

The Ricardian Model and the Structure of Irish Trade

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In a recent article J. McGilvray and D. Simpson (1973) examined the commodity structure of trade between the Irish Republic and the United Kingdom in the light of international trade theory. Their investigation was partly concerned with the role of the Ricardian model which they conclude appears to have little relevance for Anglo-Irish trade. It is argued here that though the methods of previous investigators have in general been followed, (as, for example, in the study by MacDougall (1951) of British and American exports) in one important respect this is not so. In consequence, the validity of McGilvray and Simpson's test is seriously open to doubt. The calculations are reworked in the light of this criticism and it is then seen that the pattern of trade between Britain and Ireland is fairly consistent with the Ricardian theory.

The Ricardian model assumes that there is only one factor of production (labour) and that differences in comparative costs can be explained by differences in the relative productivity of labour between countries. Suppose there are two countries (*A* and *B*) and n commodities in which output per unit of labour is O_i/L_i ($i=1, \dots, n$). The n ratios of output per unit of labour in *A* to that in *B*, $(O_{iA}/L_{iA})/(O_{iB}/L_{iB})$, ($i=1, \dots, n$) show the relative productivity of labour for each commodity in the two countries and if these ratios are ranked from highest to lowest, this ranking also shows the goods in order of comparative advantage to country *A*. When trade is opened up country *A* will export goods in which her productivity is relatively high and *B* will export goods where *A*'s productivity is relatively low. All the goods that *A* exports will be in the upper part of the ranking; all those that *B* exports will be in the lower part. Exactly where the division between *A*'s and *B*'s exports is located depends on demand conditions.

The applicability of the Ricardian model to actual trade patterns can be tested by comparing the relative productivity of labour in various industries with trade flows. Country *A*'s exports to *B* ought to be characterised by a relatively high productivity ratio, $(O_{iA}/L_{iA})/(O_{iB}/L_{iB})$, compared with imports. Such a test is only feasible if trade is restricted by tariffs or transport costs. If there were no barriers of any sort to trade, commodity prices would be equalised between countries. Because prices must be proportional to labour productivities this implies that trade will expand until either comparative labour productivities become equal or some products are produced only in one country. Only if

commodity prices are not completely equalised after trade will differences in comparative labour productivity persist and will it be possible to carry out this test.

A problem which frequently occurs in an exercise of this kind relates to the identification of the pattern of comparative advantage. In traditional theory, where all goods are homogeneous, a country either exports a product or imports it (or it may not be traded). The simultaneous export and import of a given commodity is not consistent with the theory. Nevertheless, because products are not homogeneous, this is exactly what does happen in the real world so that some rule has to be constructed for determining which country possesses the trading advantage. The nature of this rule, which must be to some extent arbitrary, can (as will be seen below) affect the interpretation of the results of the test.

McGilvray and Simpson's application of this test to Anglo-Irish trade apparently proceeds in a fairly predictable way, though there are some differences pointed out between this and other such tests. For present purposes, the most important difference (which, it is implied, represents an improvement over previous practice) is that the scope of the analysis covers the whole of merchandise trade, not just a few selected commodities. In order to obtain this benefit, it is stated that "we are compelled to use a measure of value rather than a measure of physical output in the numerator of labour productivity." (McGilvray and Simpson 1973, p. 452). Thus, the measure of labour productivity that they use is the value of net output per head. They recognise that this is open to objection because "the ranking of labour productivities may be distorted by inter-country differences in relative price structures." (*op cit.*). But this objection is countered by the argument that the main source of distortion is by tariffs, quotas and subsidies and that what evidence there is, does not suggest that a systematic distortion of rankings will occur.

However, the use of net output per head as a measure of labour productivity is open to much stronger objections than this. In a world where there is only one factor of production, where all units of this factor (labour) have identical economic attributes and where competitive equilibrium obtains, net output per head would be equal in all industries. This is so because unit costs of production and prices will equal the labour input per unit of output multiplied by the wage rate. Thus, letting P_i denote price and w the wage rate; we have $P_i = (L_i/O_i)w$ ($i=1, \dots, n$); or in other words, the value of output per unit of labour in all industries will be identical (and equal to the wage rate) i.e. $w = (O_i/L_i)P_i$.

The example used here assumes that there are no intermediate goods so that there is no distinction between net and gross output. Where intermediate goods exist, O_i is to be taken to refer to net output.

Thus, the situation where a unit of labour produces a larger value of net output in one industry than in another could not represent an equilibrium because, given competition, this would imply variation in wage rates between industries. If such a situation were to exist labour would move out of the low-wage, low value-added industry into others where wage rates and value added were higher. Equality between value added in different industries would come about either as a result

of labour productivities changing as outputs change or by variations in supply giving rise to price changes.

The ranking of commodities by relative value productivity ratios as suggested by McGilvray and Simpson,

$$\frac{O_{iA} \cdot P_{iA}}{L_{iA}} \left/ \frac{O_{iB} \cdot P_{iB}}{L_{iB}} \right. \quad (i=1, \dots, n)$$

would therefore not be possible in a situation where the assumptions of the Ricardian model held in their entirety because all the n ratios $\frac{O_{iA} \cdot P_{iA}}{L_{iA}}$ would

have the same value as would these ratios for country B . Their test is not logically applicable to the model under investigation, and a physical (as opposed to a value) measure of labour productivity must be employed. However, the matter is perhaps worth pursuing further because, in reality, net output per head is not the same in all industries and differences in relative net output per head between countries do occur. But this is because in the real world the assumptions of the Ricardian model do not hold and does not imply that the methods employed by McGilvray and Simpson are economically justifiable. Net output per head may differ between any two industries for several reasons; most obvious is the possibility that there are two (or more) factors of production and not one as the Ricardian model assumes.¹ Net output per head will be greater than the wage by the amount required to compensate other factors of production. If industries vary in their relative factor intensity they will also vary with respect to net output per head, which will be lower the greater the degree of labour intensity.

Just as net output per head may differ between industries in these circumstances so there may be differences in relative net output per head between countries. Suppose there are two factors of production (labour and capital) and that country A is capital abundant relative to country B . Assume that there are only two commodities (1 and 2) and that commodity 1 is capital intensive compared with commodity 2. Because a higher capital to labour ratio will be employed in the production of 1 in both countries net output per head will be higher in 1 than in 2. Thus:

$$\frac{O_{1A} \cdot P_{1A}}{L_{1A}} > \frac{O_{2A} \cdot P_{2A}}{L_{2A}} \quad \text{and} \quad \frac{O_{1B} \cdot P_{1B}}{L_{1B}} > \frac{O_{2B} \cdot P_{2B}}{L_{2B}}$$

Also, country A , which is relatively well endowed with capital, will employ a higher capital to labour ratio in each of the commodities so that net output per head in 1 and 2 will be higher than in B . Thus:

$$\frac{O_{1A} \cdot P_{1A}}{L_{1A}} > \frac{O_{1B} \cdot P_{1B}}{L_{1B}} \quad \text{and} \quad \frac{O_{2A} \cdot P_{2A}}{L_{2A}} > \frac{O_{2B} \cdot P_{2B}}{L_{2B}}$$

1. Other possibilities include less than perfect labour mobility between industries so that different wage rates can prevail, differences in the quality of labour between industries and the lack of a competitive market.

But whether

$$\frac{O_{1A}}{L_{1A}} \cdot P_{1A} \int \frac{O_{1B}}{L_{1B}} \cdot P_{1B} \cdot \cong \frac{O_{2A}}{L_{2A}} \cdot P_{2A} \int \frac{O_{2B}}{L_{2B}} \cdot P_{1B}$$

cannot be determined from these general considerations. The result depends on relative factor substitutability in each industry and on the relationship between capital per man and net output per man. Equality between the ratios would be a matter of coincidence so that the sort of differences in relative-value productivity discussed by McGilvray and Simpson would normally occur. But from an analytical viewpoint such differences would be unimportant.

A legitimate test of the Ricardian theory must therefore be carried out in terms of physical productivities. Even then, the existence of factors of production other than labour has adverse effects, just as the value productivity ratios may be influenced by varying factor intensities so may the physical productivity ratios. Clearly, the Ricardian assumptions do some violence to the facts; however, the purpose of testing this theory (or any other) is to see whether it provides a workable approximation to reality even though some of its assumptions may not be realistic.

Information on the physical productivity of labour in the United Kingdom and the Republic of Ireland was obtained from the Censuses of production of the two countries.² Labour productivities were computed by dividing the volume of output in physical terms by employment in particular industries. Output per head in the United Kingdom could then be compared with that in the Republic of Ireland. Two main difficulties were encountered in this exercise. First, it was not possible to obtain coverage of all industries; though the United Kingdom Census provides data on the physical volume of output for all industries, this is by no means so for the Republic of Ireland where, for many industries, output is given only in value terms. Most of the industries so treated produce in any case commodities which are complex or diverse so that the physical volume of output (measured in weight or number) is not an economically significant quantity. However, many important industries (such as chemicals and drugs, the manufacture of machinery and electrical machinery, and printing and publishing) had to be excluded for this reason.

The second difficulty relates to the comparability of outputs in particular industries between the two countries. Unless the composition of output in each sector as well as the quality of output is the same in both countries the productivity figures are not comparable. While such differences were normally overlooked, in one sector, the assembly and construction of mechanically propelled road and land vehicles, the discrepancy was so great that it had to be excluded; in the United Kingdom this industry is concerned mainly with the manufacture of vehicles, while in the Irish Republic it is concerned entirely with assembly.

2. Department of Trade and Industry, *Report on the Census of Production 1968*, London, HMSO 1971, and Central Statistics Office, *Irish Statistical Bulletin*, 1964-65.

The results of the calculations on productivity in the United Kingdom and the Republic of Ireland are presented in the first three columns of Table 1. Information is given for 22 industries and all are in manufacturing; of these, 16 are concerned with food processing or textiles. As in the McGilvray and Simpson enquiry, the base year for the exercise was 1963. Columns 4 and 5 of this table, showing values of Irish imports from and exports to Britain,³ provide the means for relating labour productivities to trading performance.

It was mentioned above that certain problems arise in the identification of the pattern of comparative advantage in a trading situation where a country both exports and imports quantities of a given product. McGilvray and Simpson approach the issue in the following way. They calculate the propensity to export of each sector (exports from the Irish Republic to the United Kingdom divided by gross domestic output of each commodity) and the propensity to import into each sector (imports into the Irish Republic from the United Kingdom divided by gross domestic output plus imports). Each of these series is ranked and is correlated with the ranking of industries according to relative labour productivities in Ireland and the United Kingdom. It is argued that in industries where Ireland's productivity is high compared with that in the United Kingdom Irish export propensities ought also to be high (and import propensities low) while the reverse ought to prevail in those industries where Irish productivity is relatively low. Neither of these correlations yield significant results, which is hardly surprising in view of the criticisms made earlier concerning the measure of productivity employed.

In the present study, it was decided to use rather different methods. In the first place, the balance of trade between the Irish Republic and Britain (though McGilvray and Simpson deal with trade between Ireland and the United Kingdom, better results were obtained here by excluding trade between the Republic of Ireland and Northern Ireland) was used as an indicator of comparative advantage because the use of export and import propensities appeared unwieldly. More important, it did not seem appropriate in the present context to make use of correlation coefficients. Trade theory does not predict that the greater a country's comparative advantage, the greater will be its trade balance or the greater its export propensity (or the smaller its import propensity); it predicts that where a comparative advantage is held exports will be positive and imports zero and where a comparative disadvantage is held exports will be zero and imports positive. In terms of export propensities, in a world in which the conclusions of trade theory held absolutely, individual commodities would be characterised either by a combination of a positive export propensity and a zero import propensity or a zero export propensity with a positive import propensity. Therefore, even if the trade pattern perfectly matched that predicted by the Ricardian model, correlation of the kind performed by McGilvray and Simpson would probably not produce good results.

3. Data derived from: Central Statistics Office, *Trade and Shipping Statistics*, 1964.

Table 1: *Labour productivity and trade in the United Kingdom and the Republic of Ireland, 1963.*

Sector		Output	Employment	Productivity (Output/ Employment)	Irish Imports from Britain £,000's	Irish Exports to Britain £,000's
1 Bacon (214)	UK	7 633	33 277	0.229	0	6 621
Th. cwts.	Ireland	1 462	3 463	0.422		
2 Butter and Cheese (215)	UK	5 267	9 569	0.550	26	8 740
Th. cwts.	Ireland	1 159	2 787	0.416		
3 Preserved Fruit and Vegetables etc. (218) Th. cwts.	UK	32 049	23 650	1.355	1 642	810
	Ireland	656	3 140	0.209		
4 Grain Milling and Animal Feedstuffs (219) Th. tons	UK	14 798	57 499	0.257	351	440
	Ireland	926	5 004	0.185		
5 Sugar (216)	UK	75 124	15 870	4.734	85	0
Th. cwts.	Ireland	5 148	3 137	1.641		
6 Cocoa chocolate and Sugar Confectionary (217)	UK	13 398	86 740	0.154	685	1 133
Th. cwts.	Ireland	868	5 207	0.167		
7 Margarine (229/1)	UK	9 842	4 079	2.413	1	0
Th. cwts.	Ireland	256	286	0.895		
8 Distilling (239/1)	UK	123 416	15 947	7.739	643	86
Th. Proof gals.	Ireland	1 282	378	3.391		
9 Brewing (231)	UK	28 506	85 665	0.333	240	5 005
Th. Standard Barrels	Ireland	2 075	4 592	0.452		
10 Tobacco (240)	UK	299 108	43 118	6.937	156	30
Th. lbs.	Ireland	13 574	2 325	5.838		
11 Woollen and Worsted Yarn (414)	UK	360 402	14 498	24.859	1 872	539
Th. lbs.	Ireland	10 723	2 641	4.060		
12 Spinning of Cotton Linen and man-made Fibres (412)	UK	1514.1	102 327	0.0148	2 159	300
Million lbs.	Ireland	9.8	1 113	0.0088		
13 Hosiery (417)	UK	42 483	30 344	1.400	90	50
Th. Dozen Pairs	Ireland	1 629	2 230	0.730		
14 Footwear (450)	UK	168.4	101 733	0.00166	315	1 633
Million Pairs	Ireland	7.2	6 002	0.00120		
15 Men's and Boys' Outerwear (442)	UK	41 133	106 502	0.386	74	546
Th. Garments	Ireland	843	3 269	0.258		
16 Men's Shirts Overall and Underwear (444) Th. Garments	UK	88 121	44 966	1.960	100	635
	Ireland	3 295	2 176	1.514		
17 Women's and Girls' Outerwear (443)	UK	36 172	42 434	0.852	298	2 014
Th. Garments	Ireland	1 975	2 878	0.686		
18 Paper and Paper Products (481-484)	UK	5 922	167 718	0.0353	3 375	1 510
Th. Tons	Ireland	118	4 339	0.0272		
19 Leather Goods (432)	UK	14 261	6 968	2.047	206	253
Thousands	Ireland	1 031	464	2.222		
20 Fertilisers (278)	UK	2 913	10 926	0.267	338	5
Th. Tons	Ireland	646	1 985	0.325		
21 Soap and Detergent (275)	UK	971	20 568	0.0472	571	23
Th. Tons	Ireland	12.6	643	0.0196		
22 Cement (464)	UK	34,039	53,151	0.640	1,092	508
Th. Tons	Ireland	950	1,979	0.480		

Sources: Department of Trade and Industry, *Report on the Census of Production 1968*, London, 1971. Central Statistics Office, *Irish Statistical Bulletin*, Vols. 39-40, 1964/5. Central Statistics Office, *Trade and Shipping Statistics 1964*.

It seems more sensible to decide for each sector which country holds the trading advantage and to match the results with comparative labour productivities. The

rule for deciding this employed here has the advantage of being simple; if Irish imports from Britain exceed Irish exports to Britain, the trading advantage lies with Britain and vice versa. The results are presented in Table 2.

Table 2: *Comparative labour productivities and trade patterns, the United Kingdom and the Republic of Ireland, 1963*

Sector	Labour productivity United Kingdom/ Republic of Ireland (1)	Irish trade balance + indicates surplus - indicates deficit (2)
1 Bacon	0.543	+
2 Butter and Cheese	1.322	+
3 Preserved Fruit etc.	6.483	-
4 Grain Milling etc.	1.389	+
5 Sugar	2.885	-
6 Cocoa, Chocolate etc.	0.922	+
7 Margarine	2.696	-
8 Distilling	2.282	-
9 Brewing	0.737	+
10 Tobacco	1.188	-
11 Woollen and Worsted Yarn	6.123	-
12 Spinning of Cotton etc.	1.682	-
13 Hosiery	1.918	-
14 Footwear	1.383	+
15 Men's and Boys' Outerwear	1.496	+
16 Men's Shirts etc.	1.295	+
17 Women's and Girls' Outerwear	1.242	+
18 Paper and Paper Products	1.298	-
19 Leather Goods	0.921	+
20 Fertilisers	0.822	-
21 Soap and Detergent	2.408	-
22 Cement	1.333	-

Note: labour productivity figures were obtained by dividing the output to employment ratio for each industry in the United Kingdom by that in the Republic of Ireland.

Source: Department of Trade and Industry, *Report on the Census of Production 1968*, London: HMSO, 1971. Central Statistics Office, *Irish Statistical Bulletin*, Vols. 39-40, 1964-65. Central Statistics, *Trade and Shipping Statistics*, 1964.

In 1963, wage rates in manufacturing (for adult males) were approximately 40 per cent higher in the United Kingdom than in the Republic of Ireland.⁴ In consequence, labour productivity would have to be 40 per cent higher in the

4. See Central Statistical Office, *Annual Abstract of Statistics No. 107, 1970, Table 153* and Central Statistics Office, *Irish Statistical Bulletin*, Vol. XXXIX No. 3, September 1964, Table 16.

United Kingdom to compensate for the wage difference. It is to be expected that, in commodities where United Kingdom productivity is more than 40 per cent higher than that in the Republic of Ireland, the United Kingdom will have the trading advantage (and an export surplus); if United Kingdom productivity is less than 40 per cent that in Ireland, the opposite should hold. From Table 1 it can be seen that this is usually true; in 17 out of the 22 industries labour productivity ratios in excess of 1.4 are accompanied by a negative trade balance for Ireland while ratios less than 1.4 are accompanied by a positive trade balance.

This result seems to indicate that, contrary to the findings of McGilvray and Simpson, the Ricardian model is of some importance in explaining the pattern of Anglo-Irish trade. However, it is interesting to note that had the results been presented in terms of correlations between trade balances and relative labour productivities they would have appeared a good deal less favourable; the Spearman coefficient of rank correlation lies in the region of $r = +0.3$.

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Comment

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Our choice of a value rather than a physical measure of labour productivity was a conscious decision, not an "error". The reasons for this choice were clearly stated on pp. 451-452, footnote 2, of the article. The weakness of the alternative approach is revealed by Davies' computations. They would appear to cover only a small proportion of Anglo-Irish Trade. In each industry, there is a wide range of products: this largely accounts for the apparent cross-trading between the two countries. To add together these products as if they were homogeneous means that the resulting labour productivity figure must be of doubtful meaning.