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Assessing the Relative Sizes of Industry- and Nation Specific Shocks to Output

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ASSESSING THE RELATIVE SIZES OF INDUSTRY- AND NATION SPECIFIC SHOCKS TO OUTPUT

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Abstract. This paper discusses efforts to determine the relative strengths of supply and demand shocks to output. Alan Stockman has used an international panel of value added by industry to try to identify demand and supply shocks to output. He uses the identifying assumption that demand has a nation specific component while supply shocks are international and industry specific. Therefore shifts in a industry’s output which are correlated with shifts in the output of different industries in the same country but are not correlated with shifts in output of the same industry in different countries are ascribed to demand shocks. Similarly shifts in output which are correlated within industries across countries but not across industries within countries are ascribed to supply shocks.

Stockman concludes that both demand and supply shocks are required to explain fluctuations in output. He estimates that identified nation effects and identified industry effects have a similar variance. Most of the variance is unidentified.

In different calculations Stockman assumes either that all industries are equally cyclical or that demand fluctuations explain an equal fraction of the variance of output of each industry. These assumptions are both false and lead him to underestimate the importance of demand relative to supply shocks. I follow Stockman but avoid the assumptions that bias his estimates of the variance of demand driven fluctuations. I conclude that identified demand shocks explain a substantially greater fraction of the variance of output than identified supply shocks.

I would like to thank Brad De Long, Larry Katz, and Larry Summers for helpful discussions.
For most of the past fifty years, macroeconomists have assumed that the principal source of macroeconomic fluctuations lies on the demand side. Recently this consensus has been challenged by “real business cycle theories" which assert that supply-side “technological" shocks are the principal cause of the business cycle (see, for example, Kydland and Prescott, 1982; Long and Plosser, 1983). This challenge has stimulated empirical work to determine the relative strength of supply and demand shocks to output.

One approach was to assume that demand-driven fluctuations were temporary, while supply-side technological fluctuations were permanent. Nelson and Plosser (1982) used this approach to argue that most of the variance in U.S. GNP growth over the past century was due to supply shocks. Their approach has been criticized on the grounds that their model had no place for transitory but long-lasting demand shocks like the Great Depression; indeed, it turned out that with the Depression excluded from their sample transitory fluctuations appeared to dominate (Delong and Summers, 1988a).

Although this approach has been extended (see, for example, Blanchard and Quah, 1989; Campbell and Mankiw, 1988; Durlauf, 1989), its underlying assumption appears dubious. There are many theoretical models in which persistent fluctuations occur without technological shocks (see, for example, Durlauf 1989, Greenwald and Stiglitz, 1988; Murphy, Shleifer, and Vishny, 1988; Shleifer, 1986). An alternative, relatively new approach to evaluating the relative sizes of demand and supply impulses is to compare the correlations of changes in output across different industries for the same country and across different countries for the same industry (see for example Stockman, 1988; Durlauf, 1989). Under the assumption that demand shocks are aggregate while supply shocks are narrowly-based and sector-specific, correlation between production growth across different industries for the same country suggests that demand shocks are important.

Such a correlation, however, could be consistent with real business cycle theories because sector-specific technology shocks could indirectly increase output in other sectors by (i) increasing the wealth of the average consumer, (ii) increasing demand for materials used in the directly-affected sector, and (iii) increasing demand for complements of the final output of the directly-affected sector.

The oil price shocks of 1973 and 1979 serve as obvious examples. Such shocks generate procyclical labor productivity, because in their aftermath output falls and labor productivity falls: the techniques of production used shift away from exploiting the now-expensive factor of production energy and toward intensively using labor. The reaction of the economy to the oil shocks thus follows the real business cycle pattern, and yet the positive correlation of output across sectors could lead Keynesian economists to see such oil-driven cycles as just additional examples of demand-driven procyclical productivity.

The possibility of cost shocks that fit the real business cycle pattern and yet affect many
different sectors at once means that one cannot rely on the identifying assumption that aggregate shifts are demand-driven shifts. However, there is a way of identifying demand and supply shocks. Cost or supply shocks—like the oil shocks of 1973 and 1979—which directly affect labor productivity in many different sectors will also affect many different countries.

An international panel of value added by industry can thus be used to separate the effects of demand and supply shocks. Shifts in a sector's output that are correlated with shifts in output in other sectors in the same country, and yet are not correlated with shifts in output in the same sector in other countries, are prime candidates for the label of "demand." In a similar fashion, shifts in a sector's output that are correlated with shifts in output in the same sector in other countries, and yet are not correlated with shifts in output in other sectors in the same country, are prime candidates for the label of "supply." Shifts correlated with shifts in both other industries in the same country and the same industry in other countries remain unidentified.

An interesting and exceptionally thought-provoking paper by Alan Stockman (1988) has used an international intersectoral panel to try to identify demand and supply shocks to output. Stockman concludes that a significant fraction of the variance of output growth in industries within manufacturing can be accounted for by country*year dummies, in a regression that also includes industry*year dummies. His principal results are reported in table 1. The orthogonal nation effects have a variance 0.87 times as great as the orthogonal industry effects. Stockman concludes that it is unlikely that almost all macroeconomic fluctuations can be attributed to technology shocks alone.

Stockman's methods, however, lead him to underestimate the magnitude of nation-specific shocks to output and to underestimate the importance of demand relative to supply shocks. In this paper I follow Stockman's tracks but avoid his assumptions that biased down his estimates of demand-driven fluctuations. I conclude that the bias in Stockman's procedures led him to substantially underestimate the relative importance of the demand-driven component.

Stockman's Procedure

Stockman estimates equation 1:

\[ D\{\log(\text{Ind.Pdn.}(i,n,t))\} = m(i,n) + f(i,t) + g(n,t) + u(i,n,t) \]

where \(\text{Ind.Pdn.}(i,n,t)\) denotes the index of industrial production of industry \(i\) in nation \(n\) at time. The term \(m(i,n)\) is the mean growth rate over time of industry \(i\) in nation \(n\). The term \(f(i,t)\) is a vector of industry-specific coefficients, one for each time \(t\), common to all countries for industry \(i\). The term \(g(n,t)\) is a vector of nation-specific coefficients, one for each time \(t\), common to all industries in country \(n\). Stockman intends \(g(n, t)\) to represent the effect of nation-specific aggregate demand.
shocks on production. And \( u(i,n,t) \) is a disturbance term, specific for year, industry, and country.

Stockman estimates equation (1) using quarterly and annual data on indices of industrial production in ten two-digit ISIC industries. His data span 1964:1 to 1985:2 for eight countries: Germany, France, Italy, Belgium, Netherlands, the United Kingdom, Switzerland and the United States. Stockman’s country*time dummy variables are not orthogonal to the industry*time dummy variables. His results do not decompose the variance in sectoral industrial production growth into country-average, country-specific, industry-specific, and idiosyncratic components.

Moreover, Stockman’s principal regressions suffer from the serious limitation that he assumes that the coefficients of country*year dummies are the same for all industries. He thus assumes that all industries have the same responsiveness to shifts in aggregate demand— that in the language of finance they all have the same \( b \) with respect to aggregate output.

Stockman recognizes in auxiliary regressions that his assumption that all industries exhibit the same responsiveness to aggregate output is dubious. In theory it would be possible for Stockman to estimate a separate \( b_i \) for each industry. Such a procedure would require a dummy country*year for one industry, and country*year*\( b_j \) dummies for other industries.

However, estimation of such a model would place heavy demands on Stockman’s available computing power. Instead, he assumes that the \( b_i \) of industry \( i \) is proportional to the standard error of output growth in that industry— he assumes that the variances of the national, sectoral, and idiosyncratic components of output growth vary across industries in the same proportions. This assumption is tested below and rejected, leaving us uncertain how to interpret Stockman’s results. His incorrect assumptions about different industries’ \( b_i \)’s certainly lead him to understate the magnitude of nation-specific movements in output, but Stockman’s regressions themselves do not tell us how serious this understatement is.

Moreover, Stockman’s estimates of the magnitude of nation and industry effects are biased upward by an additional effect: his nation*year and industry*year dummies pick up some of the idiosyncratic variance as well. Since the number of dummy right-hand-side variables is comparable to the number of data points, these biases are substantial. Since Stockman has ten industries and only eight countries, this bias is greater in the estimates of orthogonal industry effects than in the estimates of orthogonal nation effects.

An Alternative Framework

A more general formulation than Stockman’s would be to regress the change of value added in industry \( i \) in country \( n \) on both (a) the international average change of value added in that industry, and (b) the change in aggregate output or productivity in that country:
(2) \[ D(\log(Y_{int})) = c_{ni} + b_{ni}[D(\log(Y_{nt} - Y_{int}))] + g_{ni}[D(\log(Y_{int}))] + e_{int} \]

where \( Y \) denotes value added, \( i \) and \( n \) denote industries and nations, respectively, \( Y_{nt} \) is aggregate value added in manufacturing and \((-n)\) denote averages taken over all nations except \( n \). Thus the percentage change in value added in industry \( i \) in nation \( n \) is regressed on the change in value added in the rest of manufacturing for that country, and on the average change in value added for the same industry in other countries. The variance of orthogonal industry-specific and nation-specific effects can then be determined from the partial \( R^2 \) of the coefficients \( g_{ni} \) on the international average for industry \( i \) and \( b_{ni} \) on aggregate output in country \( n \).

This allows the same industry specific shocks to have different effects on the same industry in different countries. For example, the price of domestically-produced oil was controlled in the United States in the aftermath of the oil shocks. Consequently, the oil shocks should have had a smaller (or opposite) effect on value added in the United States chemical industry than on value added in the chemical industries of European countries. Thus simple separate regressions for each industry in each country can answer the question addressed by Stockman (1988), and can answer it without requiring his particular strong and implausible assumptions.

In my analysis I do not use Stockman's data source. Instead, I use the OECD International Sectoral Data Bank, which contains annual data on real value added, employment, and capital for fourteen OECD nations from 1960 to 1986. Since my approach will require a balanced panel, in order to obtain a sample of reasonably long length I am forced to focus on the seven nations for which data on real value added are available from the 1960s. These nations are the United States, Germany, France, Belgium, Finland, Norway, and England. (In principal, data are also available for the Netherlands; unfortunately a change in definitions in 1970 makes Dutch data form the 1960s incomparable to data from 1970 on.) Within these countries, data are available for seven ISIC industries within the manufacturing sector: food, textiles, paper, chemicals, non-metallic minerals, basic metal production, and mechanical equipment. For two additional industries; wood and wood products and other manufacturing industries, some nations reported no data at all. They were not used as dependent variables. Value added in manufacturing as a whole, including these industries, was available, and was used to calculate the right hand side variable. Observations are complete from 1962 to 1985 (see Meyer zu Schlochtern, 1986), further limiting the size of my balanced panel.

Results

I perform 49 individual regressions of the pattern of equation (2). By allowing the \( b \) and \( g \) coefficients to differ for each industry in each country, I recognize that industries and countries have different characteristics. Furthermore, I exclude the output of that industry which is the dependent
variable on the left hand side from the national and international averages which are the explanatory variables on the right hand side. This avoids a positive bias in the estimates of nation- and industry-specific effects caused by averaging the left hand side variable—including its idiosyncratic disturbance—with other data to create the right hand side variables.

Results are reported in table 2-4. Table 2 reports the estimates of the nation-specific coefficients. The averages of the coefficients taken across industries for a given nation n and taken across nations for a given industry i are reported along the borders of the table. They are to be interpreted as summary statistics, not as a recantation of the assertion that the true coefficients differ for different industries and nations.

The average estimates of b are similar for six of the seven countries, ranging from .526 for Belgium to .791 for the United Kingdom. By contrast, the average b coefficient for Norway is only 0.199. I interpret this as due to the enormous nation- and industry-specific shock experienced by Norway when oil was discovered in the North Sea. Equation 2 implicitly requires that this shock have the same effect on value added in other industries as an increase in aggregate demand.

More important, the b coefficients differ across industries. In particular, the food industry is almost acyclic, with an average coefficient across nations of only 0.279. Thus a one percent increase in manufacturing output corresponds to an increase of only 0.279 percent in food output. Other industries are more cyclical, with average coefficients across nations that range from 0.522 for paper to 0.781 for non-metalic minerals (i.e., stone, clay, and glass).

Table 3 reports industry-specific effects—the g coefficients of the responsiveness of an industry to the average rate of growth in the same industry in other countries. Again averages are reported for countries and industries. It is not surprising that Belgium, a small open economy, has the highest average g coefficient: 0.699. The prosperity of the basic metals industry in Belgium is very highly correlated with the prosperity of the basic metals industries of France and Germany no matter what is the ultimate source of output variability. It is also not surprising that the United States, a large closed economy, has the lowest average coefficient: 0.296.

Table 4 reports the partial $R^2$ of the coefficients reported in tables 2 and 3—that is to say the fraction of the variance in the dependent variable accounted for by the orthogonal nation- and industry-specific effects. This is equal to the increase in the $R^2$ when, for example, the growth of output in the rest of manufacturing is added to a regression already including the international average of the growth of value added in the industry. For each nation, the fraction of the total variance of industry growth explained by orthogonal nation- and industry-specific effects is reported. (This is, of course, different from the average of the partial $R^2$'s.) Similar statistics are reported for the fraction of the variance in the output of industry i in all countries accounted for by the orthogonal nation- and industry-specific effects. Finally, the grand average of the fraction of variance explained...
by nation and industry effects is reported.

Orthogonal nation-specific effects account for 17 percent of the variance in output, while orthogonal industry-specific effects account for only 9.5% of the variance. To the extent that they can be distinguished, nation effects appear to be considerably greater than industry effects. These results are not strictly comparable to Stockman's because the sample of nations and industries is different. However, they do suggest that Stockman's assumptions led him to underweight the importance of nation-specific effects, and thus of demand shocks.

More importantly, the fraction of the variance explained by nation effects varies across countries in a reasonable manner. For the United States, fully 37.5 percent of the variance in industry value added growth can be accounted for by orthogonal nation-specific effects. By contrast, for Belgium such nation-specific effects can account for only 8.3 percent of the variance in output, and for Norway only 2.2 percent of the variance in output can be explained by nation effects.

These disparities directly contradict Stockman's working assumption that the partial $R^2$ of nation effects are the same for different nations. His assumption that the partial $R^2$ of nation effects are the same for different industries fails as well. The fraction of the variance accounted for by orthogonal nation-specific effects varies from 9.1 percent for the chemical industry, disproportionally affected by oil shocks, to 29.5 percent for mechanical equipment. The data clearly reject the assumption that the proportion of variance explained by nation effects is the same for all industries. And Stockman's adoption of this assumption does appear to bias down his estimate of the relative fraction of variance explained by nation effects.

Applying Stockman's Procedures to My Data

Since I use a different data set from Stockman, it is important to check that the differences in our conclusions spring from my allowing for $b$ and $g$ coefficients to vary and not from different characteristics of the data. I have therefore estimated statistics comparable to Stockman's using the OECD international sectoral data set.

Even though I possess a balanced panel, nation*year effects are still correlated with industry*year effects: in 1975 all nations and all industries had poor output growth. I decompose the variance in the change in log value added into a year effect, an orthogonal nation*year effect, and an orthogonal industry*year effect; in other words, I include year dummies as well as nation*year and industry*year dummies. The ratio of nation to year effects is only 1.23 when I use my data and Stockman-like procedures (results not shown).

Moreover, a substantial proportion of the orthogonal nation and industry effects obtained from Stockman-like procedures is spurious. Stockman reports $f$-statistics of 2.61 for industry effects.
and 2.94 for nation effects. The expected value of an F-statistic is 1 under the null hypothesis so more than one third of the effect reported by Stockman is spurious. In my balanced panel there are seven nations and seven years, so estimated orthogonal industry and nation effects each pick up one-seventh of the idiosyncratic disturbance. I have also constructed corrected estimates of the variance of orthogonal nation and industry effects, still under the assumption that all b and g coefficients are one. These estimates are low: only 9.0 percent of the variance is accounted for by corrected orthogonal nation effects, and only 6.1 percent by corrected orthogonal industry effects. Stockman’s estimates of the variance of his effects include part of the variance of the disturbance term (as do all fitted variances estimated by OLS), and in the OECD international sectoral data base I use this disturbance term is a major source of fitted variance.

Of course, this does not mean that the orthogonal nation and industry effects are small. The unconstrained estimates show that they are large. The problem is that the requirement that all industries have the same b and g biases the estimated orthogonal nation and industry effects down.

Conclusion

Needless to say, this reexamination of Alan Stockman’s analysis does not threaten his principal conclusion: that there appear to be important nation-specific shocks that are not associated with industry-specific cross-national shocks, and thus that demand-driven fluctuations appear to play a significant role in the business cycle. This reexamination strengthens Stockman’s principal conclusion: allowing for the fact that industries differ in their cyclicality increases estimated nation relative to industry effects.
REFERENCES


### TABLE 1
ALAN STOCKMAN’S RESULTS

Model: $D[\ln(IP(i,n,t))] = m(i,n) + f(i,t) + g(n,t) + u(i,n,t)$

(A) Unadjusted data

Total SS = 6.45, Model SS = 4.77, $R^2 = 0.74$
Total SS attributable to $f(i,t) + g(n,t) = 3.27 = 50.7\%$ of total SS

<table>
<thead>
<tr>
<th>Effect</th>
<th>SS</th>
<th>% of Total SS</th>
<th>F-Stat</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Orthogonal Industry*Time</td>
<td>0.90</td>
<td>14.0%</td>
<td>2.61</td>
<td>0.0001</td>
</tr>
<tr>
<td>Orthogonal Nation*Time</td>
<td>0.79</td>
<td>12.2%</td>
<td>2.94</td>
<td>0.0001</td>
</tr>
</tbody>
</table>

(B) Growth rate of output divided by industry standard error

Total SS = 0.321, Model SS = 0.226, $R^2 = 0.70$
Total SS attributable to $f(i,t) + g(n,t) = 0.107 = 33.3\%$ of total SS

<table>
<thead>
<tr>
<th>Effect</th>
<th>SS</th>
<th>% of Total SS</th>
<th>F-Stat</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Orthogonal Industry*Time</td>
<td>0.023</td>
<td>7.2%</td>
<td>1.22</td>
<td>0.0430</td>
</tr>
<tr>
<td>Orthogonal Nation*Time</td>
<td>0.032</td>
<td>10.0%</td>
<td>2.14</td>
<td>0.0001</td>
</tr>
<tr>
<td>Industry/Country</td>
<td>U.S.A</td>
<td>Germany</td>
<td>France</td>
<td>Belgium</td>
</tr>
<tr>
<td>------------------</td>
<td>--------</td>
<td>---------</td>
<td>---------</td>
<td>---------</td>
</tr>
<tr>
<td>Food</td>
<td>0.096</td>
<td>0.236</td>
<td>0.523</td>
<td>0.147</td>
</tr>
<tr>
<td></td>
<td>(0.114)</td>
<td>(0.081)</td>
<td>(0.241)</td>
<td>(0.107)</td>
</tr>
<tr>
<td>Textiles</td>
<td>0.657</td>
<td>0.634</td>
<td>0.577</td>
<td>0.492</td>
</tr>
<tr>
<td></td>
<td>(0.159)</td>
<td>(0.225)</td>
<td>(0.319)</td>
<td>(0.308)</td>
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<td>Paper</td>
<td>0.545</td>
<td>0.756</td>
<td>0.631</td>
<td>0.077</td>
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<tr>
<td></td>
<td>(0.139)</td>
<td>(0.202)</td>
<td>(0.289)</td>
<td>(0.246)</td>
</tr>
<tr>
<td>Chemicals</td>
<td>0.450</td>
<td>0.309</td>
<td>0.357</td>
<td>1.217</td>
</tr>
<tr>
<td></td>
<td>(0.154)</td>
<td>(0.169)</td>
<td>(0.235)</td>
<td>(0.522)</td>
</tr>
<tr>
<td>Stone, Clay and Glass</td>
<td>0.965</td>
<td>0.704</td>
<td>0.616</td>
<td>0.629</td>
</tr>
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<td></td>
<td>(0.119)</td>
<td>(0.231)</td>
<td>(0.299)</td>
<td>(0.425)</td>
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<td>Basic Metals</td>
<td>1.257</td>
<td>0.712</td>
<td>0.546</td>
<td>0.563</td>
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<td></td>
<td>(0.361)</td>
<td>(0.376)</td>
<td>(0.277)</td>
<td>(0.234)</td>
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<tr>
<td>Mechanical</td>
<td>1.312</td>
<td>0.861</td>
<td>0.893</td>
<td>0.553</td>
</tr>
<tr>
<td>Equipment</td>
<td>(0.178)</td>
<td>(0.187)</td>
<td>(0.258)</td>
<td>(0.251)</td>
</tr>
<tr>
<td>Average</td>
<td>0.754</td>
<td>0.602</td>
<td>0.592</td>
<td>0.526</td>
</tr>
<tr>
<td></td>
<td>(0.073)</td>
<td>(0.086)</td>
<td>(0.104)</td>
<td>(0.123)</td>
</tr>
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</table>

Standard errors in parentheses.
### TABLE 3
COEFFICIENT OF OUTPUT ON AVERAGE GROWTH IN THE SAME INDUSTRY IN OTHER COUNTRIES

<table>
<thead>
<tr>
<th>Industry/Country</th>
<th>U.S.A.</th>
<th>Germany</th>
<th>France</th>
<th>Belgium</th>
<th>Finland</th>
<th>Norway</th>
<th>England</th>
<th>Average</th>
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<tr>
<td>Food</td>
<td>0.535</td>
<td>0.261</td>
<td>-0.494</td>
<td>0.270</td>
<td>0.478</td>
<td>0.749</td>
<td>0.546</td>
<td>0.335</td>
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<td></td>
<td>(0.451)</td>
<td>(0.251)</td>
<td>(0.550)</td>
<td>(0.323)</td>
<td>(0.418)</td>
<td>(0.912)</td>
<td>(0.134)</td>
<td></td>
</tr>
<tr>
<td>Textiles</td>
<td>0.180</td>
<td>0.095</td>
<td>0.585</td>
<td>1.166</td>
<td>-0.328</td>
<td>0.524</td>
<td>-0.138</td>
<td>0.607</td>
</tr>
<tr>
<td></td>
<td>(0.334)</td>
<td>(0.354)</td>
<td>(0.414)</td>
<td>(0.539)</td>
<td>(0.360)</td>
<td>(0.456)</td>
<td>(0.220)</td>
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<tr>
<td>Paper</td>
<td>0.295</td>
<td>0.466</td>
<td>0.165</td>
<td>0.812</td>
<td>1.128</td>
<td>0.547</td>
<td>0.834</td>
<td>0.607</td>
</tr>
<tr>
<td></td>
<td>(0.257)</td>
<td>(0.260)</td>
<td>(0.295)</td>
<td>(0.305)</td>
<td>(0.264)</td>
<td>(0.267)</td>
<td>(0.213)</td>
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<td>Chemicals</td>
<td>0.445</td>
<td>1.163</td>
<td>0.779</td>
<td>0.161</td>
<td>1.076</td>
<td>0.639</td>
<td>0.536</td>
<td>0.685</td>
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<td></td>
<td>(0.203)</td>
<td>(0.156)</td>
<td>(0.176)</td>
<td>(0.510)</td>
<td>(0.262)</td>
<td>(0.268)</td>
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<tr>
<td>Stone, Clay and Glass</td>
<td>0.326</td>
<td>0.663</td>
<td>0.715</td>
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<td>0.385</td>
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<td></td>
<td>(0.164)</td>
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<td>(0.257)</td>
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<td>Basic Metals</td>
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<td></td>
<td>(0.420)</td>
<td>(0.293)</td>
<td>(0.178)</td>
<td>(0.191)</td>
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<td>Mechanical Equipment</td>
<td>-0.505</td>
<td>0.492</td>
<td>0.085</td>
<td>0.966</td>
<td>-0.099</td>
<td>0.894</td>
<td>0.484</td>
<td>0.313</td>
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<tr>
<td></td>
<td>(0.303)</td>
<td>(0.286)</td>
<td>(0.321)</td>
<td>(0.444)</td>
<td>(0.516)</td>
<td>(0.525)</td>
<td>(0.273)</td>
<td></td>
</tr>
<tr>
<td>Average</td>
<td>0.296</td>
<td>0.482</td>
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<td>0.699</td>
<td>0.444</td>
<td>0.867</td>
<td>0.415</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.121)</td>
<td>(0.100)</td>
<td>(0.127)</td>
<td>(0.157)</td>
<td>(0.144)</td>
<td>(0.191)</td>
<td>(0.081)</td>
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Standard errors in parentheses.
### TABLE 4
PARTIAL R-SQUARED OF ORTHOGONAL COUNTRY AND INDUSTRY EFFECTS

<table>
<thead>
<tr>
<th>Industry/Country</th>
<th>U.S.A.</th>
<th>Germany</th>
<th>France</th>
<th>Belgium</th>
<th>Finland</th>
<th>Norway</th>
<th>England</th>
<th>Average</th>
<th>Ratio</th>
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<tbody>
<tr>
<td><strong>Food</strong></td>
<td></td>
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<td></td>
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<td></td>
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<tr>
<td>Country</td>
<td>0.030</td>
<td>0.198</td>
<td>0.183</td>
<td>0.072</td>
<td>0.152</td>
<td>0.046</td>
<td>0.338</td>
<td>0.101</td>
<td>2.267</td>
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<tr>
<td>Industry</td>
<td>0.062</td>
<td>0.032</td>
<td>0.031</td>
<td>0.027</td>
<td>0.040</td>
<td>0.029</td>
<td>0.219</td>
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<td>0.044</td>
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<td><strong>Textiles</strong></td>
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<td></td>
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<tr>
<td>Country</td>
<td>0.389</td>
<td>0.207</td>
<td>0.093</td>
<td>0.071</td>
<td>0.291</td>
<td>0.034</td>
<td>0.693</td>
<td>0.248</td>
<td>5.075</td>
</tr>
<tr>
<td>Industry</td>
<td>0.007</td>
<td>0.002</td>
<td>0.057</td>
<td>0.129</td>
<td>0.029</td>
<td>0.053</td>
<td>0.005</td>
<td></td>
<td>0.050</td>
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<td><strong>Paper</strong></td>
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<tr>
<td>Country</td>
<td>0.240</td>
<td>0.213</td>
<td>0.161</td>
<td>0.003</td>
<td>0.186</td>
<td>0.042</td>
<td>0.124</td>
<td>0.147</td>
<td>1.157</td>
</tr>
<tr>
<td>Industry</td>
<td>0.021</td>
<td>0.049</td>
<td>0.011</td>
<td>0.177</td>
<td>0.288</td>
<td>0.137</td>
<td>0.108</td>
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<td>0.127</td>
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<tr>
<td>Country</td>
<td>0.169</td>
<td>0.022</td>
<td>0.025</td>
<td>0.137</td>
<td>0.062</td>
<td>0.023</td>
<td>0.182</td>
<td>0.091</td>
<td>0.521</td>
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<tr>
<td>Industry</td>
<td>0.066</td>
<td>0.376</td>
<td>0.210</td>
<td>0.002</td>
<td>0.328</td>
<td>0.168</td>
<td>0.082</td>
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<td>0.174</td>
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<td><strong>Stone, Clay and Glass</strong></td>
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<td>0.038</td>
<td>0.048</td>
<td>0.312</td>
<td>0.052</td>
<td>0.257</td>
<td>0.214</td>
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<td>Industry</td>
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<td>0.097</td>
<td>0.150</td>
<td>0.056</td>
<td>0.002</td>
<td>0.065</td>
<td>0.040</td>
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<td>0.062</td>
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<tr>
<td><strong>Basic Metals</strong></td>
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<tr>
<td>Country</td>
<td>0.258</td>
<td>0.095</td>
<td>0.099</td>
<td>0.076</td>
<td>0.021</td>
<td>0.004</td>
<td>0.279</td>
<td>0.126</td>
<td>1.266</td>
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<tr>
<td>Industry</td>
<td>0.076</td>
<td>0.017</td>
<td>0.109</td>
<td>0.225</td>
<td>0.064</td>
<td>0.147</td>
<td>0.014</td>
<td></td>
<td>0.099</td>
</tr>
<tr>
<td><strong>Mechanical Equipment</strong></td>
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<td></td>
<td></td>
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<tr>
<td>Country</td>
<td>0.730</td>
<td>0.276</td>
<td>0.303</td>
<td>0.109</td>
<td>0.025</td>
<td>0.009</td>
<td>0.218</td>
<td>0.295</td>
<td>5.698</td>
</tr>
<tr>
<td>Industry</td>
<td>0.038</td>
<td>0.039</td>
<td>0.020</td>
<td>0.106</td>
<td>0.002</td>
<td>0.121</td>
<td>0.063</td>
<td></td>
<td>0.095</td>
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<tr>
<td><strong>Average</strong></td>
<td></td>
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<td></td>
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<tr>
<td>Country</td>
<td>0.375</td>
<td>0.137</td>
<td>0.109</td>
<td>0.083</td>
<td>0.121</td>
<td>0.022</td>
<td>0.292</td>
<td>0.170</td>
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</tr>
<tr>
<td>Industry</td>
<td>0.056</td>
<td>0.118</td>
<td>0.097</td>
<td>0.099</td>
<td>0.130</td>
<td>0.118</td>
<td>0.049</td>
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<td>0.095</td>
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<tr>
<td><strong>Ratio</strong></td>
<td>6.754</td>
<td>1.161</td>
<td>1.121</td>
<td>0.845</td>
<td>0.935</td>
<td>0.186</td>
<td>5.903</td>
<td>1.796</td>
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