Abstract

Empirically, Heckscher-Ohlin (H-O) factor-intensity differences are of considerable importance when one examines recent changes in the composition of trade for major industrial nations. This evidence contradicts (i) the assertion of the new trade theory that north-north comparative advantage is determined by product differentiation and (ii) recent empirical research that it is driven by Ricardian productivity differentials. Here we test these three approaches to comparative advantage in a dynamic context using a panel of 11 industrialized countries, 13 sectors and 13 years. We find that trade patterns over time are best explained by a dynamic version of H-O, although Ricardian effects are also significant.

JEL Codes: F11, F12, F114.

Keywords: trade, comparative advantage, dynamic, factor proportions, imperfect competition.
I. Introduction

Between 1970 and the early 1990s, Japan built up a considerable comparative advantage relative to other industrialized countries in human-capital-intensive machinery and transportation equipment (see Figure 1). Over the same period, the U.S. and Germany, the other two largest economies, developed a strong comparative advantage relative to Japan in labor-intensive light industry. This empirical evidence of important Heckscher-Ohlin (H-O) factor-productivity differences emerging in the comparative advantages of the major industrialized countries contradicts the conventional wisdom of the new trade theory. According to the synthesis proposed by Helpman and Krugman (1985) and Helpman (1987), north-north trade is determined by product differentiation and north-south trade by factor abundance. The observed trends also contradict recent single-year empirical studies by Trefler (1993, 1995) and Davis et al. (1997) showing that international trade is driven by Ricardian differences in factor productivity which are correlated with per-capita income.\(^1\)

[Insert Figure 1 about here.]

Here we attempt to assess the relative importance of the H-O, Ricardian and product differentiation approaches to the comparative advantage of industrialized countries in a dynamic context. To do so, we employ the concept of revealed comparative advantage (RCA), suggested by Balassa (1965, 1979), to measure changes over time in trade structure for 13 industries in 11 major OECD countries from 1980 to 1992. We then link this measure of comparative advantage to an index of specialization within countries to document more easily the nature of the changes that occurred during the time period under study. Finally, we turn to regression analysis, using a specification that incorporates

\(^1\) Whereas these studies assume a common technology matrix, Davis and Weinstein (2001) calculate separate input-output matrices for each of ten OECD countries. They find that net factor-service flows of capital and labor for these countries in 1985 were as predicted by H-O theory. However, unlike the present study, their model is static, they do not have a measure of human capital and they do not explicitly test H-O against other approaches to comparative advantage.
the three theoretical approaches and controlling for both heteroskedasticity and first-order autocorrelation.

Overall, we find that a dynamic version of H-O theory best explains the observed changes in trade patterns of our panel countries. There is little evidence of the product-differentiation effects proposed by the new trade theory. However, there is dynamic support for the Ricardian approach: research and development has a significant effect on labor productivity.

The paper proceeds as follows. In section II, we document observed patterns of industry specialization. Section III reviews potential explanations for changes in comparative advantage found in the literature. Section IV presents our empirical findings on the extent to which major theories are capable of explaining the dynamics of comparative advantage.

II. Observed Patterns of Comparative Advantage and Specialization

A country is said to have a comparative advantage in producing a certain good relative to another country if it can produce that good at a lower opportunity cost than the second country. A country that has a comparative advantage in a good will tend to export that good and import those goods in which it has a comparative disadvantage. Consequently, a country reveals its comparative advantage if it exports relatively more in a certain industry than other countries do. In a series of studies, Balassa (1965, 1979) proposed the following measure of Revealed Comparative Advantage (RCA) of country $j$ in sector $i$:

$$x_{ij} = \frac{X_{ij}}{X_i} / \frac{X_{j}}{X},$$

(1)
where $X_{ij}$ represents exports of sector $i$ by country $j$, $X_i$ world exports of sector $i$, $X_j$ total exports of country $j$ and $X$ total world exports. If the country's share of world markets in sector $i$ is greater than its share of total exports, then it has a comparative advantage in that sector; if the measure is less than one, the country has a comparative disadvantage in $i$. Note that although a country may have a comparative disadvantage in a given sector, it may still have a comparative advantage relative to another country in that sector, if the value of the first country’s RCA index is higher.

To illustrate the application of this measure, consider Table 1, which describes the export structure of the Group-of-Seven countries relative to a larger group of 14 OECD countries of which they form a part. As the third panel shows, in 1970, Japanese exports of machinery and equipment were 51 percent of total Japanese exports, whereas for the group of 14 countries as a whole, exports in this sector were 49 percent of total exports. In column (4), accordingly, we see that Japan's RCA in this sector was the ratio of these two percentages or 1.04. The corresponding figure for the U.S. is 1.26, while for Canada it is 0.97. In other words, in machinery and equipment in 1970, the U.S. had a revealed comparative advantage relative to both Japan and Canada while Japan still had a comparative advantage relative to Canada.

How has comparative advantage developed over time? Since this is hard to document for all industries and countries, we aggregate the 13 industries into three groups, namely light and heavy industry as well as machinery, and study a country’s revealed comparative advantage for those three aggregates first. Figure 1 shows the revealed comparative advantage for Japan, Germany and the US. Japanese data show growing comparative advantage in machinery, falling RCA in heavy industry and very strongly falling RCA in light industry. The picture is nearly reversed for Germany. While Germany’s RCA in heavy industry stays roughly constant around one, the value of no
specialization, Germany loses RCA in machinery and gains RCA in light industry. The United States displays a pattern similar to Germany’s.

While these examples indicate that these three countries experienced changes in RCA during the sample period, the question is whether these changes are sizable when compared to those in other countries. To answer this question, we turn to the concept of specialization. Balassa’s measure implies that an increase in RCA in one industry must reduce RCA in the remaining industries taken as a whole. In other words, if a country specializes increasingly in exports of a certain industry, it can only do so at the expense of at least one other sector. The more industries there are in a particular country that have values of RCA around one, the less specialized is the country’s export behavior. In contrast, we would call a country specialized if many of its industries exhibit values of RCA that depart from the value one.

Unfortunately, the Balassa measure turns out to be asymmetric: it is bounded from below by zero, but in principle not bounded from above. However, empirically, simply taking the log of each value transforms the distribution of the Balassa index in a way so that it is approximately distributed symmetrically around zero in our sample (see Figure 2). We use this feature to construct a simple measure of specialization similar to the entropy-concentration measures used in industrial organization (see, e.g. Tirole 1988). We define a measure of country \( j \)'s specialization \( S_j \) such that:

\[
S_j = \frac{1}{n} \sum_{i=1}^{n} \ln x_{ij},
\]

where \( \ln \) is the natural logarithm and \( x_{ij} \) is the Balassa measure of RCA for country \( j \) and industry \( i \) and \( n \) is the number of industries. Since \( \ln(1) = 0 \), this measure sums over the deviations from no specialization. As a consequence of the natural log, a value of \( x_{ij} \) of \( \frac{1}{2} \) gets the same weight as a value of 2 in the index. While this measure is ad hoc, it allows for a simple evaluation of the average degree of specialization of a specific country or its
changes of specialization over time. We employ this measure for all the countries in our sample based on the 13 industries in our classification and report the values for 1970, 1980 and 1992 in Table 2.

[Insert Table 2 about here.]

Finally, we plot the changes of $S_j$ from 1970-80 relative to the changes of $S_j$ from 1980-92 in Figure 3. For example, in this figure, the point for Japan indicates that the value of the index $S_j$ increased by 0.26 from 1970-80 and by 0.10 from 1980-92. Each of the quadrants as well as the diagonal has an interpretation. Countries whose values for $S_j$ are located in the first quadrant (like Japan) increased their level of specialization in both periods. Analogously, countries in the third quadrant (like Australia) decreased their level of specialization in both periods. Countries located in quadrant two and four increased their specialization in one sub-period only to reduce it in the other or vice versa. Countries located close to or on the diagonal through the second and fourth quadrant (like Belgium) experienced little or no change in specialization.

[Insert Figure 3 about here.]

The first striking observation is that nearly all countries experienced a decrease in specialization over the sample period. Only two countries experienced an increase in specialization (Italy and Japan) and three countries roughly kept the same level of specialization (Belgium, Denmark and France). This indicates that there have been sizable changes in RCA over the sample period. The second observation worth noting is that Japan is a very significant outlier. This, however, should not come to a surprise given the observed pattern of RCA presented earlier in Figure 1. In fact, based on the measure with 13 industries, Japan starts out in the sample as one of the least specialized countries, while it ends up second only to Australia at the end of the sample\textsuperscript{2}. Finally, most of the changes

\textsuperscript{2} This turns out to be even more extreme if one calculates the specialization index based on the three aggregate second to Australia. See Dudley and Moenius (2001) for details.
seem to have taken place during the first (shorter) period as indicated by the more sizable changes along the x-axis and the clustering of values along that axis.

Have these changes occurred homogeneously and smoothly? The answer is: not quite. To see this, in Figure 4, we plot another type of phase-diagram similar to the previous one. Here, however, we record annual changes: on the x-axis, we record the value of the specialization index $S_j$ in year $t$. The corresponding y-value is the value of $S_j$ for the following year. This type of graph offers a wide range of information all at once: the further to the northeast a country is located on the graph, the larger is the degree of specialization. Smooth changes of specialization appear as straight lines along the diagonal, while frequent changes in specialization that return to the original levels are represented by loops. All the loops are to be read clock-wise. Points above the diagonal represent increases, points below decreases in the value of the variable. The larger a loop, the larger has been an off-equilibrium adjustment. An example will be discussed below.

[Insert Figure 4 about here.]

We plot these diagrams for five of the G7 countries: Canada, Germany, Italy, Japan and the US in Figure 4 and again separately for the US in Figure 5. We find both loops indicating fluctuations, e.g. for Canada and the US, and fairly smooth straight-line transitions (Japan and Italy upwards, Germany downwards). This finding sheds some light on the interpretation of our results reported below and may also be of help in interpreting other results in empirical trade. First, it suggests that static tests of H-O theory may be sensitive to the year chosen, since some fluctuations are sizable. Secondly, there seem to be country-specific levels of specialization that are quite persistent, with few exceptions. In other words, change along the equilibrium path takes quite a long time. Finally, patterns of adjustment differ across countries. It is especially instructive to look at the changes in Germany and the US over the 23 years of our sample period. While Germany

\[\text{The graphs for France and the United Kingdom complicated the picture without providing additional information. They are available from the authors on request.}\]
decreased its degree of specialization quite smoothly (Figure 4), the US underwent a similar change in two connected loops (Figure 5).

[Insert Figure 5 about here.]

To summarize, we note the following stylized facts: (1) there are varying degrees of specialization across countries; (2) specialization has changed substantially over time within and across countries; and (3) there are possibly structural as well as cyclical effects. This finding suggests that explanations for observed patterns of changes in comparative advantage are likely to differ by country and industry.\(^4\) We now need to investigate whether we can identify underlying patterns consistent with standard theories of international trade. In order to do so, we next investigate potential explanations and then turn to the evaluation of their explanatory contribution.

\(^4\) We control for constant differences through fixed effects in our panel-estimation below.
III. Potential explanations for changes in comparative advantage

Three names and two models have traditionally been connected with the theory of comparative advantage: David Ricardo, August Heckscher and Bertil Ohlin. While Ricardo’s model predicts that for given labor productivities, a country will export the goods in which it has a comparative cost-advantage, the Heckscher-Ohlin model predicts that a country will export the goods that use its abundant factor of production intensively. Ricardo’s theory has been validated empirically recently in work by Eaton and Kortnum (1997). Although the Heckscher-Ohlin (H-O) theory of trade is probably the most elegant, it has resisted numerous temptations at empirical validation until recently. There is a long list of studies showing that observed trade and production measures fail to comply with the theory’s predictions. The best-known study is probably Leontief’s (1953) early work, later confirmed by Trefler (1993, 1995), who showed in an informative way how the theory failed. Davis, Weinstein, Bradford and Shimpo (1997) postulated technological differences as potential causes for failure, since the H-O model seemed to work well for trade within Japan’s regions but not across countries. Debeare (1998) finds that relative endowments in pair-wise trade matter exactly in the way the theory predicts.

While Krugman’s (1979, 1981) models were designed to explain intra-industry trade, it is not unreasonable to reinterpret them as a theory of comparative advantage by industry if there are at least two industries producing varieties of products. In Krugman’s models there are \( n \) monopolistically competitive firms, each producing one specific variety of a product. If there are differences across otherwise identical countries (not explained in the theory) that favor the development of varieties in a specific industry in one country over the same industry in another country, then the country that produces more varieties in a certain industry should export relatively more in that industry. In terms of empirical success, Krugman’s models have been frequently discussed in the context of the gravity model of trade, the stunning success of which Deardorff (1998) calls “a fact of life.”. Evenett and Keller’s (1998) work probably provides the most convincing evidence
so far that product differentiation is at the heart of the success of the gravity model of trade.

All three of these trade theories and their empirical implementations suffer from an important shortcoming: they are static. Nevertheless, they do permit some interesting comparative-static results. From Dornbusch et al. (1977), it follows that changes in relative labor productivities in the Ricardian model shift the range of goods produced in favor of the country with the increased relative productivity schedule (their A-schedule). In the H-O framework, a shift in relative factor endowments towards more dissimilarity leads to a higher degree of specialization (as long as the endowments are inside the Factor-Price-Equalization box). From the discussion above, it follows that a relative increase in the number of varieties produced should increase the exports of a country in that particular industry.

IV. Empirics

The literature just described suggests that we might proceed as follows: first, write down an empirical specification derived from one of the models described above; then examine whether the empirical results are consistent with the theory; finally, repeat this exercise for the other two theories. However, this procedure would not tell us anything about the relative contributions of the three theories, e.g., which one really works best empirically. Moreover, the results derived from such estimations are potentially susceptible to omitted-variable bias if important other influences are left out.

To avoid these difficulties, we go a different path here and test the predictions derived from the three theories directly against one other. In order to do so, we run regressions that test the relative contributions of our proxies for the three major theories that attempt to explain comparative advantage.

5 See also Hakura (2001).
Our first step will be to discuss the hypotheses to be tested and the measures employed. Next we will describe the data sources used. Finally, we will present regression results from our panel-data set, where we use country-industry dummies to control for sector attributes that are different across countries but constant over time. A discussion of the results and some caveats follow.

(a) Hypothesis and Measures

The three approaches to modeling international trade discussed in the preceding section suggest the following hypotheses. Relative export performance should be positively correlated with (i) H-O: relative factor-intensities; (ii) product differentiation: a higher number of varieties produced in a specific industry in one country relative to the same industry in other countries; (ii) Ricardo: higher factor productivity (e.g. labor productivity). We take the predictions of the theories literally and construct our measures accordingly. This may involve (substantial) measurement error, but we would still expect correlations that meet the predictions of the theories.

One of the most difficult measurement problems occurs when it comes to the measurement of human capital. Woessmann (2000) has argued that the most commonly used measure, average years of schooling of the labor force, fails to take account of decreasing returns to additional years of education. Mulligan and Sala-i-Martin (1997) have suggested a market-based calculation that overcomes this difficulty. They measured the human capital of a skilled individual by the ratio of her wage rate to that of a worker with no schooling. Unfortunately, this measure will tend to overestimate the changes in human capital over time, since it fails to take account of the increases in physical capital available to the skilled worker that are not available to the uneducated individual. To avoid this problem, we therefore measure the average human capital per worker in a
sector by the ratio of that sector’s average salary to the average salary in the sector with
the least-skilled workers -- textiles. By replacing the uneducated worker (for example, a
street sweeper) by a textile worker in the denominator of our measure, we allow more
adequately for changes in capital per worker over time.

A no less thorny problem than the measurement of human capital is the
representation of Ricardian production technology. While average-wage data are readily
available, measurements of labor productivity are harder to obtain. Although one could
use output per worker, this measure has some undesirable features, since it does not take
account of the contribution of physical capital. We therefore follow a path similar to
Eaton and Kortnum (1997), who calculated measures of research and development (R&D)
stocks as proxies for labor productivity. We use R&D as a share in value added, since this
measure provides information on how R&D-intensive the products and processes have
been. We calculate our (Neo-) Ricardian measure as the wage rate in an industry divided
by the share of R&D in this industry.

Despite the methodological difficulties just described, the measurement of human
capital and Ricardian technology are straightforward compared to the measurement of
product varieties per industry. Although there is no generally accepted measure of this
characteristic, theory suggests a possible approach. Krugman’s (1979, 1981) theory of
monopolistic competition and trade suggests that each company produces exactly one
variety. We take this theory literally and use the number of establishments in an industry
as a measure of product variety. This measure is reasonable as long as structures within
industries are not too different across countries.

(b) Data

Data come primarily from the 1994 OECD data set, International Sectoral
Database. They are completed with data from the 1999 OECD source, Industrial
Structure Statistics. A relatively small number of missing data points were estimated by interpolation. The data on research and development come from the 1998 OECD data set, \textit{ANBERD, Basic Science and Technology Statistics}.

The following countries were included in our sample: the United States, Canada, Japan, Germany, the United Kingdom, Australia, Netherlands, Denmark, Norway, Sweden, Finland. Manufacturing was divided into the following two-digit industries: Food, Beverages and Tobacco; Textiles, Apparel and Leather; Wood Products; Paper, Paper Products and Printing; Chemical Products; Non-metallic Mineral Products; Basic Metal Industries; Metal Products; Non-Electrical Machinery; Office & Computing Machinery, Professional Goods; Electrical Machinery; Transport Equipment; and Other Manufacturing, not elsewhere specified.

\textbf{(c) Regression Analysis}

Balassa (1979) proposed a two-step procedure to explain comparative advantage in a cross-section of countries for a single year. First, for each country $j$, RCA by industry, $x_{ij}$, is regressed on that country’s factor intensities, physical and human capital being aggregated into a single factor. Second, in a single regression for a cross-section of countries, the country factor-intensity coefficients from the first step are regressed on the country factor endowments.

Although we retain Balassa's basic approach, we make several changes in methodology. Since very different decision processes are involved in the creation of human and physical capital, we distinguish these two forms of capital. In addition, instead of assuming a constant technology matrix for all countries, we use the observed factor intensities in each country. Finally, in order to take account of the dynamic effects of capital accumulation, we estimate a panel of 13 years.
Accordingly, define the following variables:

- \( k_{ijt} \): ratio of physical capital to labor in sector \( i \) of country \( j \) in period \( t \) divided by country \( j \) average;
- \( h_{ijt} \): ratio of human capital to labor in sector \( i \) of country \( j \) in period \( t \) divided by country \( j \) average;
- \( K_{jt} \): ratio of country \( j \)'s physical-capital endowment per worker to that of all countries in period \( t \);
- \( H_{jt} \): ratio of country \( j \)'s human-capital endowment per worker to that of all countries in period \( t \);
- \( R_{ijt} \): the value of the Ricardian factor defined above in sector \( i \) of country \( j \) in period \( t \) divided by sector \( i \) average
- \( E_{ijt} \): the share of country \( j \) establishments in sector \( i \) of in period \( t \) divided by country \( j \)'s share of all establishments in that period

The equation for the first step is then:

\[
x_{ijt} = \alpha + \beta_{jt} k_{ijt} + \gamma_{jt} h_{ijt} + \varphi R_{ijt} + \delta E_{ijt} + u_{ijt} ,
\]

where \( u_{ijt} \) is a random error.

There are two equations in the second step:

\[
\beta_{jt} = a^* + b^* K_{jt} + c^* H_{jt} \quad (4)
\]
\[
\gamma_{jt} = a + b K_{jt} + c H_{jt} \quad (5)
\]

Substituting from (4) and (5) into (3), we obtain a specification of comparative advantage:

\[
x_{ijt} = m_1 k_{ijt} + m_2 K_{jt} k_{ijt} + m_3 H_{jt} k_{ijt} + m_4 h_{ijt} + m_5 K_{jt} h_{ijt} + m_6 H_{jt} h_{ijt} + m_7 R_{ijt} + m_8 E_{ijt} + u_{ijt} , \quad (6)
\]

where

\[
m_1 = a^* \quad m_2 = b^* \quad m_3 = c^* \quad m_4 = a \quad m_5 = b \quad m_6 = c \quad m_7 = \varphi \quad \text{and} \quad m_8 = \delta .
\]
The first part of the Rybczynski theorem, whereby the accumulation of a factor of production leads to an increase in the production of the good intensive in that factor, is captured by the coefficients $m_2$ and $m_6$. Their expected signs are both positive. The coefficients $m_3$ and $m_5$ capture the second part of the Rybczynski theorem whereby the accumulation of one factor reduces the production of goods intensive in the other factor. Their expected signs are negative. Finally, according to the discussion above, the expected sign of the Ricardian factor, $m_7$, is negative and that of the relative number of varieties, $m_8$, positive.

The results can be found in Table 3. We employ panel-estimation techniques, allowing for country- and industry-specific fixed effects that accommodate the observed differences across countries and industries described above. We therefore identify our coefficients through variation over time. Because of the comparatively small number of observations and large number of categories, not all of the coefficients are significant, as should be expected\(^6\).

[Insert Table 3 about here.]

Inspection of Table 3 reveals that all coefficients our theories delivered predictions that have the correct signs. Three out of the four Rybzynski-coefficients are statistically significant and robust to changes in specification and estimation technique. The Ricardian factor also bears the correct sign and is statistically significant in a robust way. However, our variable for product variety did not perform as well as expected. Although it has the correct sign, it does not reach a conventional level of significance. It is noteworthy that the values of all other coefficients do not seem to change at all when we include information of Ricardian technology or product variety. Therefore, omitted-variable bias might be less important than we originally suspected. We conclude that both Heckscher-
Ohlin and Ricardo help explain the observed variation in revealed comparative advantage across major industrialized countries. However, the explanatory power of the Ricardian proxy is comparatively small. Surprisingly, the relative number of establishments had no explanatory power in our regression analysis. We return to this point in the discussion below.

The results of the regression analysis show that a specification which incorporates the three principal theories of comparative advantage explains observed changes in comparative advantage quite well. However, the three theories do not contribute equally—surprisingly, the new trade theory turns out not to be significant. This result may have a very simple explanation. The observed time period saw very little variation in industry structure over time, but large changes in industrial organization, namely outsourcing and international division of labor. So while the new trade theory seems to have little to contribute to the dynamics of comparative advantage, it still may substantially determine the levels of comparative advantage in industries. These, however, cannot be identified in our estimation since they are absorbed in our fixed effects. We will take up this issue in future research.
V. Conclusion

In recent years, Heckscher-Ohlin (H-O) theory has been gradually pushed aside both as the fundamental *theoretical* approach to international trade and as a reliable basis for *empirical* modeling. However, recent trends in the trade of industrialized countries suggest that this phasing out of a sturdy work horse may have been premature. Over the past three decades, among industrial countries, the most important changes in Balassa’s (1979) measure of Revealed Comparative Advantage (RCA) have occurred in Japan. This country has developed a very strong comparative advantage in human-capital-intensive machinery and equipment and an even stronger comparative *disadvantage* in labor-intensive light industry. As a result, other countries – particularly the U.S. and Germany – have been forced to reduce their specialization in machinery and equipment and slow the decline of their more labor-intensive sectors. In short, the most important recent *changes* in comparative advantage among industrialized countries fit quite nicely into a H-O framework.

Our goal in this paper was to verify whether the principal approaches to comparative advantage – H-O, product differentiation and Ricardo – could be applied in a dynamic context to explain these observed changes in north-north RCA. Using export data from a panel of 11 OECD countries with 13 sectors and 13 years, we found that overall, a dynamic version of H-O performed best. Research and Development also had a significant effect on Ricardian labor productivity. There was little support for the product-differentiation approach of the new trade theory.

But please stay tuned. A paradoxical feature of Japan’s move into human-capital intensive exports from the 1970s on is that this trend occurred despite an important *physical*-capital deepening relative to human capital. During these recent decades of growing specialization in machinery and equipment, Japan was engaged in an exceptional effort of investment in physical capital, catching up with the Western countries in
measured physical capital per worker. This paradox suggests that a possible extension of the approach used in this paper would be to allow for biased technological change. Over the past few decades, the management teams of firms in the major industrialized countries have been under strong competitive pressure to develop production techniques that augment stocks of production factors that are locally scarce. In a companion paper, Dudley and Moenius (2001), we attempt to incorporate such activities into a formal trade model and test empirically the hypotheses that the model generates.
References


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<td>-0.02</td>
<td>1.01</td>
<td>1.12</td>
<td>0.11</td>
</tr>
<tr>
<td>Italy</td>
<td>0.26</td>
<td>0.23</td>
<td>-0.03</td>
<td>0.80</td>
<td>0.82</td>
<td>0.02</td>
</tr>
<tr>
<td>UK</td>
<td>0.29</td>
<td>0.31</td>
<td>0.02</td>
<td>0.91</td>
<td>1.12</td>
<td>0.21</td>
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<td><strong>Machinery and Equipment:</strong></td>
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<tr>
<td>OECD 14</td>
<td>0.49</td>
<td>0.56</td>
<td>0.07</td>
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<td>1.00</td>
<td>0.00</td>
</tr>
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<td>USA</td>
<td>0.61</td>
<td>0.63</td>
<td>0.01</td>
<td>1.26</td>
<td>1.12</td>
<td>-0.13</td>
</tr>
<tr>
<td>Canada</td>
<td>0.47</td>
<td>0.51</td>
<td>0.04</td>
<td>0.97</td>
<td>0.92</td>
<td>-0.05</td>
</tr>
<tr>
<td>Japan</td>
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<td>0.28</td>
<td>1.04</td>
<td>1.41</td>
<td>0.37</td>
</tr>
<tr>
<td>Germany</td>
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<td>0.02</td>
<td>1.18</td>
<td>1.06</td>
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<tr>
<td>France</td>
<td>0.43</td>
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<td>0.05</td>
<td>0.89</td>
<td>0.87</td>
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<tr>
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<td>0.00</td>
<td>0.94</td>
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<tr>
<td>UK</td>
<td>0.52</td>
<td>0.53</td>
<td>0.01</td>
<td>1.06</td>
<td>0.94</td>
<td>-0.12</td>
</tr>
</tbody>
</table>


Note: Small countries included in OECD14 are Australia, Netherlands, Belgium, Denmark, Norway, Sweden and Finland.

Sectors are defined from ISIC-2. *Light industry*: Food, Textiles, Wood and Other manufacturing; *Heavy industry*: Paper, Chemicals, Non-metallic minerals, Basic metals; *Machinery and equipment*: Metal products, Industrial machinery, Office and computing machinery, Electrical machinery, transportation equipment.
<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>Australia</td>
<td>1.19</td>
<td>1.04</td>
<td>0.93</td>
<td>-21.8%</td>
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<tr>
<td>Belgium</td>
<td>0.54</td>
<td>0.49</td>
<td>0.55</td>
<td>0.8%</td>
</tr>
<tr>
<td>Canada</td>
<td>0.92</td>
<td>0.80</td>
<td>0.82</td>
<td>-11.1%</td>
</tr>
<tr>
<td>Denmark</td>
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<tr>
<td>Finland</td>
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<td>0.55</td>
<td>0.56</td>
<td>4.9%</td>
</tr>
<tr>
<td>France</td>
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<td>0.89</td>
<td>0.78</td>
<td>-31.3%</td>
</tr>
<tr>
<td>Germany</td>
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<td>0.24</td>
<td>0.24</td>
<td>-5.5%</td>
</tr>
<tr>
<td>Italy</td>
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<td>0.52</td>
<td>0.54</td>
<td>20.5%</td>
</tr>
<tr>
<td>Japan</td>
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<td>0.74</td>
<td>0.84</td>
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<tr>
<td>Netherlands</td>
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<tr>
<td>Norway</td>
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<td>0.66</td>
<td>0.66</td>
<td>-15.9%</td>
</tr>
<tr>
<td>Sweden</td>
<td>0.64</td>
<td>0.58</td>
<td>0.58</td>
<td>-9.9%</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>0.30</td>
<td>0.28</td>
<td>0.24</td>
<td>-20.3%</td>
</tr>
<tr>
<td>USA</td>
<td>0.32</td>
<td>0.23</td>
<td>0.25</td>
<td>-23.9%</td>
</tr>
</tbody>
</table>
### Table 3. The Determinants of Revealed Comparative Advantage, 14 OECD Countries, with Country-Industry Effects

<table>
<thead>
<tr>
<th>Variable</th>
<th>Without AR1 Correction</th>
<th>With AR1 Correction</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
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<tr>
<td>$k$</td>
<td>0.12</td>
<td>0.13</td>
</tr>
<tr>
<td></td>
<td>(0.77)</td>
<td>(0.79)</td>
</tr>
<tr>
<td>$Kk$</td>
<td>0.40***</td>
<td>0.39***</td>
</tr>
<tr>
<td></td>
<td>(3.51)</td>
<td>(3.43)</td>
</tr>
<tr>
<td>$h$</td>
<td>0.39*</td>
<td>0.40*</td>
</tr>
<tr>
<td></td>
<td>(1.82)</td>
<td>(1.88)</td>
</tr>
<tr>
<td>$Hh$</td>
<td>0.12</td>
<td>0.14</td>
</tr>
<tr>
<td></td>
<td>(0.62)</td>
<td>(0.69)</td>
</tr>
<tr>
<td>$Hk$</td>
<td>-0.46***</td>
<td>-0.46***</td>
</tr>
<tr>
<td></td>
<td>(-3.46)</td>
<td>(-3.50)</td>
</tr>
<tr>
<td>$Kh$</td>
<td>-0.42***</td>
<td>-0.42***</td>
</tr>
<tr>
<td></td>
<td>(-3.88)</td>
<td>(-3.86)</td>
</tr>
<tr>
<td>Ricardo-Factor</td>
<td>-0.01***</td>
<td>-0.01***</td>
</tr>
<tr>
<td></td>
<td>(-2.99)</td>
<td>(-3.02)</td>
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<tr>
<td>Establishments</td>
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<tr>
<td>Constant</td>
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<td>0.90***</td>
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<tr>
<td></td>
<td>(8.27)</td>
<td>(8.17)</td>
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<tr>
<td>$R^2$</td>
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<td>0.9805</td>
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<tr>
<td>Durbin-Watson</td>
<td>0.41</td>
<td>0.41</td>
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</tbody>
</table>

Dependent variable: revealed comparative advantage of sector.
Number of observations: 1783.
Robust t-statistics in parentheses.
* significant at 10% level; ** significant at 5% level; *** significant at 1% level; two-tailed test.
Method of estimation: Columns (1)-(3) fixed effects; (4) to (6) Prais-Winsten regression with country-sector dummies.
Figure 1. RCA for Japan, Germany and the United States, 1970-92
Figure 2. The log-distribution of the Balassa-Index, 1970-92

Figure 3. Changes in Specialization, 1970-80 and 1980-1992
FIGURE 4. ANNUAL CHANGES IN SPECIALIZATION, FIVE MAJOR INDUSTRIALIZED COUNTRIES, 1970-92

FIGURE 5. ANNUAL CHANGES IN SPECIALIZATION, UNITED STATES, 1970-92