2.6 |
| Chile | 5 | 2 | 1 | | | 2.7 |
| Sudan | 2 | 5 | 1 | | | 2.7 |
| Algeria | 2 | 2 | 4 | | | 2.7 |
| Guatemala | 5 | 2 | 1 | | | 2.7 |
| Nepal | 3 | 3 | 2 | | | 2.7 |
| Sweden | 2 | | | 2 | 4 | 2.7 |
| Switzerland | 2 | | | 1 | 5 | 2.7 |
| Egypt | 1 | 4 | 3 | 5 | 1 | 2.8 |
| Cameroon | 1 | 4 | 3 | 5 | 1 | 2.8 |
| Netherlands | 2 | | | 2 | 5 | 3.0 |
| Israel | | | | 1 | 5 | 3.0 |
| Austria | | | | 2 | 4 | 3.0 |

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Table 2 (cont.)

| | 1 | 2 | 3 | 4 | 5 | Mean |
|---|---|---|---|---|---|---|
| Congo | 1 | 3 | 5 | | | 3.0 |
| Malawi | 2 | 2 | 5 | | | 3.0 |
| Cyprus | 4 | 2 | 3 | 4 | 2 | 3.0 |
| Morocco | 3 | 4 | 3 | 4 | 2 | 3.2 |
| Philippines | 4 | 3 | 4 | 3 | 2 | 3.2 |
| Dominican Republic | 3 | | | 5 | 2 | 3.3 |
| Zambia | 2 | 3 | 5 | | | 3.3 |
| Uganda | 4 | 1 | 5 | | | 3.3 |
| Finland | 4 | | | 2 | 4 | 3.3 |
| Tunisia | 3 | 3 | 4 | | | 3.3 |
| Zimbabwe | 3 | 2 | 5 | | | 3.3 |
| Fiji | 5 | | | 4 | 1 | 3.3 |
| Ghana | 4 | 3 | 3 | | | 3.3 |
| Portugal | 3 | | | 4 | 3 | 3.3 |
| Venezuela | 4 | 3 | 3 | | | 3.3 |
| Kenya | 2 | 4 | 4 | | | 3.3 |
| Trinidad y Tobago | 5 | 5 | 3 | 1 | 3 | 3.4 |
| Thailand | 4 | 4 | 2 | 4 | 3 | 3.4 |
| Bangladesh | 3 | 5 | 3 | 5 | 1 | 3.4 |
| Pakistan | 3 | 5 | 4 | 2 | 3 | 3.4 |
| Ecuador | 3 | 4 | 4 | 3 | 3 | 3.4 |
| Panama | | | | 5 | 2 | 3.5 |
| Greece | | | | 4 | 3 | 3.5 |
| Uruguay | 5 | | 2 | | | 3.5 |
| Mozambique | | 2 | 5 | | | 3.5 |
| Turkey | 4 | 5 | 4 | 2 | 3 | 3.6 |
| El Salvador | 4 | | | 5 | 2 | 3.7 |
| Australia | 4 | | | 5 | 2 | 3.7 |
| India | 2 | 5 | 4 | | | 3.7 |
| United States | 3 | | | 4 | 4 | 3.7 |
| United Kingdom | 4 | | | 3 | 4 | 3.7 |
| Denmark | 4 | | | 2 | 5 | 3.7 |
| New Zealand | 5 | | | 1 | 5 | 3.7 |
| Germany (West) | 4 | | | 2 | 5 | 3.7 |
| Yemen | 4 | 2 | 5 | | | 3.7 |
| Japan | 5 | | | 2 | 4 | 3.7 |
| Paraguay | 5 | 5 | 1 | | | 3.7 |
| Syria | 3 | | 3 | 5 | | 3.7 |
| Madagascar | 3 | 4 | 4 | | | 3.7 |
| Burundi | 3 | 3 | 5 | | | 3.7 |
| Italy | 5 | | | 1 | 5 | 3.7 |
| Brazil | 3 | 5 | 3 | 4 | 4 | 3.8 |
| Colombia | 5 | 5 | 4 | 3 | 2 | 3.8 |
| Peru | 5 | 5 | 3 | 5 | 1 | 3.8 |
| Nicaragua | 5 | | | 5 | 2 | 4.0 |
| Spain | | | | 4 | 4 | 4.0 |
| Surinam | | | | | | 4.0 |
| Burkino Faso | 3 | 5 | 4 | | | 4.0 |

Table 2 (cont.)

| | 1 | 2 | 3 | 4 | 5 | Mean |
|---|---|---|---|---|---|---|
| Argentina | 5 | 4 | 3 | 5 | 3 | 4.0 |
| Benin | 2 | 5 | 5 | | | 4.0 |
| Rwanda | 4 | | | | | 4.0 |
| France | 5 | | | 3 | 4 | 4.0 |
| Tanzania | 3 | 4 | 5 | | | 4.0 |
| Sierra Leone | 4 | 3 | 5 | | | 4.0 |
| Iran | 5 | 5 | 5 | | | 5.0 |

Explanations:
1: Pritchett (1991): Trade Intensity Ratio.
2: UNCTAD (1988): Average Tariff Rate.
3: UNCTAD (1988): Coverage Ratio for NTB.
4: Leamer (1988): Openness Indicator.
5: Leamer (1988): Distortion Indicator.

## TABLE 3

### TRADE DISTORTION INDICES: AVERAGE RANK DIFFERENCE FROM MEAN

| Distortion Measures | Source | Total | Manu. |
|---|---|---|---|
| Price Distortion | World Bank (1987) | 0.89 | |
| Price Distortion (Var.) | Dollar (1992) | 0.94 | |
| Trade Intensity | Pritchett (1991) | 0.97 | 0.82 |
| Non-Tariff Barriers | Unctad (1988) | 1.00 | 0.88 |
| Price Distortion (Level) | Dollar (1992) | 1.01 | |
| Allocative Distortion | Skoorka (1991) | 1.05 | |
| Average Tariff Rate | Unctad (1988) | 1.12 | 0.90 |
| Trade Pattern (Openness) | Leamer (1988) | 1.12 | 1.13 |
| Trade Pattern (Distort) | Leamer (1988) | 1.25 | 1.23 |

## 2.3. Calculating the trade orientation index

Our trade orientation measure is based on the distance between actual trade and the trade predicted by the 'true' model in the absence of distortions. Applying Ockham's razor, we select a generic variant of the relative factor endowment approach as our baseline model. While the basic approach corresponds to that used by Edward Leamer (1984, 1988), we extend the factor set and employ highly aggregated data both for the trade flows and for the endowment measures. Choosing a consistent level of aggregation sharply reduces the problem of mislabeling the effect of product specific factors as trade distortions. The gain comes not without cost, however, as higher aggregation

raises the possibility of mislabelling regimes employing offsetting distortions on a higher level of disaggregation as 'non-interventionist'.

If all relevant variables except trade distortion proxies have been included as explanatory variables, then the residuals of the model regressions can be directly employed as trade orientation measures. Specifically, let the true trade model be given by:

$$T_i = V_t \beta_0 + X_t \beta_1 + Y_t \beta_2 + u_t \tag{1}$$

X and V are vectors of observed and unobserved variables determining trade in the absence of distortions and $Y \beta_2$ equals the effect of trade distortions. The index of trade orientation is then defined as the difference between the actual level of trade and the estimated normal level:

$$PDP = [\, Y_t \, \beta_2 \,] + [\, V_t \, \beta_0 + X_t \, (\beta 1 - b_1) + u_t \,] \tag{2}$$

where $b_1$ denotes the estimated coefficient vector. The informational value of the proxy is thus determined by the ratio of the two bracketed terms: excluded explanatory variables and high intrinsic noise limit the signal value of the index.

### 2.3.1. Data

Reflecting the focus of endogenous trade theory, the distortion index is based on trade in manufactures. The model is estimated separately for the years 1975, 1980 and 1985. The trade data are taken from the World Bank World Tables and are in 1980 dollars.

The quality of the distortion index depends crucially on obtaining a sufficiently comprehensive set of explanatory variables to yield a satisfactory fit to the trade model. Considerable care has therefore been devoted to constructing a set of endowment variables.[8]

1. **Capital Stock** data were obtained by accumulating annual gross investment from 1950 onwards, depreciating at 13.3 percent per annum. The exclusion of the 1950 level renders the measures somewhat problematic, however,

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[8] A more complete description and a complete listing of all variables used in the construction is available from the author.

since the earliest year used in the empirical work is 1975, the potential bias should be fairly minor.

2. **Human Capital** is proxied by the aggregate number of years of education received by the population separately for primary, secondary and tertiary education. The annual enrollment figures (equal to the total additional number of year of education obtained in that year) provide estimates for the gross investment in education of the specific type. The flows are again summed up from 1950 onwards, using the adult mortality rate as the discount factor.

3. **Labor Force** data refer to the economically active population and are available both on the aggregate level and by sector (agriculture, industry and services). The 1975 values were calculated by interpolating the 1970 and 1980 shares.

4. **Land Endowment** data were obtained separately for farmed land, pasture, forests and 'other' lands.

5. **Raw Materials and Minerals** Since endowment data are not available, we follow the standard procedure of using production, assumed to be proportional to the total endowment. For many countries the main resource endowment also provides a major export product. We hence forgo the use of dated resource endowments, instead employing *the average* production over the three sample years.

Tables 4 to 7 report the distribution of absolute and relative (scaled by the labor force) factor endowments, both in the aggregate and separately by the four development groups of the World Bank classification. A notable convergence trend for the human capital variables is apparent, predominantly reflecting a catchup of the initially human capital poor economies. Across types of human capital, tertiary education displays the most marked change, almost doubling over the ten year period. In marked contrast, the distribution of the capital to labor ratio remains largely unchanged over the period, implying a marked increase in the ratio of human to physical capital during the decade under consideration.

The results change quite markedly once different development levels are considered. Capital labor ratios for the high income economies are seen to be highly centered, while the distribution for low income economies reveals substantially more dispersion. The evidence for further convergence within groups over time is moderate, except for the low income economies. A remarkably similar picture emerges for the human capital to labor ratios. Again dispersion strongly decreases with the income level while dispersion across time within groups displays only limited decreases, except again for the low income economies.

## TABLE 4

### FACTOR ENDOWMENTS I: ABSOLUTE

| Series | Year | No.obs. | Mean | St. Dev. | Minimum | Maximum | C.o.V. | Min:Max |
|---|---|---|---|---|---|---|---|---|
| Years of | 75 | 107 | 7.4E+07 | 1.9E+08 | 3.0E+05 | 1.4E+09 | 2.6 | 4695 |
| Primary | 80 | 107 | 8.5E+07 | 2.1E+08 | 4.3E+05 | 1.5E+09 | 2.5 | 3438 |
| Education | 85 | 107 | 9.6E+07 | 2.4E+08 | 6.8E+05 | 1.7E+09 | 2.5 | 2441 |
| Years of | 75 | 93 | 2.3E+07 | 7.4E+07 | 6.2E+04 | 5.6E+08 | 3.2 | 8972 |
| Secondary | 80 | 93 | 2.8E+07 | 8.2E+07 | 1.1E+05 | 6.2E+08 | 3.0 | 5659 |
| Education | 85 | 93 | 3.3E+07 | 8.9E+07 | 1.7E+05 | 6.6E+08 | 2.7 | 4004 |
| Years of | 75 | 101 | 2.7E+06 | 1.3E+07 | 1.5E+03 | 1.3E+08 | 4.9 | 86560 |
| Tertiary | 80 | 101 | 3.9E+06 | 1.8E+07 | 4.4E+03 | 1.7E+08 | 4.7 | 40046 |
| Education | 85 | 101 | 5.2E+06 | 2.3E+07 | 7.6E+03 | 2.2E+08 | 4.4 | 28967 |
| Total | 75 | 115 | 9.0E+03 | 2.5E+04 | 9.6E+01 | 2.4E+05 | 2.8 | 2536 |
| Labor | 80 | 116 | 9.9E+03 | 2.8E+04 | 1.1E+02 | 2.7E+05 | 2.8 | 2527 |
| Force | 85 | 116 | 1.1E+04 | 3.1E+04 | 1.2E+02 | 2.9E+05 | 2.8 | 2506 |
| Share in | 75 | 116 | 4.7E-01 | 2.9E-01 | 1.7E-02 | 9.3E-01 | 0.6 | 55 |
| Agriculture | 80 | 116 | 4.5E-01 | 2.9E-01 | 1.6E-02 | 9.3E-01 | 0.6 | 58 |
| | 85 | 116 | 4.2E-01 | 2.9E-01 | 1.3E-02 | 9.2E-01 | 0.7 | 71 |
| Share in | 75 | 116 | 2.0E-01 | 1.3E-01 | 1.0E-02 | 5.3E-01 | 0.6 | 51 |
| Industry | 80 | 116 | 2.0E-01 | 1.2E-01 | 5.7E-03 | 5.1E-01 | 0.6 | 89 |
| | 85 | 116 | 2.0E-01 | 1.2E-01 | 2.7E-03 | 4.8E-01 | 0.6 | 180 |
| Share in | 75 | 116 | 3.2E-01 | 1.7E-01 | 4.7E-02 | 6.5E-01 | 0.5 | 14 |
| Services | 80 | 116 | 3.5E-01 | 1.8E-01 | 4.3E-02 | 6.9E-01 | 0.5 | 16 |
| | 85 | 116 | 3.8E-01 | 1.9E-01 | 3.9E-02 | 7.6E-01 | 0.5 | 20 |
| Real | 75 | 114 | 9.6E+10 | 3.2E+11 | 2.3E+08 | 2.8E+12 | 3.4 | 12463 |
| Capital | 80 | 116 | 1.2E+11 | 3.8E+11 | 4.7E+08 | 3.3E+12 | 3.3 | 7076 |
| Stock | 85 | 118 | 1.3E+11 | 4.3E+11 | 6.1E+08 | 3.8E+12 | 3.4 | 6227 |
| Land | | | | | | | | |
| - Total | | 115 | 7.9E+04 | 1.6E+05 | 3.2E+01 | 9.2E+05 | 2.1 | 28646 |
| - Arable | | 115 | 9.1E+03 | 2.5E+04 | 2.0E+00 | 1.9E+05 | 2.8 | 94960 |
| - Pasture | | 115 | 2.0E+04 | 5.1E+04 | 0.0E+00 | 4.3E+05 | 2.6 | - |
| - Forest | | 115 | 2.5E+04 | 6.9E+04 | 0.0E+00 | 5.7E+05 | 2.8 | - |

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# TABLE 5

## FACTOR ENDOWMENTS II: RELATIVE TO LABOR FORCE

| Series | Year | No.obs. | Mean | St. Dev. | Minimum | Maximum | C.o.V. | Min:Max |
|---|---|---|---|---|---|---|---|---|
| Capital | 75 | 111 | 9.4E+06 | 1.0E+07 | 1.2E+05 | 3.9E+07 | 1.11 | 314 |
| | 80 | 114 | 1.1E+07 | 1.1E+07 | 1.2E+05 | 3.8E+07 | 1.04 | 311 |
| | 85 | 116 | 1.1E+07 | 1.2E+07 | 1.7E+05 | 4.5E+07 | 1.07 | 261 |
| Primary | 75 | 105 | 8.1E+03 | 4.8E+03 | 4.7E+02 | 1.9E+04 | 0.59 | 40 |
| Education | 80 | 106 | 8.5E+03 | 4.6E+03 | 6.2E+02 | 1.9E+04 | 0.54 | 30 |
| | 85 | 106 | 8.8E+03 | 4.3E+03 | 8.6E+02 | 1.8E+04 | 0.48 | 21 |
| Secondary | 75 | 91 | 2.1E+03 | 2.0E+03 | 3.5+01 | 7.8E+03 | 0.94 | 222 |
| Education | 80 | 92 | 2.5E+03 | 2.2E+03 | 7.0E+01 | 8.2E+03 | 0.85 | 117 |
| | 85 | 92 | 2.9E+03 | 2.2E+03 | 9.4E+01 | 8.6E+03 | 0.77 | 91 |
| Tertiary | 75 | 99 | 1.6E+02 | 2.1E+02 | 5.8E-01 | 1.3E+03 | 1.30 | 2291 |
| Education | 80 | 100 | 2.3E+02 | 2.7E+02 | 1.1E+00 | 1.6E+03 | 1.18 | 1473 |
| | 85 | 100 | 3.0E+02 | 3.3E+02 | 1.1E+00 | 1.9E+03 | 1.12 | 1759 |

# TABLE 6

## CAPITAL TO LABOR RATIOS BY DEVELOPMENT LELVEL

| Series | Year | No.obs. | Mean | St. Dev. | Minimum | Maximum | C.o.V. | Min:Max |
|---|---|---|---|---|---|---|---|---|
| Low | 75 | 28 | 8.8E+05 | 9.2E+05 | 1.2E+05 | 4.6E+06 | 1.04 | 37 |
| Income | 80 | 29 | 9.9E+05 | 8.8E+05 | 1.2E+05 | 3.9E+06 | 0.89 | 32 |
| | 85 | 29 | 1.0E+06 | 8.8E+05 | 1.7E+05 | 4.0E+06 | 0.89 | 23 |
| Lower | 75 | 37 | 3.8E+06 | 2.5E+06 | 5.8E+05 | 1.1E+07 | 0.66 | 19 |
| Middle | 80 | 38 | 4.4E+06 | 2.8E+06 | 6.9E+05 | 1.1E+07 | 0.63 | 16 |
| Income | 85 | 39 | 4.3E+06 | 2.9E+06 | 5.5E+05 | 1.2E+07 | 0.68 | 22 |
| Upper | 75 | 25 | 1.3E+07 | 6.1E+06 | 4.9E+06 | 3.0E+07 | 0.46 | 6 |
| Middle | 80 | 25 | 1.6E+07 | 5.8E+06 | 9.2E+06 | 3.2E+07 | 0.36 | 3 |
| Income | 85 | 25 | 1.7E+07 | 6.7E+06 | 9.6E+06 | 3.3E+07 | 0.40 | 3 |
| High | 75 | 18 | 2.8E+07 | 6.5E+06 | 1.6E+07 | 3.9E+07 | 0.23 | 2 |
| Income | 80 | 19 | 3.0E+07 | 6.0E+06 | 1.8E+07 | 3.8E+07 | 0.20 | 2 |
| | 85 | 19 | 3.0E+07 | 6.7E+06 | 1.7E+07 | 4.0E+07 | 0.23 | 2 |

Based on World Bank classification.

# TABLE 7

## HUMAN CAPITAL TO LABOR RATIOS BY DEVELOPMENT LEVEL

| Series | Year | No.obs. | Mean | St. Dev. | Minimum | Maximum | C.o.V. | Min:Max |
|---|---|---|---|---|---|---|---|---|
| | | | | **Primary Education** | | | | |
| Low | 75 | 26 | 3.1E+03 | 2.9E+03 | 4.7E+02 | 1.5E+04 | 0.94 | 32 |
| Income | 80 | 26 | 3.5E+03 | 2.8E+03 | 6.2E+02 | 1.4E+04 | 0.79 | 23 |
| | 85 | 26 | 4.0E+03 | 2.8E+03 | 8.6E+02 | 1.5E+04 | 0.69 | 17 |
| Lower | 75 | 37 | 7.9E+03 | 4.0E+03 | 9.5E+02 | 1.8E+04 | 0.51 | 19 |
| Middle | 80 | 37 | 8.5E+03 | 3.7E+03 | 1.5E+03 | 1.7E+04 | 0.44 | 11 |
| Income | 85 | 37 | 9.9E+03 | 3.3E+03 | 2.1E+03 | 1.6E+04 | 0.37 | 7 |
| Upper | 75 | 23 | 1.1E+04 | 3.6E+03 | 4.0E+03 | 1.9E+04 | 0.32 | 5 |
| Middle | 80 | 23 | 1.2E+04 | 3.5E+03 | 4.8E+03 | 1.9E+04 | 0.30 | 4 |
| Income | 85 | 23 | 1.2E+04 | 3.2E+03 | 5.8E+03 | 1.8E+04 | 0.27 | 3 |
| High | 75 | 16 | 1.2E+04 | 1.8E+03 | 8.8E+03 | 1.6E+04 | 0.15 | 2 |
| Income | 80 | 17 | 1.2E+04 | 1.8E+03 | 9.0E+03 | 1.5E+04 | 0.15 | 2 |
| | 85 | 17 | 1.2E+04 | 1.7E+03 | 8.7E+03 | 1.5E+04 | 0.14 | 2 |
| | | | | **Secondary Education** | | | | |
| Low | 75 | 19 | 3.0E+02 | 3.3E+02 | 3.5E+01 | 1.4E+03 | 1.11 | 40 |
| Income | 80 | 19 | 4.4E+02 | 4.4E+02 | 7.0E+01 | 1.9E+03 | 1.01 | 26 |
| | 85 | 19 | 6.2E+02 | 5.8E+02 | 9.4E+01 | 2.2E+03 | 0.94 | 24 |
| Lower | 75 | 31 | 1.1E+03 | 8.9E+02 | 7.2E+01 | 3.0E+03 | 0.80 | 41 |
| Middle | 80 | 31 | 1.5E+03 | 1.1E+03 | 1.7E+02 | 4.1E+03 | 0.74 | 24 |
| Income | 85 | 31 | 1.9E+03 | 1.3E+03 | 3.9E+02 | 4.9E+03 | 0.68 | 13 |
| Upper | 75 | 22 | 2.6E+03 | 1.0E+03 | 3.3E+02 | 4.8E+03 | 0.41 | 14 |
| Middle | 80 | 22 | 3.0E+03 | 1.0E+03 | 5.4E+02 | 5.0E+03 | 0.35 | 9 |
| Income | 85 | 22 | 3.5E+03 | 1.1E+03 | 8.1E+02 | 5.6E+03 | 0.30 | 7 |
| High | 75 | 16 | 5.3E+03 | 1.2E+03 | 3.5E+03 | 7.8E+03 | 0.22 | 2 |
| Income | 80 | 17 | 5.9E+03 | 1.2E+03 | 4.6E+03 | 8.2E+03 | 0.20 | 2 |
| | 85 | 17 | 6.3E+03 | 1.0E+03 | 4.8E+03 | 8.6E+03 | 0.17 | 2 |
| | | | | **Tertiary Education** | | | | |
| Low | 75 | 24 | 1.1E+01 | 1.6E+01 | 5.8E-01 | 7.1E+01 | 1.49 | 123 |
| Income | 80 | 24 | 1.6E+01 | 2.4E+01 | 1.1E+00 | 1.1E+02 | 1.45 | 102 |
| | 85 | 24 | 2.4E+01 | 3.1E+01 | 1.1E+00 | 1.3E+02 | 1.30 | 122 |
| Lower | 75 | 34 | 9.2E+01 | 1.0E+02 | 4.0E+00 | 4.4E+02 | 1.10 | 110 |
| Middle | 80 | 34 | 1.4E+02 | 1.5E+02 | 1.0E+01 | 5.6E+02 | 1.06 | 54 |
| Income | 85 | 34 | 2.0E+02 | 2.0E+02 | 1.5E+01 | 7.2E+02 | 1.01 | 49 |
| Upper | 75 | 22 | 2.2E+02 | 1.8E+02 | 6.5E+00 | 7.4E+02 | 0.81 | 114 |
| Middle | 80 | 22 | 2.9E+02 | 2.3E+02 | 1.5E+01 | 9.3E+02 | 0.78 | 64 |
| Income | 85 | 22 | 3.8E+02 | 2.9E+02 | 3.3E+01 | 1.2E+03 | 0.76 | 35 |
| High | 75 | 16 | 4.2E+02 | 1.3E+02 | 2.8E+02 | 7.4E+02 | 0.31 | 3 |
| Income | 80 | 17 | 5.8E+02 | 1.5E+02 | 3.8E+02 | 9.3E+02 | 0.26 | 2 |
| | 85 | 17 | 7.3E+02 | 1.7E+02 | 4.9E+02 | 1.2E+03 | 0.23 | 2 |

# TABLE 8

## TRADE PATTERNS

| Series | Year | No.obs. | Mean | St. Dev. | Minimum | Maximum | C.o.V. | Min:Max |
|---|---|---|---|---|---|---|---|---|
| | | | | Imports | | | | |
| Total | 75 | 105 | 1.3E+10 | 3.0E+10 | 8.0E+07 | 1.9E+11 | 2.4 | 2385 |
| | 80 | 105 | 1.6E+10 | 3.8E+10 | 1.3E+08 | 2.5E+11 | 2.4 | 1899 |
| | 85 | 105 | 1.8E+10 | 4.8E+10 | 1.2E+08 | 3.8E+11 | 2.7 | 3116 |
| Fuels | 75 | 105 | 2.7E+09 | 8.3E+09 | 1.4E+06 | 5.5E+10 | 3.1 | 39404 |
| | 80 | 105 | 4.0E+09 | 1.2E+10 | 3.4E+06 | 8.2E+10 | 3.0 | 24129 |
| | 85 | 105 | 3.5E+09 | 1.0E+10 | 3.6E+06 | 6.6E+10 | 2.9 | 18292 |
| Non-Fuel | 75 | 105 | 3.0E+09 | 7.9E+09 | 2.2E+07 | 4.7E+10 | 2.7 | 2162 |
| Primary | 80 | 105 | 3.2E+09 | 8.1E+09 | 1.8E+07 | 4.3E+10 | 2.5 | 2336 |
| Products | 85 | 105 | 3.2E+09 | 8.2E+09 | 2.1E+07 | 4.5E+10 | 2.6 | 2142 |
| Manufactured | 75 | 105 | 6.9E+09 | 1.5E+10 | 5.1E+07 | 1.0E+11 | 2.2 | 2007 |
| Goods | 80 | 105 | 8.9E+09 | 2.0E+10 | 1.0E+08 | 1.3E+11 | 2.2 | 1237 |
| | 85 | 105 | 1.1E+10 | 3.2E+10 | 4.3E+07 | 2.7E+11 | 2.8 | 6351 |
| Services | 75 | 105 | 2.9E+09 | 7.3E+09 | 2.0E+07 | 4.2E+10 | 2.5 | 2113 |
| | 80 | 105 | 3.6E+09 | 8.0E+09 | 3.8E+07 | 4.4E+10 | 2.3 | 1176 |
| | 85 | 105 | 4.0E+09 | 9.4E+09 | 2.6E+07 | 6.1E+10 | 2.3 | 2380 |
| | | | | Exports | | | | |
| Total | 75 | 105 | 1.2E+10 | 2.7E+10 | 1.9E+07 | 1.6E+11 | 2.3 | 8502 |
| | 80 | 105 | 1.5E+10 | 3.6E+10 | 2.3E+10 | 2.2E+11 | 2.4 | 9598 |
| | 85 | 105 | 1.7E+10 | 4.0E+10 | 2.5E+07 | 2.4E+11 | 2.3 | 9581 |
| Fuels | 75 | 96 | 2.8E+09 | 9.5E+04 | 5.6E+04 | 8.2E+10 | 3.4 | - |
| | 80 | 96 | 3.3E+09 | 1.2E+10 | 1.0E+04 | 1.1E+11 | 3.6 | - |
| | 85 | 95 | 2.7E+09 | 5.7E+09 | 1.1E+03 | 3.0E+10 | 2.1 | - |
| Non-Fuel | 75 | 104 | 2.5E+09 | 5.1E+09 | 1.7E+07 | 4.0E+10 | 2.1 | 2334 |
| Primary | 80 | 104 | 3.2E+09 | 7.5E+09 | 3.0E+07 | 6.1E+10 | 2.3 | 2074 |
| products | 85 | 104 | 3.5E+09 | 7.4E+09 | 2.0E+07 | 5.4E+10 | 2.1 | 2726 |
| Manufactured | 75 | 104 | 6.6E+09 | 2.1E+10 | 3.0E+05 | 1.2E+11 | 3.1 | 410738 |
| Goods | 80 | 104 | 9.3E+09 | 2.8E+10 | 1.0E+06 | 1.7E+11 | 3.0 | 159071 |
| | 85 | 104 | 1.2E+10 | 3.3E+10 | 4.0E+05 | 2.2E+11 | 2.9 | 539212 |
| Services | 75 | 105 | 2.6E+09 | 6.1E+09 | 5.8E+06 | 3.3E+10 | 2.4 | 5621 |
| | 80 | 105 | 3.3E+09 | 7.9E+09 | 9.9E+06 | 4.3E+10 | 2.4 | 4332 |
| | 85 | 105 | 3.9E+09 | 9.0E+09 | 1.4E+07 | 4.6E+10 | 2.3 | 3205 |

## TABLE 9

## TRADE PER WORKER BY DEVELOPMENT LEVEL

| Series | Year | No.obs. | Mean | St. Dev. | Minimum | Maximum | C.o.V. | Min:Max |
|--------|------|---------|------|----------|---------|---------|--------|---------|
| | | | **Exports** | | | | | |
| Low | 75 | 25 | 1.1E+05 | 9.1E+04 | 1.6E+04 | 4.2E+05 | 0.82 | 26 |
| Income | 80 | 25 | 1.2E+05 | 9.5E+04 | 1.8E+04 | 4.3E+05 | 0.82 | 24 |
| | 85 | 25 | 9.9E+04 | 6.8E+04 | 1.9E+04 | 2.6E+05 | 0.68 | 14 |
| Lower | 75 | 37 | 6.7E+05 | 4.5E+05 | 1.4E+04 | 2.1E+06 | 0.67 | 148 |
| Middle | 80 | 37 | 6.8E+05 | 4.0E+05 | 1.5E+04 | 1.6E+06 | 0.59 | 102 |
| Income | 85 | 37 | 6.7E+05 | 4.7E+05 | 3.5E+04 | 2.2E+06 | 0.69 | 64 |
| Upper | 75 | 22 | 2.9E+06 | 3.5E+06 | 2.9E+05 | 1.3E+07 | 1.19 | 44 |
| Middle | 80 | 22 | 3.5E+06 | 4.0E+06 | 4.5E+05 | 1.7E+07 | 1.13 | 38 |
| Income | 85 | 22 | 3.8E+06 | 4.4E+06 | 5.1E+05 | 2.0E+07 | 1.18 | 40 |
| High | 75 | 18 | 4.9E+06 | 2.7E+06 | 1.0E+06 | 1.2E+07 | 0.55 | 12 |
| Income | 80 | 18 | 6.0E+06 | 2.9E+06 | 1.6E+06 | 1.4E+07 | 0.49 | 8 |
| | 85 | 18 | 7.1E+06 | 3.3E+06 | 2.3E+06 | 1.5E+07 | 0.46 | 6 |
| | | | **Imports** | | | | | |
| Low | 75 | 25 | 1.6E+05 | 1.0E+05 | 3.3E+04 | 4.4E+05 | 0.64 | 13 |
| Income | 80 | 25 | 1.9E+05 | 1.3E+05 | 4.1E+04 | 5.7E+05 | 0.68 | 14 |
| | 85 | 25 | 1.6E+05 | 9.6E+04 | 5.0E+04 | 4.0E+05 | 0.61 | 8 |
| Lower | 75 | 37 | 8.9E+05 | 6.1E+05 | 2.0E+05 | 2.5E+06 | 0.69 | 13 |
| Middle | 80 | 37 | 9.6E+05 | 6.9E+05 | 2.5E+05 | 3.7E+06 | 0.72 | 15 |
| Income | 85 | 37 | 7.9E+05 | 6.6E+05 | 1.9E+05 | 3.8E+06 | 0.84 | 20 |
| Upper | 75 | 22 | 3.6E+06 | 3.9E+06 | 5.9E+05 | 1.7E+07 | 1.09 | 29 |
| Middle | 80 | 22 | 4.0E+06 | 4.6E+06 | 5.6E+05 | 2.1E+07 | 1.13 | 38 |
| Income | 85 | 22 | 3.9E+06 | 5.2E+06 | 3.2E+05 | 2.4E+07 | 1.32 | 73 |
| High | 75 | 18 | 5.9E+06 | 2.6E+06 | 2.2E+06 | 1.2E+07 | 0.45 | 5 |
| Income | 80 | 18 | 6.7E+06 | 3.1E+06 | 2.5E+06 | 1.4E+07 | 0.46 | 6 |
| | 85 | 18 | 6.7E+06 | 2.7E+06 | 2.5E+06 | 1.3E+07 | 0.41 | 5 |

Based on World Bank Classification.

Tables 8 and 9 report the same statistics for trade variables, including total trade and four subgroups, (1) non-fuel primary products, (2) fuels, (3) manufactures and (4) services. Absolute trade displays little change in dispersion

with the exception of fuel export. Turning to trade per worker, the high income economies again display the smallest variation, with the middle income group displaying the most variability. On this aggregate level, the evidence -convergent endowments but equally dispersed trade- thus appears to support the view that models of intra-industry trade assume increasing importance with advancing development.[9]

### 2.3.2. Regression Analysis

We now turn to the regression analysis. In going beyond the two factor, two good, two country model, the theoretically implied signs of the HOS model depend non-trivially on relative factor intensities.[10] Lacking information on these, we do not impose a priori restriction on the coefficients but rather let the data choose the sign pattern minimizing the unexplained variance.

Tables 10 and 11 report the result of the regressions of manufacturing imports and exports on ten resources, three human capital variables, the physical capital stock, four land variables and the share of industry in GDP as a proxy for infrastructure. All variables are scaled by the labor force.

The regression results suggest that variations in endowments explain a high fraction of the variation in per worker trade, with $R^2$s between 0.8 and 0.84 for exports and between 0.61 and 0.67 for imports. Exclusion tests on endowment groups are generally rejected. The explanatory power appears stable over time, suggesting that on this aggregate level relative factor endowments models provide a reasonably satisfactory fit.

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[9] See Helpman and Krugman (1986) and Lowe (1991).
[10] Deardorff (1983), Leamer (1984).

## TABLE 10

### TRADE REGRESSIONS: MANUFACTURING EXPORTS

| Expl. Variable | 1975 Coefficient | t-Stat. | 1980 Coefficient | t-Stat. | 1985 Coefficient | t-Stat |
|---|---|---|---|---|---|---|
| Constant | 106013 | 0.43 | 315400 | 1.12 | 631315 | 1.23 |
| Bauxite | 187135 | 0.82 | 429671 | 1.35 | 563409 | 0.89 |
| Cooper | -172944 | 0.12 | 864479 | 0.85 | 2679046 | 0.68 |
| Petroleum | -8429 | 0.70 | -68819 | 1.59 | -91672 | 2.75 |
| Tin | -8633738 | 0.17 | -73986345 | 0.76 | -188123786 | 1.28 |
| Sulphur | -3918747 | 2.21 | -7628163 | 2.57 | -11933709 | 2.67 |
| Nickel | 113733660 | 2.56 | 202127276 | 2.91 | 292735084 | 2.62 |
| Phosphate | -134821 | 1.63 | -162667 | 1.04 | -172528 | 0.80 |
| Manganese | -182425 | 1.04 | -287540 | 1.84 | -268325 | 0.63 |
| Iron | -217574 | 1.95 | -248757 | 2.07 | -388652 | 1.34 |
| Lead | 15355522 | 1.47 | 33920778 | 2.24 | 55215152 | 2.03 |
| Primary Edu. | -123856 | 4.31 | -174973 | 4.82 | -195631 | 2.96 |
| Secondary Edu. | -80769 | 0.94 | -325349 | 1.53 | -290362 | 1.77 |
| Tertiary Edu. | -1241790 | 2.31 | -1013225 | 1.21 | -782819 | 1.09 |
| Capital | 0.1115 | 7.19 | 0.1586 | 5.65 | 0.2019 | 7.13 |
| Total Land | 5613 | 0.45 | 7776 | 0.11 | 10193 | 0.31 |
| Arable Land | -146013 | 1.36 | -578496 | 2.44 | -675340 | 2.33 |
| Pasture Land | -38720 | 2.09 | -58339 | 1.52 | -96102 | 2.03 |
| Forest Land | 7638 | 0.40 | 36314 | 1.19 | 56447 | 1.15 |
| Labor Share in Industry | 6251985 | 4.91 | 11357937 | 5.32 | 10120781 | 4.52 |
| R² | 0.84 | | 0.80 | | 0.80 | |
| No. of Observation | 73 | | 75 | | 75 | |
| Degrees of Freedom | 53 | | 55 | | 55 | |
| Mean of Dep. Var. | 742712 | | 1089484 | | 1355921 | |
| Standard Error | 603642 | | 1013480 | | 1250378 | |
| F-Test for Exclusion of | | | | | | |
| - Endowments | 2.00* | | 3.11** | | 3.26** | |
| - Education | 13.91** | | 13.92** | | 11.51** | |
| - Land | 2.68* | | 4.65** | | 4.64** | |

* (**): Significant at 5 (1) percent level.

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## TABLE 11

## TRADE REGRESSIONS: MANUFACTURING IMPORTS

| Expl. Variable | 1975 Coefficient | t-Stat. | 1980 Coefficient | t-Stat. | 1985 Coefficient | t-Stat |
|---|---|---|---|---|---|---|
| Constant | 152373 | 0.40 | 108669 | 0.19 | 397174 | 0.61 |
| Bauxite | -194479 | 0.40 | -166730 | 0.26 | 229834 | 0.28 |
| Copper | -2005539 | 0.58 | -879981 | 0.22 | -441066 | 0.08 |
| Petroleum | 15431 | 3.29 | -21790 | 0.65 | -57918 | 1.37 |
| Tin | -22517346 | 0.25 | -36166016 | 0.25 | -109489152 | 0.58 |
| Sulphur | -3617783 | 1.22 | -6614150 | 1.42 | -8495567 | 1.50 |
| Nickel | 148935959 | 2.41 | 178002319 | 1.53 | 249408863 | 1.76 |
| Phosphate | 40204 | 0.24 | -13337 | 0.06 | 58804 | 0.21 |
| Manganese | -107118 | 0.42 | -251605 | 0.56 | -103719 | 0.19 |
| Iron | -31096 | 0.04 | -80045 | 0.27 | 43955 | 0.11 |
| Lead | 19285656 | 0.90 | 42592196 | 1.54 | 48518477 | 1.40 |
| Primary Edu. | 28618 | 0.38 | -22974 | 0.32 | -56406 | 0.67 |
| Secondary Edu. | -362466 | 2.02 | -412689 | 2.07 | -379274 | 1.82 |
| Tertiary Edu. | -1488810 | 1.32 | -1943487 | 1.93 | -764864 | 0.84 |
| Capital | 0.1527 | 4.69 | 0.1682 | 4.62 | 0.1911 | 5.34 |
| Total Land | 16134 | 0.35 | 28691 | 0.89 | 33512 | 0.82 |
| Arable Land | -337161 | 1.38 | -657822 | 2.28 | .787400 | 2.14 |
| Pasture Land | -57986 | 1.48 | -75379 | 1.55 | -110127 | 1.84 |
| Forest Land | -6697 | 0.18 | -3443 | 0.06 | 21881 | 0.35 |
| Labor Share in Industry | 4146638 | 1.56 | 9098724 | 3.23 | 7381093 | 2.60 |
| R² | 0.61 | | 0.66 | | 0.67 | |
| No. of Observation | 73 | | 75 | | 76 | |
| Degrees of Freedom | 53 | | 55 | | 56 | |
| Mean of Dep. Var. | 1430078 | | 1602373 | | 1684395 | |
| Standar Error | 1299047 | | 1423294 | | 1587387 | |
| F-Test for Exclusion of | | | | | | |
| - Endowments | 0.49 | | 0.69 | | 1.01 | |
| - Education | 2.29 | | 4.95** | | 3.64* | |
| - Land | 1.54 | | 2.60* | | 2.93* | |

*(**): Significant at 5 (1) percent level.

## 2.4. The trade orientation index

The residual of the trade regression, scaled by the dependent variable, provides a natural estimate of trade distortion. Tables 12 and 13 report the rankings for 1975, 1980 and 1985. To control for cyclical factors, the countries are ordered according to the *average* rank over the three years. Rank 1 denotes the country with the largest exports and imports relative to the model's prediction.

The index suggests that most OECD economies export and import roughly the predicted amount as indicated by their middle ranks. Japan forms the exception, both exporting and in particular importing less than predicted by relative factor endowments. The same pattern is observed for Korea, while Hong Kong and Singapore, two countries often cited for their liberal trade policies, are among the third of countries exporting and importing most relative to the predicted levels.

Lacking a quality measuring gauge, yet another entrant to the already crowded market of distortion indices would provide little value added. We therefore now present a number of indirect 'quality checks' for the index. Specifically, we examine three criteria. First, if the index indeed represents trade orientation rather then noise, the estimated ranks should display substantial stability for most countries. Second, for those countries exhibiting a fall (rise) of their rank, indicating increased (decreased) outward orientation, a particularly strong increase (decrease) in trade growth should be observed. Thirdly, the index should match independently identified episodes of strong trade liberalization.

A visual glance at the Table reveals a fair degree of time persistence of the rankings: for 65 percent of all countries the maximum rank difference over the three years falls short of 10 ranks. Figures 1 and 2 plot the change in rank between 1975 and 1985 against the growth rate of exports and imports over that period. The predicted negative correlation is present in both cases, with a decline of twenty ranks being associated with a 1 percent higher growth rate of exports. Choksi et al. (1991) have identified strong liberalization episodes. Table 14 lists these episodes, along with the change in the trade orientation index. On the export side, four of the five countries have seen a substantial fall in their ranking, consistent with increased exports in the wake of successful reforms. On the import side, two of the countries, Argentina and Spain, saw a substantial fall in their rank, consistent with increased imports, while the other three countries approximately maintained their previous ranking.

The proposed index thus satisfies the three intuitive criteria of (1) overall stability over time most countries, (2) matching between independently identified strong liberalizations and movements in the index and (3) negative correlations between rank changes and trade growth. We now employ the index to examine the link between trade orientation and growth.

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## TABLE 12

### TRADE ORIENTATION RANKING: EXPORTS

| | 1975 | 1980 | 1985 |
|---|---|---|---|
| Rwanda | 1 | 1 | 1 |
| Madagascar | 3 | 4 | 2 |
| Zambia | 4 | 2 | 5 |
| Lesotho | 2 | 6 | 4 |
| Sudan | 10 | 3 | 3 |
| Paraguay | 5 | 8 | 6 |
| Cameroon | 8 | 5 | 7 |
| Togo | 9 | 9 | 8 |
| Senegal | 13 | 7 | 9 |
| Philippines | 6 | 11 | 12 |
| Venezuela | 16 | 12 | 11 |
| Uruguay | 14 | 15 | 14 |
| Thailand | 11 | 14 | 21 |
| Jordan | 17 | 17 | 19 |
| Fiji | 21 | 16 | 18 |
| Mauritius | 19 | 22 | 22 |
| Barbados | 33 | 18 | 20 |
| Egypt | 37 | 19 | 16 |
| Nicaragua | 50 | 13 | 13 |
| Singapore | 24 | 24 | 29 |
| United Kingdom | 27 | 28 | 28 |
| Canada | 30 | 27 | 27 |
| Gabon | 25 | 25 | 34 |
| Kenya | 51 | 21 | 15 |
| Hong Kong | 31 | 30 | 26 |
| Ireland | 28 | 29 | 31 |
| Switzerland | 29 | 31 | 30 |
| United States | 23 | 23 | 46 |
| Jamaica | 35 | 33 | 25 |
| Costa Rica | 20 | 42 | 32 |
| Malawi | 7 | 20 | 69 |
| Syria | 15 | 26 | 56 |
| Germany | 32 | 34 | 33 |
| Norway | 26 | 36 | 40 |
| Korea | 22 | 41 | 42 |
| Australia | 36 | 32 | 38 |
| Spain | 48 | 40 | 23 |
| Malta | 34 | 35 | 44 |
| Malaysia | 40 | 37 | 36 |
| Denmark | 39 | 39 | 35 |
| Finland | 41 | 38 | 37 |

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Table 12 (cont.)

|  | 1975 | 1980 | 1985 |
|---|---|---|---|
| Tunisia | 18 | 47 | 52 |
| France | 38 | 44 | 45 |
| Israel | 44 | 45 | 39 |
| Italy | 42 | 46 | 41 |
| Botswana | 43 | 43 | 43 |
| Congo | 60 | 48 | 24 |
| Argentina | 59 | 58 | 17 |
| Ecuador | 68 | 57 | 10 |
| Trinidad | 47 | 49 | 47 |
| Niger | 70 | 10 | 72 |
| Japan | 49 | 53 | 50 |
| New Zealand | 55 | 52 | 48 |
| Cyprus | 56 | 51 | 51 |
| Portugal | 53 | 56 | 49 |
| Somalia | 12 | 74 | 74 |
| Tanzania | 46 | 54 | 62 |
| Greece | 54 | 55 | 53 |
| Haiti | 52 | 59 | 55 |
| Ivory Coast | 45 | 62 | 61 |
| Honduras | 58 | 60 | 60 |
| Morocco | 57 | 65 | 59 |
| Panama | 62 | 50 | 70 |
| Turkey | 65 | 67 | 54 |
| Mexico | 63 | 66 | 58 |
| Peru | 69 | 61 | 57 |
| Chile | 61 | 64 | 64 |
| Colombia | 64 | 63 | 65 |
| CAR | 67 | 68 | 67 |
| Zaire | 66 | 70 | 71 |
| Indonesia | 74 | 71 | 63 |
| Burkina Faso | 75 | 69 | 66 |
| Nigeria | 72 | 72 | 68 |
| Ghana | 71 | 73 | 73 |
| Ethiopia | 73 | 75 | 75 |

# TABLE 13

## TRADE ORIENTATION RANKING: IMPORTS

|  | 1975 | 1980 | 1985 |
|---|---|---|---|
| Madagascar | 1 | 1 | 1 |
| Zambia | 3 | 3 | 2 |
| Senegal | 4 | 2 | 3 |
| Sudan | 6 | 4 | 4 |
| Cameroon | 8 | 6 | 5 |
| Paraguay | 5 | 7 | 8 |
| Philippin | 12 | 5 | 7 |
| Uruguay | 7 | 12 | 6 |
| Barbados | 9 | 10 | 11 |
| Singapore | 11 | 15 | 17 |
| Lesotho | 27 | 9 | 9 |
| Nicaragua | 21 | 11 | 13 |
| Panamá | 19 | 17 | 16 |
| Syria | 10 | 18 | 29 |
| Ireland | 15 | 19 | 24 |
| Hong Kong | 20 | 24 | 18 |
| Denmark | 17 | 25 | 21 |
| Norway | 16 | 23 | 26 |
| Costa Rica | 14 | 20 | 31 |
| Togo | 44 | 13 | 12 |
| Canada | 26 | 22 | 27 |
| United Kingdom | 32 | 28 | 19 |
| Jordan | 38 | 21 | 20 |
| Jamaica | 30 | 31 | 23 |
| Mauritius | 23 | 40 | 22 |
| New Zealand | 25 | 29 | 32 |
| Venezuela | 34 | 33 | 25 |
| Burkina F | 74 | 8 | 10 |
| Malta | 24 | 27 | 43 |
| Switzerland | 37 | 26 | 33 |
| Malaysia | 28 | 32 | 36 |
| United States | 41 | 16 | 41 |
| Fiji | 36 | 34 | 28 |
| Cyprus | 40 | 30 | 30 |
| Israel | 22 | 43 | 37 |
| Gabon | 31 | 36 | 38 |
| Egypt | 50 | 41 | 15 |
| Australia | 29 | 35 | 42 |
| Ivory Coast | 13 | 37 | 56 |
| Somalia | 2 | 58 | 50 |
| Finland | 33 | 39 | 45 |

Table 13 (cont.)

| | 1975 | 1980 | 1985 |
|---|---|---|---|
| Tunisia | 18 | 47 | 54 |
| Trinidad | 35 | 42 | 46 |
| Botswana | 39 | 44 | 44 |
| Ecuador | 55 | 38 | 34 |
| Argentina | 62 | 53 | 14 |
| Rwanda | 66 | 14 | 57 |
| Nigeria | 54 | 45 | 39 |
| France | 46 | 46 | 47 |
| Honduras | 45 | 50 | 48 |
| Germany | 48 | 48 | 49 |
| Congo | 63 | 49 | 35 |
| Greece | 42 | 52 | 55 |
| Spain | 53 | 56 | 40 |
| Tanzania | 49 | 51 | 58 |
| Korea | 47 | 60 | 52 |
| Thailand | 60 | 54 | 51 |
| Italy | 57 | 55 | 53 |
| Ghana | 43 | 66 | 62 |
| Portugal | 56 | 61 | 59 |
| Malawi | 51 | 57 | 68 |
| Chile | 68 | 59 | 61 |
| Turkey | 58 | 71 | 60 |
| Morocco | 52 | 69 | 69 |
| Kenya | 64 | 62 | 65 |
| Peru | 59 | 67 | 66 |
| Mexico | 70 | 63 | 64 |
| Colombia | 71 | 65 | 63 |
| Haiti | 69 | 64 | 67 |
| CAR | 61 | 70 | 75 |
| Ethopia | 65 | 73 | 71 |
| Niger | 73 | 68 | 72 |
| Zaire | 67 | 75 | 74 |
| Indonesia | 75 | 72 | 70 |
| Japan | 72 | 74 | 73 |

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# FIGURE 1

## EXPORT LIBERALIZATION AND EXPORT GROWTH
### (Export Growth = 2.89 - 0.051*dRank)
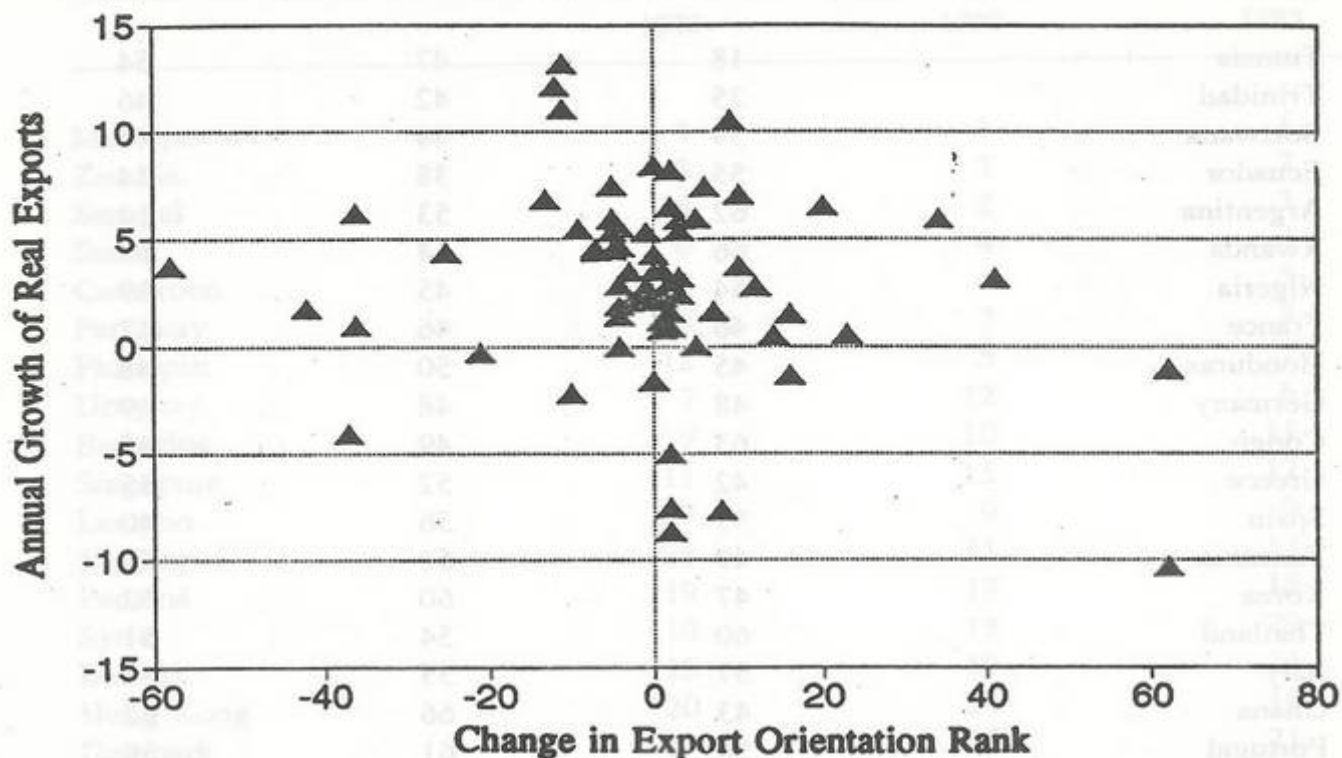


# FIGURE 2

## IMPORT LIBERALIZATION AND IMPORT GROWTH
### (Import Growth = 1.02 - 0.008*dRank)



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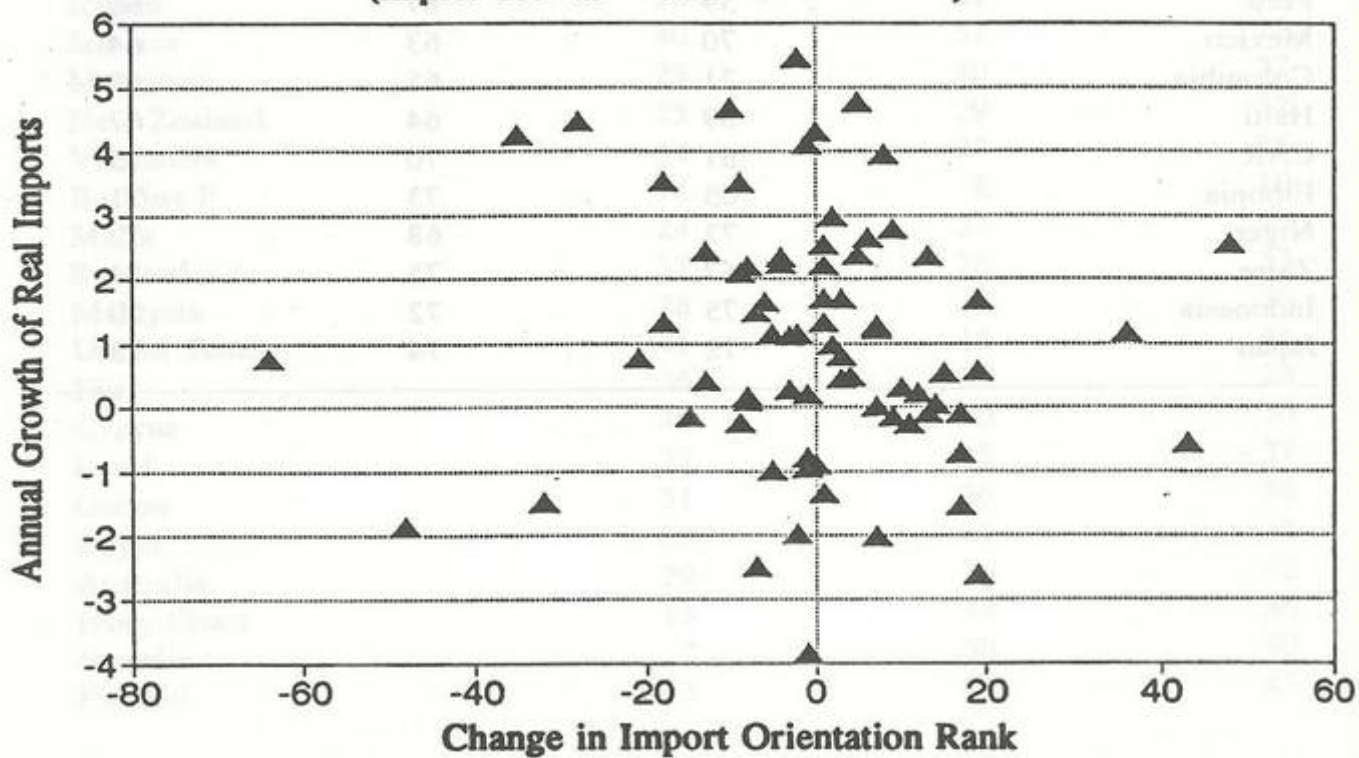
## TABLE 14

## CONSISTENCY WITH KNOWN LIBERALIZATION EPISODES

| Country | | Change in Rank |
|---|---|---|
| Argentina | -42 | -48 |
| Chile | +4 | -7 |
| Peru | -12 | +7 |
| Spain | -25 | -13 |
| Turkey | -11 | +2 |

Source: Choksi et al. (1991), p. 33.

## 3. TRADE ORIENTATION AND GROWTH

The pendulum in the long ranging debate on the relative merits of outwardly versus inwardly oriented development strategies has lately swung decisively in favor of outward orientation. The 1987 World Bank Development Report, devoted to trade, advised without qualifications that *"countries should move toward the adoption of an outward-oriented trade strategy. Such a strategy means removing the bias against exports, replacing quantitative restrictions with tariffs and adopting more realistic exchange rates"*.[11] In like vein, the near uniform prescription for the post-socialist transition economies of Eastern Europe has stressed trade liberalization as a key reform step.

The firmness of the policy prescription is based on a slender -and increasingly undermined- theoretical underpinning. New trade theory and endogenous growth models are casting doubts on the classical predilection for free trade: temporary protection for industries with unexploited learning by doing potentials may yield permanent growth advantages; strategic subsidies may influence location choices with lock-in effects, liberalization between highly and less developed economies may enhance the growth potential of the richer at the expense of the poorer country, *etc*. At present, theory thus fails to offer a consensus view on the merits of outward versus inward-oriented growth strategies, placing a premium on empirical analysis. We now turn to a brief discussion of the theory before presenting our econometric results.

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[11] World Bank, World Development Report 1987, page 4. See also Balassa (1985a, b, 1986, 1989), Bhagwati (1986), Choksi et al. (1991), Dornbusch (1992), Edwards (1992), Michaeli et al. (1991) Riedel (1988) *inter alia*.

## 3.1. Trade and growth: theory

Traditional neoclassical growth models predict a level but not a growth rate effect of trade liberalization. While a range of informal arguments for a positive link between trade liberalization and growth have been proposed, emphasizing a reduction in X-inefficiency and rent seeking activities, stimulated competition, access to improved inputs, increased market access, *etc.*, these informal arguments remained theoretically unappealing until the advent of new growth theory in the late eighties. The latter class of models in general *do* predict a growth rate effect of liberalization, however, no general presumption in favor of a positive effect has emerged.

Conceptually, changes in trade orientation may cause changes in the growth rate either by affecting the rate of growth of technological knowledge, or by altering the rate of accumulation of production factor. In the basic endogenous growth model, removing trade distortions in a single good world is equivalent to integrating two previously autarkic economies. With increasing returns in production or R & D, the increased market size and increased stock of human capital results in a higher growth rate reflecting either higher investment, greater availability of intermediate inputs or increased innovation. The basic integration effect is reinforced by the elimination of duplication effort in R&D as information flows more freely, yielding an unambiguous positive growth rate effect of trade liberalization.

The simple conclusion changes however once the single good assumption is abandoned. Heterogeneity in goods and differential skills in innovation may lead to shifts in specialization patterns with potential adverse growth effects possibly outweighing the *integration* and *redundancy* effects.[12] Grossman and Helpman (1990, 1991) and Young (1991) provide two illustrative examples. The first set of papers focuses on the allocation of effort to R&D -the growth machine-between two economies. Starting from a position in which both the initially poorer country ('South') and the initially richer country ('North') engage in both production and R&D trade liberalization typically facilitates the copying of blueprints in the 'South', leading to a reallocation of resources towards production in the 'South' and towards R&D in the 'North', with an increased growth rate for both South and North in most scenarios.

As Young (1991) demonstrates, the pro-trade result however depends crucially on the ability of the South to participate in the extra growth created by increased Northern research and development. In his model, based on heterogeneity in goods with respect to learning by doing potentials, trade liberalization may lead to specialization of the South in 'mature' goods with almost exhausted learning

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[12] See e.g. Krugman (1987), Rodrick (1992), Rivera-Batiz and Romer (1991a,b).

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by doing potentials, *reducing* the post-liberalization growth rate. In like vein, protection can increase growth in models of the Grossman-Helpman type if it stimulates investment in the research intensive sectors due to higher expected returns.[13]

The profusion of theoretical arguments suggests that the search for a single invariant link between trade orientation and growth thus may be misguided: the effect of trade orientation may well depend on the structural characteristics of the economy and the precise format of the liberalization effort.

## 3.2. Trade and growth: evidence

To date, the richness of theoretical models has only found a limited reflection in empirical work which predominantly continues to search for an invariant link between trade and growth.[14] The results of empirical studies continue to be mixed.[15]

We begin our examination of the link between trade-orientation and growth on a similarly aggregate level before turning to informal tests of some of the novel hypotheses advocated by the endogenous growth literature. The distortion indices used throughout (Orientation) is the ratio of the residual from the regression of trade on endowments to the trade variable, i.e., the percentage by which endowments under or overpredict trade.

Column 2 in Table 15 reports the regression results for the entire sample. The per capita growth rate of output is regressed on the initial level, the years of primary and secondary education per worker, the savings rate and the two trade orientation proxies. Initial per capital output enters negatively and within the predicted numerical range. Higher human capital levels are associated with higher growth rates, as is a higher savings rate. Increased export orientation enters positively, increased import orientation negatively; at two tailed significance levels of 17 and 24 percent.

Column two instead uses dummies for the sign patterns of the export and import orientation variables for the levels. Relative to outward orientation for both exports and imports, inward orientation on exports lowers the growth rate by 0.99 percent per year while inward orientation on imports reduces the growth

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[13] See also Rodrick (1989, 1992).
[14] General overviews of the trade growth literature can be found in Bhagwati (1987), Bliss (1989), Diaz-Alejandro (1975), Evans (1989) and the World Development Report of 1987 and 1991.
[15] See Agosin (1991), Banuri (1990) Dollar (1992), Edwards (1989, 1991, 1992) and Harrison (1991) for recent analyses.

rate by 0.4 percent per year. Inward orientation for both imports and exports reduces the growth rate by 0.75 percent.

## TABLE 15

## GROWTH REGRESSIONS

|  | All Countries | | | |
|---|---|---|---|---|
|  | Coeff. | t-Stat. | Coeff. | t-Stat. |
| Constant | -0.0365 | 3.31 | -0.0311 | |
| 1975 Output per worker | -0.0108 | 1.83 | -0.0106 | |
| Education | | | | |
| - Primary | 0.0009 | 0.95 | 0.0007 | |
| - Secondary | 0.0049 | 1.85 | 0.0048 | |
| Savings | 0.1839 | 4.01 | 0.1900 | |
| Export | 2.4E-05 | 0.46 | | |
| Import | -0.0005 | 0.30 | | |
| Positive X | | | -0.0044 | 0.55 |
| Negative M | | | | |
| Negative X | | | -0.0075 | 1.15 |
| Negative M | | | | |
| Negative X | | | -0.0099 | 0.95 |
| Positive M | | | | |
| $R^2$ | 0.32 | | 0.34 | |
| No. of Observations | 73 | | 73 | |
| Degrees of Freedom | 66 | | 65 | |
| Mean of Dep. Var. | 0.013 | | 0.013 | |
| Standard Error | 0.023 | | 0.023 | |

Table 16 disaggregates by development level, using the World Bank classification.[16] The results display considerable disparity. Intra-group

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[16] Group 1: Least developed countries, Group 2 and 3 Lower and Upper Middle Income, Group 4: Industrialized Countries.

convergence appears considerably weaker than inter-group convergence. Primary education becomes more important with development while secondary education exerts the strongest influence on growth for the lower middle income group. Domestic savings rates are of increasing importance for the three lower groups but play a lesser role for the industrialized world.

## TABLE 16

### GROWTH REGRESSIONS

| | Group 1 | | Group 2 | | Group 3 | | Group 4 | |
|---|---|---|---|---|---|---|---|---|
| | Coef. | t-Stat. | Coef. | t-Stat. | Coef. | t-Stat. | Coef | t-Stat. |
| Constant | 0.0095 | 0.32 | -0.0154 | 0.78 | -0.0282 | 0.64 | -0.0311 | 0.58 |
| 1975 Output per worker | 0.0064 | 0.28 | -0.0281 | 2.30 | -0.0194 | 1.13 | 0.0022 | 0.16 |
| Education | | | | | | | | |
| - Primary | -0.0065 | 1.79 | -0.0008 | 0.36 | -0.0017 | 0.82 | 0.0018 | 0.90 |
| - Secondary | -0.0108 | 0.60 | 0.0184 | 2.01 | 0.0096 | 1.27 | 0.0025 | 0.95 |
| Savings | 0.0250 | 0.21 | 0.1000 | 1.25 | 0.3033 | 2.51 | 0.0484 | 1.03 |
| Export | 4.5E-05 | 0.89 | 0.0001 | 1.40 | 0.0019 | 0.66 | 0.0067 | 1.52 |
| Import | -0.0019 | 1.04 | -0.0050 | 1.28 | -0.0004 | 0.04 | -0.0031 | 1.28 |
| $R^2$ | 0.60 | | 0.41 | | 0.53 | | 0.55 | |
| No. of Observations | 13 | | 26 | | 19 | | 14 | |
| Degrees of Freedom | 6 | | 19 | | 12 | | 7 | |
| Mean of Dep. Var. | -0.012 | | 0.013 | | 0.023 | | 0.022 | |
| Standard Error | 0.017 | | 0.023 | | 0.026 | | 0.008 | |

The trade orientation variables have gained significance relative to the overall regressions. For all four subsamples, increased export orientation raises growth rates, with a coefficient increasing in the development level. In contrast, an increased import orientation lowers uniformly lowers growth rates. For the two lower income groups, an equal percentage increase in exports and imports reduces the growth rate, while for the two upper income groups, a positive net effect emerges.

# 4. CONCLUSION

The paper constructs a new measure of trade distortion based on the deviation of actual exports and imports of manufactures from the levels predicted from a relative factor endowments model. The constructed index is shown to pass a number of intuitive checks. The paper then examines the trade growth link. The results indicate that countries with exports levels exceeding and import levels falling short of predicted levels enjoy the highest growth rates.

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