HOW STRATIFIED IS THE WORLD?

Openness and Development

by

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Abstract:

This paper examines whether certain subgroups of economies in the world form distinct income groups (or strata). The results indicate that economies are stratified *not* by how outward-oriented they are (to trade) but rather by their market openness in general. Politically free and/or research-intensive nations are also found to form distinct groups.

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1. Introduction

The importance of trade and outward orientation to a country's economic development is a subject of much research.[1] One study in particular (widely cited in standard international economics textbooks[2]) is the World Bank (1987) study which classifies countries according to their degree of outward orientation and investigates whether more open economies enjoy a higher level of economic development (see Table 1 which reproduces this classification). The inference from this study is that openness is an important underlying characteristic of highly developed (and growing) economies. However, it is empirically questionable whether these countries do form distinct income groups (or strata), in relation to this particular characteristic.

The stratification analysis which follows shows otherwise. After expanding the set of countries and examining different time

[1] See, for example, Dollar (1992), Edwards (1993), Friedman (1996), Leamer (1988), Pritchett (1991), and World Bank (1987).

[2] For example, Yarborough-Yarborough (1994). Todaro (1994) also refers to "this conceptual and classifacatory background".

periods and measures of openness, this paper finds that countries can only be weakly grouped (into high per-capita GDP groups or low per-capita GDP groups) according to their degree of openness. Rather, nations are better grouped (or layered) according to other characteristics such as their levels of political and market freedom, and intensity of science and research activities. The fact that nations cannot be strongly grouped by openness implies that country classification by openness is rather arbitrary as far as referring to these groups as strata is concerned. Throughout the paper, the objective will be to illustrate that it is possible to examine the degree to which countries "overlap" and to distinguish the characteristics upon which this "overlap" is based. We defer from causality at this stage in our analysis. We are challenging the use of certain characteristics in the literature.

Stratification analysis is quite common in sociology and relatively new in economics[3] – but nonexistent in international economics. Stratification studies have typically sought to determine whether individual incomes are related to one's race, gender, occupation, or social status. For example, if every member of tribe A has a higher income than any member of tribe B, tribes A and B form distinct strata. To the extent that there exist some members of B who have higher incomes than some members of tribe A,

[3] See the discussion in Yitzhaki-Lerman (1991).

stratification along tribal dimensions is less perfect.

This paper extends the concept of stratification internationally to determine whether countries are stratified according to some characteristic. There are various characteristics, or combinations thereof, that can be studied. However, only a few are examined in order to illustrate the methodology, which has not yet been applied to cases where the *nation* is the unit of analysis. The country characteristics that are considered are the ones given prominence in the recent empirical growth literature.[4]

The next section reviews how stratification can be quantified. Section 3 focuses on outward orientation as a source of global stratification while section 4 focuses on alternative measures. Section 5 concludes.

2. Stratification Index

Suppose there are N countries, heirarchically ordered by some characteristic (say by their level of openness). Groups of countries form well-defined strata to the extent that their members' incomes differ from those of the rest of the world (ROW). The following index, developed by Yitzhaki-Lerman (1991) in this Review, measures the degree of overlap between group members' incomes and ROW's:

[4] See Barro-Sala-i-Martin (1995), Chapter 12, for a survey.

$$S_i = 1 - \frac{cov_i(R_{ni}, y)}{cov_i(R_i, y)}$$

where R_i denotes the *ranks* of members of Group i within that group (ranked according to their real per-capita GDPs) and y their corresponding real *per-capita GDPs*. R_{ni} denotes their ranks outside their Group (that is, their ranks in the rest-of-the-world).[5] Note that $-1 \leq S_i \leq 1$. If Group i forms a perfect stratum, $S_i = 1$. The intuition is that changes in Group i's incomes would have no effect on their rankings outside the Group (hence $cov(R_{ni},y) = 0$). If Group i is distributed identically as in the rest-of-the-world, then $S_i = 0$ and the Group would not form a stratum at all. The intuition is that, in this case, $cov(R_{ni},y) = cov(R_i,y)$. Finally, if Group i is not homogeneous but consists of several different groups, $S_i < 0$. In this case, the divergence of member rankings outside the group exceeds that within the group.

[5] R_i and R_{ni} are actually normalized to be between zero and one by dividing through by the number of observations in the respective group. A *Quattro Pro* spreadsheet file for computing stratification indices (with data) is available from the author upon request.

3. Openness and Stratification

If the world were stratified according to "openness," the more open countries should be ranked higher in the global income scale. The first test is with the World Bank's own groupings. Edwards (1993) mentions these groupings as being somewhat subjectively based. The first two panels of Table 2 show indeed that the chosen groupings generally do not form distinct strata. Group 1 is the Strongly Inward-Oriented countries, Group 4 the Strongly Outward-Oriented. Panel A reports the S values for the 1963-73 grouping and Panel B for the 1973-85 grouping. Each group is followed over time (from 1960-90). In Panel A, Groups 1-3 are seen to be diverse. Only Group 4 becomes "congealed" in 1990; however, the index is not unity because Israel (from Group 3) has a higher per-capita GDP than Korea in 1990. Now Group 3 countries in Panel B have a fairly high level of stratification (vis-a-vis the other countries in this small sample). The question is whether this is robust if a larger sample of countries is included.

Hence in Panel C, a sample of 110 countries is studied and the Summers et. al. (1995) measure of openness,[6] averaged from 1960-1990, is used to group countries. Again, Group 4 is the most open, Group 1 the least. The indexes are all fairly low. The negative values for Group 1 are due to the fact that highly developed countries like the U.S. is a member. A criticism with this measure

[6] That is, exports plus imports to GDP.

of openness is that it does not take trade interventionist policies into account. Hence Leamer's (1988) measures of openness, which adjust for tariff/quota rates, are considered. As Panel D shows, his very open groups (like Groups 3 and 4) also have low stratification index values (none exceeding 0.6). Moreover, negative values for Group 2 indicate that it is composed of countries with vastly different levels of income (e.g. the U.S., Japan, Pakistan, Nicaragua, among others).

4. Alternative Groupings

In this section, countries are grouped according to measures of political freedom, market freedom, and research and science. Recent cross-country growth studies have identified these measures or variables as important determinants of growth. Their importance can also be seen from another perspective – namely, whether they help identify global strata.

Panel A of Table 3 groups countries using the political rights index (from Barro (1991)). Group 4 consists of the most politically free nations; Group 1 the least. Group 4 is quite stratified (indexes close to 0.8), suggesting that democracies tend to have higher per-capita GDPs. But less democratic nations do not necessarily have lower per-capita GDPs, as Groups 1 and 2 are not stratified, if at all. Some politically unfree regimes which achieved increased economic development include Chile, Iran, and Syria. Note that Group 2's index rises and falls after 1980. The

reason is that this group consists of countries like Korea, Taiwan, and Singapore which started with low levels of development but caught up to the others in that group (thus making that group more stratified in 1980) and eventually surpassed them (thus reducing stratification in 1990). Group 3 members include India, Sri Lanka, and Bangladesh, whose incomes were low generally and fell severely in 1980. This explains why Group 3 (the second most democratic group) is weakly stratified – especially in 1980.

Panel B groups countries by a market freedom index (from Johnson-Sheehy (1995)).[7] Group 4 is the most free, Group 1 the least. Here, not only do free market economies form a relatively strong stratum, but the least free market economies also form a strong stratum. This suggests that the nature of the market system is an attribute underlying international income differences.

[7] The market freedom index measures the extent to which markets are free of interventionist, regulatory forces. The index also incorporates freer trade as part of its definition.

Panel C sorts countries by the ratio of scientists and engineers to workers.[8] Group 4 is the richest in science human capital, Group 1 the poorest. The results suggest that science-intensive countries do form a strata (i.e. are richer relative to ROW), but countries that have relatively low ratios of scientists and engineers to workers are not necessarily poorer.[9] The same kind of results occur when nations are sorted by the ratio of R&D expenditures to GDP. In Panel D, Group 4 has the highest research activity; Group 1 the lowest. Research-intensive nations are richer but weak R&D nations are not necessarily poor.[10] Thus science and research activities segment just the upper group that heavily invests in new knowledge. One explanation is that countries that do not invest in new knowledge can nevertheless acquire it (or some of it) through imitation, trade, and knowledge spillovers, and hence are not economically disadvantaged if they do not engage heavily in research. However, the leading research nations have been able to occupy a prominent position in the global income scale, though not so strongly in 1990, due to the catch-up of Group 3 research nations (among which are East Asian NICs).

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[8] Data on Scientists and Engineers and R&D are from UNESCO.

[9] Moreover, the indexes for the lower groups vary over time; for example, the index for Group 2 varies because one of its members, Trinidad and Tobago, had an exceptionally high per-capita GDP in 1980 and then a significantly low per-capita GDP in 1990.

[10] Group 3's index turns negative in 1980 because this group consists of fast-growing economies like Korea and Singapore and slow-growing ones like Zambia and Madagascar that diverged from one another significantly in 1980 but later converged somewhat by 1990.

5. Conclusions

This study considered a number of characteristics describing countries and ranked countries according to how much (and how little) of a characteristic they possess. The analysis focused on the extent to which the resulting rankings mapped into their income rankings. The findings indicate that countries are stratified not by openness to trade but rather by other criteria, especially market freedom (which includes freer trade but is much broader). Countries that are most politically free and/or most science and research-intensive also tend to form distinct (high-income) strata. Grouping by measures that successfully stratify nations should thus be viewed as less arbitrary, if at all, precisely because nations would otherwise have failed to separate themselves into specific income groups, as was the case with openness measures.

Some directions for future research are to study other characteristics (such as levels of educational attainment) and to develop multidimensional attributes of nations (or an aggregate index of country characteristics).

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Table 1: Classification of Forty-one Developing Economies by Trade Orientation, 1963-73 and 1973-85

	Outward Oriented		Inward Oriented	
Period	*Strongly outward oriented*	*Moderately outward oriented*	*Moderately inward oriented*	*Strongly inward oriented*
1963-73	Hong Kong Korea,Rep Singapore	Brazil Cameroon Colombia Costa Rica Cote d'Ivoire Guatemala Indonesia Israel Malaysia Thailand	Bolivia El Salvador Honduras Kenya Madagascar Mexico Nicaragua Nigeria Philippines Senegal Tunisia Yugoslavia	Argentina Bangladesh Burundi Chile Dominican Republic Ethiopia Ghana India Pakistan Peru Sri Lanka Sudan Tanzania Turkey Uruguay Zambia
1973-85	Hong Kong Korea,Rep Singapore	Brazil Chile Israel Malaysia Thailand Tunisia Turkey Uruguay	Cameroon Colombia Costa Rica Cote d'Ivoire El Salvador Guatemala Honduras Indonesia Kenya Mexico Nicaragua Pakistan Philippines Senegal Sri Lanka Yugoslavia	Argentina Bangladesh Bolivia Burundi Dominican Republic Ethiopia Ghana India Madagascar Nigeria Peru Sudan Tanzania Zambia

Source: World Bank Development Report, 1987.

Note: The World Bank's rankings are based on quantitative and qualitative information, such as the average levels of effective protection, the range of effective protection rates, reliance on direct controls, provision of export incentives, and exchange rate alignment.

Table 2: Stratification Indexes - Openness Groupings

A. Grouping by World Bank Openness (1963-73) N=38

	1960	1970	1980	1990	
Group 1	-0.1480	-0.360	-0.578	0.060	N_1=14
Group 2	-0.1690	-0.080	0.4640	-0.300	N_2=11
Group 3	-0.046	0.214	0.662	0.314	N_3=10
Group 4	0.472	0.629	0.7003	0.996	N_4=3

B. Grouping by World Bank Openness (1973-85) N=38

	1960	1970	1980	1990	
Group 1	-0.2090	-0.213	-0.563	0.228	N_1=12
Group 2	-0.560	-0.0098	0.562	0.308	N_2=15
Group 3	0.813	0.8592	0.859	0.879	N_3=8
Group 4	0.472	0.629	0.7003	0.996	N_4=3

C. Grouping by Openness (Summers-Heston) N=110

	1960	1970	1980	1990	
Group 1	-0.1441	-0.2436	-0.299	-0.1178	N_1=27
Group 2	0.0197	0.1902	0.1705	0.1004	N_2=27
Group 3	0.293	0.248	0.2433	0.1014	N_3=28
Group 4	0.228	0.232	0.315	0.1095	N_4=28

D. Grouping by Openness (Leamer) N=50

	1960	1970	1980	1990	
Group 1	0.192	0.199	0.110	0.138	N_1=12
Group 2	-0.605	-0.764	-0.710	-0.727	N_2=13
Group 3	0.464	0.438	0.444	0.597	N_3=13
Group 4	0.391	0.436	0.383	0.325	N_4=12

Notes:

N_i denotes number of countries in group i, N total countries.

For Panels A and B, N=38 because Ethiopia, Sudan, and Yugoslavia were dropped due to lack of data.

For Panel C, Group 1 has an openness index ranging from 13.35 to 37.58, Group 2 from 38.10 to 51.99, Group 3 from 54.25 to 80.52, and Group 4 from 84.96 to 321.36. See Data Appendix.

Table 3: Stratification Indexes - Alternative Groupings

A. Grouping by Political Freedom, N=106

	1960	1970	1980	1990	
Group 1	0.1431	0.2786	-0.0441	-0.109	N_1=27
Group 2	0.1819	0.3747	0.6835	0.3748	N_2=28
Group 3	0.4884	0.3591	0.0915	0.2924	N_3=27
Group 4	0.7974	0.7983	0.7637	0.7397	N_4=24

B. Grouping by Market Freedom, N=77

	1960	1970	1980	1990	
Group 1	0.7005	0.6291	0.7267	0.7699	N_1=20
Group 2	0.3492	0.5025	0.6346	0.318	N_2=19
Group 3	0.5155	0.499	0.5182	0.563	N_3=20
Group 4	0.6250	0.6952	0.7346	0.8685	N_4=18

C. Grouping by Scientists & Engineers per 10,000 workers, N=77

	1960	1970	1980	1990	
Group 1	0.4431	0.5650	0.5817	0.4166	N_1=20
Group 2	0.3115	0.3017	0.0520	0.4875	N_2=19
Group 3	0.706	0.790	0.7263	0.597	N_3=19
Group 4	0.7119	0.688	0.690	0.6210	N_4=19

D. Grouping by R&D/GDP ratio, N=74

	1960	1970	1980	1990	
Group 1	0.3642	0.4330	0.4056	0.1710	N_1=18
Group 2	0.0773	0.2420	0.4590	0.4969	N_2=18
Group 3	0.1579	0.204	-0.1750	0.3634	N_3=19
Group 4	0.8291	0.813	0.742	0.6080	N_4=19

Notes:

For Panel A, Group 1 has a Political Index ranging from 7 to 5.6, Group 2 from 5.5 to 4.5, Group 3 from 4.4 to 2, and Group 4 from 1.7 to 1, where lower values indicate greater political rights.

For Panel B, Group 1 has a Market Index ranging from 4.4 to 3.35, Group 2 from 3.3 to 3.05, Group 3 from 3 to 2.65, and Group 4 from 2.6 to 1.25, where lower values indicate greater market freedom.

For Panel C, Group 1 has a Scientists & Engineers per 10,000 Workers ratio ranging from 0.212 to 2.13, Group 2 from 2.51 to 4.83, Group 3 from 4.87 to 14.4 and Group 4 from 14.6 to 121.

For Panel D, Group 1 has an R&D to GDP ratio ranging from 0.001 to 0.159, Group 2 from 0.164 to 0.310, Group 3 from 0.322 to 0.765 and Group 4 from 0.793 to 2.6.

See also Data Appendix.