Comparative growth and comparative advantage: Tests of the effects of interest group behavior on foreign trade patterns

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1. Introduction

Economists are not usually reticent to comment on the efficiency of differing modes of economic organization. Yet, paradoxically, organizational variables rarely find their way into models of economic growth relevant to developed market economies. Perhaps the reason for this paradox is that there is little convincing theory which would explain any continuing systematic differences in the mode of economic organization within this set of countries. Without such a theory, and given that organizational variables are difficult to measure, it is not surprising that organizational factors are little mentioned in discussions of economic growth.

Without theory or measurement of organizational factors, all one can do is conjecture on the importance of organizational change. Douglass North (1965: 87-88) has provided one such conjecture:

> I would hazard the speculation that if we ever did the research necessary to get some inside idea of the magnitudes involved, we would discover that improved economic organization was as important as technological change in the development of the Western world between 1500 and 1830. I mean by this, improvements in the factor and product markets, reduction in impediments to efficient resource allocation and economies of scale.

As soon as one admits the possibility that organizational change can be as important as North conjectures, other intriguing notions can be entertained. For example, could detrimental changes in organization cancel out the benefits of technological change so that growth would cease?

Organizational change detrimental to growth is not usually considered to be an important long-run phenomenon. In fact, the prevailing view, which especially appears in the modernization literature, is that, as economic devel-

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opment proceeds, the institutions of society change in a way which promotes efficiency and growth. However, once traditional barriers to the movement of resources are removed, national markets developed and free trade established, potential gains from organizational change must be limited. As economies modernize and traditional barriers to trade decline, it is possible that new impediments to economic efficiency will arise. In developing a new theory of comparative growth, Mancur Olson argues that such a possibility exists. He theorizes that the natural accumulation of interest groups in countries having freedom of organization will reduce growth rates.

The basic premise of the present paper is that any theory of comparative growth relevant to a set of countries which trade with each other will have implications for foreign trade patterns. Therefore, in this paper, I investigate the implications of Olson's theory for foreign trade patterns. These implications are then embodied in testable hypotheses. Each of these hypotheses is then tested using trade data from six major industrial nations: Canada, Italy, Japan, the United Kingdom, United States and Federal Republic of Germany (F.R.G.).

2. The theoretical background[1]

Before examining the implications of Olson's theory for foreign trade, it will be useful to state briefly the most important elements of that theory. The main features of that theory are as follows (see Olson, 1965, 1976a, 1976b, 1977, and 1980):

1. Common interest groups will be formed slowly, and the largest and most scattered interests will never be able to organize.
2. Developed democratic societies will therefore accumulate more common interest organizations as time passes but these societies will never achieve complete or symmetrical organization.
3. Common interest groups cause a reduction in the rate of growth of a country by restricting entry into markets, by lobbying for efficiency-distorting government programs, and by reducing the extent to which free markets foster the success of those ideas and innovations which produce growth.
4. Countries whose common interest organizations have been emasculated or abolished by war, revolution or foreign occupation should grow relatively quickly after a free and stable legal order is established.
5. Those countries that have had democratic freedom of organization the longest without upheaval or invasion will suffer the most from growth-repressing organizations.[2]

Olson has coined the term 'institutional sclerosis' to describe a situation in which the denseness of common-interest organization is sufficient to reduce the rate of growth.

Olson's theory, because its primary concern is the growth of a whole economy, emphasizes the efficiency of resource allocation between markets. The emphasis in this paper is on patterns of trade and the implications of Olson's theory for the trade performance of individual industries. Therefore, it is important here to emphasize those aspects of institutional sclerosis specific to one industry. The process which Olson has identified will have economy-wide and industry-specific implications. However, the argument for the presence of industry-specific effects can be strengthened by using theories of organizational behavior.

The predictions of the theories of organizational behavior are immediately relevant to this study because of the role that large organizations play in economic production. These predictions are completely consistent with Olson's theory. A basic result is that when organizations age they become less responsive to change and increasingly reliant on existing arrangements rather than searching for alternatives. Anthony Downs' (1967: 264) 'Law of Increasing Conservatism' explicitly states this prediction: 'All organizations tend to become more conservative as they get older, unless they experience periods of rapid growth or internal turnover.'

Peter Blau and Marshall Meyer (1971: 50-53) identify a source of this conservatism:

> One important organizational process that engenders rigidity is the tendency, in large bureaucracies, for organizational ideologies to develop that take precedence over original goals, distort perceptions, and typically create resistance to change by sanctifying the existing state of affairs.... Because ideologies tend to glorify not only the organization itself but also the existing arrangements and institutions within it and its particular leaders, critical evaluation of organizational patterns and practices is discouraged, top executives are insulated from criticisms, and needed innovations are not introduced.

These organizational theories imply that, as a large firm matures it will become less responsive to change and unable to adopt innovations needed to promote efficiency. Such unresponsiveness will be called organizational rigidity throughout this paper. Organizational rigidity is, of course, one form of Olson's institutional sclerosis. These terms will be used interchangeably in the ensuing pages.

In the remainder of this section, it will be argued that the relative strength of rigidities between industries is not uniform across countries. This argument establishes one important link between the previously mentioned theories and patterns of trade. However, this link is not the only foreign trade implication of the theories. Other links, which do not depend upon non-uniformity of rigidities across countries, will be discussed briefly in Section 4 of this paper.

The foregoing theory gives the following predictions:

(a) Rigidities will increase with the length of time that the industry has been in existence.
(b) Rigities will decrease when a country experiences a major domestic political upheaval.[3]

These predictions are important for identifying both the overall size of organizational rigidities and the differences in the rigidities between industries. In order to examine these differences, let us suppose for the remainder of this section that one can identify two industries such that industry *A* came into existence at the beginning of the era of modern economic growth and industry *B* grew to prominence in all countries at a later date or example, *A* is textiles and *B* is electronics. Organizational rigidities will be relatively small in industry *B* in every country. The extent of organizational rigidity in industry *A* in a particular country *X*, will depend on when *X* began its process of industrialization and whether *X* experienced any large domestic political upheavals after it began the process of industrialization.

Let us compare two countries *X* and *Y*, and make the following assumption:

(A.1) *X* and *Y* began their industrialization processes at the same time. *X* has had a stable political history during the period of modern economic growth while *Y* experienced a major political upheaval in the recent past.

The political upheaval will have affected all social and economic institutions in *Y*. However, it is reasonable to assume that the interest groups which were most prominent had their power more than proportionately reduced. Also, the oldest economic organizations would be the ones most likely to have secured a powerful place under the old regime. Therefore, the oldest economic organizations would be the most obvious targets of a new regime. For both interest groups and organizations, the effects of political upheaval in *Y* will have centered on the older industry, *A*. Thus, the effect of the political upheaval is to reduce the ratio[4]

$$\frac{\text{organizational rigidities in industry } A}{\text{organizational rigidities in industry } B} \qquad (1)$$

in country *Y*, while leaving this ratio unchanged in country *X*.

Consider an alternative scenario:

(A.2) Country *X* began its industrialization process before country *Y* and neither country experienced a major domestic political upheaval in the recent past.[5]

The accumulation of organizational rigidities in industry *A* in country *X* will be greater than in country *Y* because this accumulation will have started at the beginning of the industrialization process. In contrast, industry *B*, being newer, is more likely to be of the same age in both countries. The accumulation of organizational rigidities in industry *B* will be of the same order in both countries. Therefore, under assumption (A.2), ratio (1) will be higher in country *X* than in country *Y*.

Organizational rigidities will, other things being equal, make an organization less ready to accept innovations and less responsive to changing market conditions. The greater organizational rigidities in a particular industry are, the less efficient that industry will be. Thus, under either scenario (A.1) or (A.2), and in a world with two industries, *A* and *B*, and two countries, *X* and *Y*, country *X* will have a comparative advantage in the goods produced by industry *B*, and country *Y* will have a comparative advantage in the goods produced by industry *A*.[6] In a many-country, many-good world, the above analysis does not show, for example, that *X* will have a comparative advantage in *B* but does show, for example, that *X* is more likely than *Y* to have a comparative advantage in *B* (or less likely to have a comparative disadvantage).

The first task in developing tests of the foregoing theory is to ascertain which country of any pair taken from the six under study can be classified as *X* and which as *Y* when applying assumptions (A.1) and (A.2). The first three columns of Table 1 provide information on the process of industrialization in the six countries. C. E. Black (1966) has identified three phases in the modernization of societies. Two of these phases are relevant to this study. In the period of the consolidation of modernizing leadership, there is '... an effective and decisive break with the institutions associated with a predominantly agrarian

Table 1. Variables influencing the extent of organizational rigidities in six countries

Country	(1) Beginning year of consolidation of modernizing leadership	(2) Beginning year of economic and social transformation	(3) Percentage share of industry in national product in 1870	(4) Major political upheaval in 20th century
United Kingdom	1649	1832	36	No
United States	1776	1865	31	No
Canada	1791	1867	26	No
F. R. Germany	1803	1871	25	Yes
Italy	1805	1871	21	Yes
Japan	1868	1945	16	Yes

Sources: Columns (1) and (2): Black (1966: 90-92).
Column (3): Kuznets (1966: 88-93) (using linear interpolations where necessary).

way of life, permitting the transition to an industrial way of life' (Black, pp. 71-72). In the phase of economic and social transformation '... virtually the entire industrial plant and communications system as we know them today were built ...' (pp. 78-79). Thus, if country X entered both of these phases before country Y, it is likely that X began to industrialize before Y. In order to provide information to supplement Black's estimates, column (3) gives the share of industry in total national product in 1870. For any two countries, the one with the higher figure in column (3) is likely to have begun the industrialization process earlier. The figures in column (3) are consistent with the figures in columns (1) and (2) in their implications for the timing of the industrialization process. For every pair of countries taken from Table 1, the country which is on the higher row will have begun to industrialize earlier, according to information in all three columns (with one exception where one of the columns gives a tie for one pair of countries).

Column (4) provides information on the second major variable which influences the size of ratio (1): the incidence of a recent major political upheaval. This information tells us that if country X is in the first three rows of the table and country Y is in the fourth to sixth rows, then one would expect ratio (1) to be higher for X than for Y. Fortunately, this conclusion about the relative sizes of ratio (1) is exactly the same as the one that would be made using the information from columns (1) to (3). Therefore, for our six countries, there is no inconsistency between the 'political upheaval' and beginning date of industrialization' variables in terms of their effect on the ratio (1).[7]

It is now useful to summarize the conclusions which have been reached in this section. Industry A is an older industry than industry B. Country X appears on a higher row of Table 1 than country Y. Thus, X is more likely than Y to have a comparative advantage in B and Y is more likely than X to have a comparative advantage in A.

3. The influence of interest groups on measured comparative advantage

Before formulating the first hypothesis to be tested, it is necessary to discuss the problems of measurement of comparative advantage. Different measures of comparative advantage will have different properties. Indeed, the differing properties of two measures provide the framework for the first formal test of the foregoing theory. The first measure is based on the export performance of an industry alone.[8] The 'export measure' of comparative advantage for industry i in country j, e_{ji}, is defined as:

$$e_{ji} = \frac{U_{ji}/W_i}{U_j/\bar{W}} \tag{2}$$

where

U_{ji} = exports of commodity i by country j,
U_j = total manufacturing exports of country j,
W_i = total exports of commodity i by a large group of countries (of which j is one), and
$\bar{W}$ = total manufacturing exports of that large group of countries.

Thus, the export measure compares the export performance of one country in a particular commodity to a standard measure of performance calculated by using the export data of a large group of countries.

The second measure uses both export and import data. This measure compares the exports of an industry to the imports of that industry. The 'export-import' measure of comparative advantage for country j in commodity i, f_{ji}, is defined as follows:

$$f_{ji} = U_{ji}/M_{ji} \tag{3}$$

where U_{ji} is defined as before, and M_{ji} is the amount of commodity i imported by country j.

Bela Balassa (1967: 203-204) has discussed the relative merits of these two measures of comparative advantage:[9]

> It is suggested here that revealed comparative advantage can be indicated by the trade performance of individual countries in regard to manufacturing products, in the sense that the commodity pattern of trade reflects relative costs as well as differences in nonprice factors. For one thing, comparative advantage would be expected to determine the structure of exports; for another, under the assumption of uniformity in tastes and a uniform incidence of duties in every industry within each country, export-import ratios would reflect relative advantages.
>
> The assumption of the uniformity of tastes and the uniform incidence of duties is not fulfilled in the real world. Imports are affected by differences in tastes as between countries, as well as by disparities in the degree of protection among individual countries...
>
> On the other hand, so long as exporters are subject to the same tariff in foreign markets, data on relative export performance are not distorted by differences in the degree of tariff protection.

Thus, in examining systematic differences between the two measures, one must look for effects produced by differing tastes or differing degrees of protection. It is plausible to argue that differences in tastes will not systematically affect the correspondence between the two measures of comparative advantage. An even stronger argument could be invoked following George Stigler and Gary Becker (1977: 76), that '... tastes neither change capriciously nor differ importantly between people.' Therefore, one should examine the non-uniform incidence of barriers to trade in order to understand the causes of differences between two measures.

A country X, which has had a long period of freedom of organization, will

have a comparative disadvantage in those industries which have strong interest groups. The combination of domestic markets threatened by imports and strong interest groups may lead to non-market actions which reduce the flow of imports. In such cases, the effect of the trade barrier is to 'improve' the revealed comparative advantage of the industry as measured by the export-import measure but to leave the export measure unchanged.[10] The effect of the trade barrier will be to weaken the correspondence between X's two measures of comparative advantage. In contrast, consider Y, a country which has much weaker interest groups because of a recent political upheaval. With weak interest groups, trade distorting measures will be less common in Y than in X. For this reason alone, one would predict that the correspondence between Y's two measures will be greater than that for X's. Also, Y will be less likely to have a comparative disadvantage in those industries in which interest groups are strongest. Therefore, the combination of damaging import competition and strong interest groups will not occur in Y. Non-market trade distorting actions, if they occur in Y, are less likely to center on the imports of a particular set of commodities.

The foregoing provides the framework for the first test of the theory of Section 2. Countries which appear higher in Table 1 will have their export-import measures 'improved' by trade barriers but the export measure will remain unchanged. Therefore, the correspondence between the two measures of comparative advantage will be weakened. Countries on lower rows of Table 1 will be less likely to use such trade barriers. For these countries, the correspondence between the two measures will not be weakened by trade policies. Hence, one can test the foregoing theory by examining the association between the measures of comparative advantage in the six countries.

The source of the data must now be described. M. Panic and A. Rajan (1971) have constructed and published measures of comparative advantage for 71 industries in each of the six countries. The 'reference' group of countries against which export performance is judged consists of eleven industrialized nations which collectively account for over 75% of world exports of manufactured goods. Panic and Rajan calculated measures for three years (1960, 1964, and 1968) and then averaged the three measures to find the comparative advantage of a country in a particular commodity. Their data are used throughout the present paper.

In order to test whether there are differences across countries in the correspondence between the two measures of comparative advantage, correlation coefficients between the two measures were calculated for each country. Both Spearman rank-order and product-moment correlations were calculated. The disadvantages of each are well known: the product-moment correlation is sensitive to extreme values while the rank-order correlation is insensitive to small changes in the variables. The results of these calculations are given in Table 2.

Table 2. Correlations between export and export-import measures of comparative advantage for six countries

Country	Product-moment correlation	Rank-order correlation
United Kingdom	0.344	0.563
United States	−0.033	0.723
Canada	0.687	0.913
F.R. Germany	0.569	0.773
Italy	0.681	0.835
Japan	0.703	0.824
Rank-order correlation between order of country in table and size of correlation coefficient	−0.77	−0.65

In order to summarize the results, it is useful to calculate a measure of association between the order of countries in Table 1 and the strength of the relationship between the two measures of comparative advantage. Rank order correlation coefficients between 'row in Table 1' and 'size of correlation coefficient in Table 2' were calculated for each set of correlation coefficients in Table 2. For this sample of only six observations, one coefficient is significant at the 95% level and the other at the 90% level.[11] Tests of significance can also be employed to examine whether the correlation coefficient for a country higher in the table is significantly lower than the coefficient for a country lower in the table. There are fifteen such tests (not all independent) for each type of correlation coefficient. For the product-moment correlations, nine of the fifteen tests show significant differences at the 95% significance level while eight of the fifteen comparisons for the rank-order coefficients are significant.

Canada is the one country whose correspondence between trade measures does not fit the theory. There is a plausible explanation for this phenomenon. Trade with the United States constitutes a large proportion of Canadian trade. Therefore, one may, at a first approximation, view Canadian trade as if it were determined in a two-country world. Given the relative rankings of the U.S. and Canada in Table 1, this would imply that Canada's behavior would be similar to that of a country at the bottom of Table 1. In such a case, the correlation between the two measures for Canada would be greater than predicted by the theory. This may account for Canada's large coefficients in Table 2.

4. Comparative advantage and organizational rigidities: A general test

In Section 2, one specific prediction about comparative advantage was made. However, other predictions can be made using Olson's theory. In the follow-

ing paragraphs, I will offer some tentative suggestions on the relationship between organizational rigidities and trade patterns. These suggestions are not explored in a detailed manner because acceptance of all of these suggestions is not crucial to the general argument of the paper. Rather, they are made in order to show that the Olson theory has important consequences for foreign trade patterns other than the specific hypothesis on industry age. As this section has a test whose results are interpretable in terms of the Olson theory but which do not necessarily rely on the age hypothesis, it is appropriate to suggest other possible sources of these results.

In the following, it will be assumed that country X is higher in Table 1 than country Y. Bearing this point in mind, one can make the following predictions:

(A) As interest group activity increases in a society so will the amount of non-market decision-making. 'Diplomatic' talents (or negotiating ability) will become an increasingly important economic tool.[12] Thus, assuming equal endowments, diplomatic talents will be relatively more costly in X than Y. Consider industry C in which diplomatic talents are expecially crucial for success. For example, C may make one-time products whose sale depends upon a complicated negotiation procedure or C may be particularly susceptible to the formation of within-industry interest groups. As C requires more of the factor which will be relatively costly in X, X is likely to have a comparative disadvantage in this industry.

(B) Organizational theorists predict that as organizations age, there arises a strong 'ideology' supportive of existing institutions and practices. This ideology will tend to stifle movement for change within the organization even though everybody is aware that change is needed.[13] Some economists have emphasized that large productivity increases are obtained through 'learning-by-doing.' Inevitably, this learning requires changes in work organization. These changes are more likely to occur in an organization which has fewer rigidities: where the 'bureaucratic ideology' is less strong. Hence, if industry D is one in which most productivity changes come through a 'learning-by-doing' proces, firms in country Y will be more likely to have reaped the benefits of these changes than firms in X. Country Y is more likely to have a comparative advantage in D than country X.

(C) New ideas and innovations will be less easily accepted within large business organizations in X than in Y. Thus, the demand for creative talents will be less in X than Y. Hence, it is plausible that creative talent in X, more than in Y, will be attracted to those endeavors in which organizational structure and interest groups are less likely to stifle initiative. For example, pure scientific research may attract a greater proportion of creative talent in X than in Y. Suppose that industry E is an industry whose existence depends upon the use of the latest pure scientific advances, then it is possible that X will have a comparative advantage in E.

(D) Technological change requiring the manufacture of a wholly new product may be best brought to fruition by construction of new production facilities. Technological change involving the use of a new manufacturing process may be best brought to fruition within existing facilities. Rigidities can be partially circumvented by the establishment of a new factory. Thus, country X will be more likely to have a comparative advantage in industries in which new products are frequently introduced than in an industry in which technological change centers on process changes.

It must be emphasized that the foregoing are tentative suggestions and are merely given here to emphasize that one does not have to rely solely on the industry-age argument to link comparative advantage to organizational rigidities. Rather, there may be many such links.

Obviously, separate tests of each of the above statements would be difficult because these tests would require measurement of many concepts which have been ignored by economists. Given that all the statements follow from a single theory, one can examine patterns in the data to ascertain whether these patterns are consistent with that theory. While the individual statements are not examined, one can conduct an analysis to see whether the data is consistent with a theory of trade of which the above statements are intended to be suggestive. One could postulate a model of the following form:

$$e_{ji} = g_j(Z_{1i}, \ldots, Z_{ni}) \qquad j = 1, \ldots, 6. \tag{4}$$

where e_{ji} is the measure of comparative advantage of country j in industry i and Z_{ki} $(k = 1, \ldots, n)$ are the measures of the characteristics of good i which are relevant to trade patterns. For example, Z_{ki} might be the measure of capital intensity of production of good i. If country j had a large endowment of capital per capita one would expect that $g_j(\cdot)$ would be increasing in Z_{ki}. Similarly, one or more of the Z's would measure the characteristics of a good which are relevant to a theory of comparative advantage based on organizational rigidities.

Given that measures of many of the Z's, especially the ones relevant to organizational rigidities, are not available, one cannot estimate equation (4). In such situations, factor analysis has been found to be useful. Factor analysis provides a method of estimating the Z_{ki} from the e_{ji} given that relationships such as (4) exist. This technique does not tell one which particular Z's, or factors, have been estimated. Rather: '... the usefulness of factor analysis in empirical investigations largely depends upon the investigator's success in identifying these factors with intuitively interpretable entities' (Dhrymes, 1970: 78).

In this study, a single factor gives a score for each commodity. The estimated factor score for the kth characteristic of the ith commodity, $\hat{Z}_{ki}$, is

found from a linear sum of the comparative advantages for that commodity:

$$\hat{Z}_{kl} = \sum_{j=1}^{6} \theta_{jk} e_{ji}. \tag{5}$$

The θ_{jl} ('factor loadings') are estimates derived in the factor analysis procedure. The value of the factor analysis procedure becomes clear when one examines the signs and sizes of the θ_{jk}, particularly remembering that θ_{jk} applies to the jth country's comparative advantage. If the theory of this paper has any credence, one would expect to find a factor whose loadings (θ_{jk}) are readily interpretable given the information in Table 1.

The measures of comparative advantage (e_{ji}) used were the export measures described in Section 3. The export-import measures were not used since the argument of Section 3 implies that these measures were not as reliable as the export measures. Factor loadings were estimated by the method of principal components. Since this method is well known, it is not described in this paper (see, for example, Dhrymes, 1970: 53-65). With six countries, a maximum of six factors could be estimated. However, it is not necessary to present the results for all six factors since the first factor estimated shows the characteristics relevant to the foregoing theory (and all the above theory indicates is that at least one factor will exhibit the required characteristics).

The factor loadings for each country for the first factor are given in Table 3. Using equation (5) to analyze the results in Table 3, one can immediately see that factor one can be interpreted in terms of the foregoing theory. As the sizes of the factor loadings are in rough correspondence with the order of the countries in Table 1, one could posit that factor one measures the characteristic of a good which causes a country with large organizational rigidities to have a comparative advantage in that good. A rank correlation coefficient between the loadings in Table 3 and the order of countries in Table 1 is significant at the 95% level.

The question remains whether the results in Table 3 can be explained using existing trade theories without the theory of this paper. Gary Hufbauer (1970) has summarized the major trade theories and presented data on national

Table 3. Results of a factor analysis using measures of comparative advantage for six countries

Country	Loading for factor one (i.e., $e_j, j = 1, \ldots, 6$)
United Kingdom	0.26
United States	0.61
Canada	0.41
F.R. Germany	−0.32
Italy	−0.62
Japan	−0.74

Table 4. Ranking by size of national attributes for six countries in 1964

Country	Fixed capital per manufacturing employee (A)	Skilled employees as percent of total (B)	Total manufacturing output (C)	GDP per capita (D)
United Kingdom	4	4	3	4
United States	2	1	1	1
Canada	1	2	6	2
F.R. Germany	3	3	2	3
Italy	6	6	5	5
Japan	5	5	4	6

Source: Hufbauer (1970: 157).

attributes relevant to these theories. Hufbauer's data refers to 1964, which is also the mid-year used for Panic and Rajan's (1971) measures of comparative advantage. Thus, Hufbauer's estimates of national attributes can be used to interpret the results in Table 3 in the light of existing trade theories. The rank orderings of the six countries for each of the four national attributes in 1964 are given in Table 4. Using the symbols in that table, variable A is relevant to the factor proportions theory, B to the human skills theory, C to the scale economy theory and D to stages of production, technological gap and product cycle theories. The rankings of the four national attributes are highly correlated with the ranking arising from the theory of this paper. Thus, one can expect that the first factor will be a function of variables relevant to all these theories.

There is one element of the data in Table 3 which cannot be explained solely by the rankings in Table 4. The factor loadings show that the pattern of British trade is closer to the patterns of Canadian and American trade than is the pattern of German trade. The rankings in Table 4 show that if one were to divide the countries into two groups of three from the viewpoint of the four national characteristics, then the U.S., Canada and the F.R.G. would form one group and the U.K., Japan and Italy would form the other. A similar exercise for the factor loadings would involve a switching of positions for the F.R.G. and the U.K. The only theory of trade which could explain the similarity in factor loadings between the U.S., the U.K., and Canada, on the one hand, and the F.R.G., Japan, and Italy, on the other, is the theory based on organizational rigidities.

Thus, the ordering of the sizes of the factor loadings can be explained by a combination of the theories of trade suggested by the variables in Table 4 and by a theory of trade based on organizational rigidities. In using the organizational rigidity theory alone, one could not explain the size of the U.K.'s factor loading relative to that of the U.S. or Canada. Introduction of the

theories represented by, say, GDP per capita would provide such an explanation. In using only existing trade theories, the relative sizes of the factor loadings for the U.K. and F.R.G. would present an anomaly. Introduction of a theory based on organizational rigidity removes this anomaly.

5. Comparative advantage and organizational rigidities: Old versus new industries

In Section 2 it was argued that, if country X appears on a higher row of Table 1 than country Y, X is more likely to have a comparative advantage in a new industry than Y. In formulating a precise hypothesis from such a theory, a difficulty arises in defining the concept of a 'new' industry. The theory does not tell us how new the industry must be in order for X to have a comparative advantage in that industry. However, to test the theory it is not necessary to define, in an absolute sense, a concept which indicates whether an industry is 'new.' Rather, all that is needed is an ordinal measure of age, so that for any two industries one can determine which is the older.

Suppose, for the moment, that such an ordinal scale exists and that it indicates that industry k is newer than industry i. The foregoing theory implies that the likelihood that the measure of comparative advantage of X in any industry is less than the similar measure for country Y decreases with the age of the industry. Using the symbols of the previous section, the theory implies that:

$$e_{Xk} - e_{Xi} > e_{Yk} - e_{Yi} \tag{6}$$

If comparative advantage were unrelated to industry age, one would expect that:

$$e_{Yk} - e_{Yi} = e_{Xk} - e_{Yi} \tag{7}$$

Therefore, one test of the theory of Section 2 is to examine whether (6) or (7) provides the better explanation of data patterns.

The data on comparative advantage have already been described. Because of the results of Section 3, only the export measure of comparative advantage is used. Also needed for the tests is an ordinal measure of industry age. It would be impossible to devise an age measure which was strictly appropriate in all circumstances because the development of organizational rigidities could be related to many factors, such as the length of time firms in the industry have had their present organizational structure, or the age of the factory buildings, or the number of second- or third-generation workers in the factories. Thus, three different measures of industry age have been constructed and each has been used in tests.

One can reasonably assume that industries are formed first in countries that first developed. Also the time lag between the establishment of a particular industry in two countries will be less than or equal to the time lag between the beginnings of industrialization in the same two countries. Under these two assumptions, the ages of the industries in the country on a lower row of Table 1 are irrelevant to the analysis which leads to ratio (1) as a conclusion. Hence, industry ages in the countries which first developed are most relevant for the statistical tests. Historical studies of British industrial development provide a natural source of data. Walther Hoffman (1955) has constructed a set of indices of annual output of British industries between 1700 and 1950. The beginning dates of these series are not uniform. It is plausible that the first year for which Hoffman could find information to construct an index for an industry is related in a systematic way to the year in which an industry reached a level of prominence.[14] Given that an ordinal, not cardinal, measure of industry age is required, one can construct:

> *Age measure 1 – Hoffman (1)* The beginning date of Hoffman's output index for an industry will be inversely related to industry age.[15]

It is possible that this first measure gives undue age to an industry which existed early in the industrialization process, but which only rose to a level of prominence later. An alternative measure which does not have this feature is:

> *Age measure 2 – Hoffman (2)* The age of an industry is measured by the year at which industry output was 50% of output in 1937 (the last year for which Hoffman has a complete set of indices)

In order to avoid relying on one source for age measures, U.S. data have also been used. Solomon Fabricant (1940) has constructed series measuring the growth of value added in American industries from 1899-1937. Using data from Fabricant, an industry is judged 'newer' the higher its growth rate from 1899-1937. The use of growth rates to measure industry age relies solely on the observation that, where there has been growth, changes have taken place in the industry. These changes might have been in management, labor force, capital stock, or more likely a combination of all these elements. The greater these changes, the less time has passed during which organizational rigidities could have developed. Thus, one is led to use:

> *Age measure 3 – Fabricant.* The relative age of an industry is judged by the relative rate of growth of that industry in the U.S. from 1899-1937.

The basic tests can now be described. For any pair of countries from the six under study, the country on a higher row of Table 1 is denoted X and the other Y when applying equations (6) and (7). Given measures of comparative advantage and industry age for any pair of industries in two countries, one can ascertain whether (6) is verified. Under the null hypothesis that organizational rigidities have no effect on the pattern of growth, one would expect (6) to be verified for one-half of the pairs of industries. If organizational rigidities affect the pattern of growth, one would expect the proportion of times that (6) was verified to be greater than one-half. The test can be repeated for every possible pair of the six countries.

The results are presented in Table 5. The basic unit of the tests is a set of comparisons between comparative advantages for a single pair of countries. Fifteen such pairs of countries are possible, given that this study focuses on six nations. For each pair of countries, the comparative advantages of every pairwise combination of industries is examined in order to ascertain whether (6) is verified. For each pair of countries, one can then examine whether the proportion of times that (6) is verified is greater than one-half and whether that proportion is significantly greater than one-half at 95% levels of significance. Since the comparisons between comparative advantages are not independent, one must take this dependence into account in formulating tests. The method of calculation of the standard errors used in the tests is explained in Murrell (1980).

The tests give similar results for all three age measures. The maximum possible entry in each cell of Table 5 is fifteen. For column (2), the expected value of an entry under the hypothesis that organizational rigidities have no effect on an industry's trade performance is seven and one-half. Thus, the entries in column (2) support the theory that organizational rigidities influence trade patterns. Column (3) gives the numbers of pairs of countries for which inequality (6) was supported at the 95% significance level. If in fact inequality (6) were incorrect, one would expect a test statistics for a single pair of countries to be significant in 5% of all tests. Yet, for all three age measures,

Table 5. Results of tests comparing the comparative advantages of old and new industries

(1) Age measure used	(2) Number of pairs of countries for which inequality (6) is verified more than 1/2 of times	(3) Number of pairs of countries for which the number of times that inequality (6) is verified is significantly greater than one-half
Hoffman (1)	13	9
Hoffman (2)	12	8
Fabricant	13	10

over 50% of the test statistics are significant. The probability of such an occurrence would be exceedingly low if inequality (6) were incorrect.

6. Conclusions

The purpose of the present paper has been to examine one particular set of implications of the Olson theory: the effect on trade patterns of the accumulation of interest groups and organizational rigidities. The results of three different tests were consistent with the predictions of that theory. Given the types of tests employed, it is perhaps best to regard the present exercise as a partial test of the Olson hypothesis. As that hypothesis focuses on variables, such as class structure and interest group power, which are difficult to measure, there are inherent difficulties in formulating tests. In the present paper, a method was employed which obviated the need for measurement of those variables. This was perhaps necessary given the multi-country, economy-wide scope of the tests. One testing approach which would complement the method of this paper would be to narrow the scope of the tests but provide more detailed data on the formation of organizational rigidities. Thus, the present paper constitutes just one approach to the testing of the Olson hypothesis. The importance of that hypothesis and the supportive nature of the present results both argue that further testing should be conducted.

Perhaps it is important to confront one objection which might be offered against the method of the tests in this paper. Although it is argued that organizational factors are responsible for the results of the tests, those organizational factors have not been directly measured. As has already been mentioned, the difficulty in testing any theory relying on organizational variables will be in measuring those variables. One important feature of the Olson theory is that it identifies variables which are themselves determinants of organizational structure. Therefore, a test of the *whole* theory can rely on the relationship between these determinants and economic performance. Nevertheless, the doubt may remain in the reader's mind whether the data patterns detected in any particular test actually reflect the influences of organizational rigidity. That is the reason why three different tests of the basic theory have been formulated. The tests give three results consistent with the basic theory: that length of freedom of organization is related to the association between the two measures of comparative advantage; that, on the one hand, the U.S., U.K., and Canada have similar trade patterns while, on the other, the F.R.R., Japan and Italy have similar trade patterns; and that comparative advantage is related to the age of an industry. Any competing explanation, not based on organizational factors, would need to explain not one but all three test results.

The results have some significance for two major areas of economics. First, a new determinant of international commodity flows, organizational structure, has been suggested. The theory has shown that the inter-sectoral pattern of organizational structure will vary between seemingly similar economic systems. This variation will produce a distinctive pattern of trade flows: a pattern which has been detected in the trade data of six developed market economies. Secondly, this paper has also tested a new theory of comparative growth. The same factors which lead to variations in the pattern of organizational rigidities will also lead to variations in the average levels of those rigidities. That variation in levels will be responsible for differences in aggregate economic performance between nations.

NOTES

1. Much of the argument in this section closely follows an argument in Murrell (1980), which was developed in order to provide a theory of inter-industrial growth patterns.
2. In this excessively brief statement of the theory, one must remember that the *ceteris paribus* assumption is being used strongly. See Olson (1981) for some of the difficulties of applying the theory when such complications as the encompassingness of interest groups are introduced.
3. This conclusion follows, for formal interest groups, immediately from Olson's theory. For organizational rigidities, the conclusion will certainly be true for political upheavals which affect the management structure of large business organizations. This was certainly true for the defeated countries in the second world war.
4. Assuming that these variables can be suitably quantified.
5. Or they experienced exactly equivalent domestic political upheavals in terms of the degree of reduction of organizational rigidities.
6. This statement assumes, as do many in this paper, that all other things are equal. It would be much too repetitive to repeat the 'other things equal' assumption every time it is used. Thus, in many cases that assumption is left implicit.
7. In this paper, it is assumed that defeat in the Second World War had an equivalent effect on the 3 countries.
8. In the entire paper, commodity *i* will be assumed to be made by industry *i*. Thus, 'comparative advantage of industry *i*' and 'comparative advantage in commodity *i*' will be used interchangeably.
9. Balassa's export-import measure involves a normalization procedure similar to the one used for the export measure. However, his comments apply equally to the 'export-import' measure used here.
10. The export measures of all countries are changed, but since the effect is spread over a number of countries its importance will be minimal.
11. Given the usual normality assumption.
12. This point was made by Sir John Hicks at the Conference on the Political Economy of Comparative Growth Rates, University of Maryland, 1978.
13. Blau and Meyer (1971: 54) discuss bureaucratic ideologies. They refer to the situation where everybody is aware that change is needed, but nobody is willing to speak out as 'pluralistic ignorance.'
14. Of course, the relationship will be subject to much random error.
15. There is no exact correspondence between Hoffman's classification system and the SITC classification system. However, the two classifications can be reconciled in broad outline, if not in the detailed delineation of boundaries between categories. In deciding which of Hoffman's categories to use for which SITC category, it was easy to find one or more of Hoffman's categories which would be classified within the SITC category or which completely contained the SITC category. Where two or more of Hoffman's categories were relevant the average of the beginning years of the series was used. If Hoffman had no category corresponding in any way to the SITC commodity, that commodity was classified as being newer than all commodities for which one could find a corresponding item in Hoffman's tables. The correspondences between the classifications can be supplied by the author on request. This footnote applies, *mutatis mutandis*, to the two other age measures.

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