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Estimation of the Contribution of the Biosector to Ireland's Net Foreign Earnings: Methodology and Results

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Abstract

An estimate of the contribution of the biosector² to Ireland's net foreign earnings in 2008 was recently published by The Department of Agriculture, Food and the Marine (2012). This paper examines these results and their derivation from a wide range of data provided by the Central Statistics Office (CSO), particularly the *Census of Industrial Production* and the *Supply and Use and Input-Output Tables for Ireland*.

- The main finding was that in 2008 the biosector accounted for 40 percent of net foreign earnings from merchandise exports. This was more than double the sector's percentage share of exports. The main reasons for the sector's disproportionately large contribution to net foreign earnings were: lower import requirements per euro of exports, and higher receipts of EU payments. These results are analysed in terms of Balance of International Payments flows per €100 of merchandise exports. Put this way, in 2008 every €100 of exports from the biosector generated €52 in net foreign earnings. In contrast, exports from the non-biosector, contributed only €19 in net foreign earnings for every €100 of exports.
- The result is shown to be quite dependable in the light of its consistency with other statistics for the economy and with results for earlier years. For example, when previous results for 2005 were updated with revised data and reclassifications, the results were very similar to those for 2008.
- More generally, these results illustrate an approach to assessment of the value to the economy of exports from specific sectors. In particular, the contribution of one sector or industry relative to another, in terms of net inflows per €100 of exports, could be a valuable way to assess the case for the expansion of one export sector, or industry, relative to another. In this case the biosector's contribution per €100 of exports in 2008 was provisionally estimated to be at least 2.7 times that of the non-biosector, and very likely to be far higher for Irish owner enterprises in the biosector sector.

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² The 'biosector' comprises the agriculture, forestry and fishing industries, along with the industries processing their products - the food and beverage industries. In total, these industries comprise a large part of Ireland's natural resource based industries and are distinguished by the biological origin of their products. For this reason the report refers to this group of industries as the 'biosector', to distinguish its coverage from any narrower definition of the agri-food sector. Appendix Table A.1. lists Census of Industrial Production industries comprising the biosector and the non-biosector along with the value of their exports in 2008.

The significance of Net Foreign Earnings to the economy

Net foreign earnings of exports are estimated by the amount of money they bring into the national economy after deducting their cost in terms of imports and other outflows (**Table 0**). This net contribution to the nation's Balance of International Payments (BOP) enables the nation to settle its international obligations. In addition, it boosts incomes in the economy by a multiple of the net inflow through the working of the export multiplier, issues that will arise below in the Analysis section.

Table 0. Balance of International Payments flows arising from exports of merchandise

Inflows
Exports of enterprises
EU Transfers related to exporting industries ¹
Deductions
Imports exported without further processing
Imports for production of exports in Ireland
Operating surplus of foreign businesses from exports ²
Net Balance of Payments inflow from exports
Balance of Payments debit for exporters' imports of capital goods
Net foreign earnings from exports

Notes:

¹ Payments to these industries from the EU, largely subsidies on agricultural products and production.

² Operating surpluses stated after deduction of corporation tax at 12.5 percent

The focus of this paper is on the net foreign earnings arising from the exports of goods and rather than all exports, including services. This focus reflects the availability of suitable data and the balance of public discourse.

Taking data availability first, merchandise exports and production generate records and provide data in the monthly *Trade Statistics* and the annual Census of Industrial Production. Services, in contrast, have no tangible counterpart to the quantities of merchandise, just values, with estimates of transactions provided by quarterly and annual surveys. Development of data and results for services, comparable with those for merchandise, has been found to be difficult and ultimately unsatisfactory.

Turning to the focus of public discourse, it is notable that the publication of the monthly *Trade Statistics* and the annual Census of Production, frequently generates considerable public comment and discussion of policy matters relating to the development of competitive export industries, particularly those producing merchandise. Such discussions generally focus on the gross value of exports, as reported in *Trade Statistics*, and thus tend to give little weight to the net inflows generated by one sector relative to another.

The paper then contrasts results for two very different sectors of the economy covered by the Census of Industrial Production, namely the biosector and the non-biosector.

The biosector comprises the agriculture, forestry and fishing industries, as well as the industries processing their products, namely the food and beverage industries. In total, these industries comprise a large part of Ireland's natural resource based industries and are

distinguished by the biological origin of their products. In contrast, the non-biosector comprises mining and quarrying, all other manufacturing industries and the utilities.

The significance of this division and the value of development based on Ireland’s natural resources was emphasised in *A review of industrial policy in Ireland, A report prepared by the Telesis Consultancy Group* (National Economic and Social Council, 1992). Its relevance to agriculture in Ireland was the subject of a paper to this Society by Riordan (1983).

The remainder of the paper comprises sections on Methods and Data used, followed by the main Results, Analysis and, finally, Summary and Conclusions.

Methods

The challenge was to estimate the Balance of International Payments (BOP) flows listed in Table 0. These flows were estimated in a number of ways using a range of CSO data. Ultimately it is ensured that the results are consistent with data on the International Balance of Payments and finally with data in the National Income and Expenditure tables.

The value of imports used to produce these exports can be estimated from data on input usage and an input-output matrix of the economy. Input-Output tables are published the CSO (2009) and one with more biosector detail has been developed by Corina Miller, Alan Matthews, Trevor Donnellan and Cathal O’Donoghue (Miller, A. C., Matthews, A. Donnellan, T. and O’Donoghue, C., 2011). In addition, reference should be made to early applications of input-output analysis to the agricultural sector in Ireland by O’Connor and Breslin (1968) and to Henry (1987). The seminal work was Leontief (1966) while O’Connor and Henry (1975) provided a text on input-output analysis and its applications.

The input-output approach assumes that an industry produces a standard mix of outputs with a standard mix of inputs and that the relationship between these two is linear. The input-output coefficients for each industry thus represents a ‘snapshot’ of the relationship for one year. As the relationship is linear, coefficients represent both the average and marginal rate of input. Under these conditions it is appropriate to say that these coefficients may be applied to exports of a product just as much as they apply to its total output. Import coefficients, derived from the CSO Input-Output tables, are shown in Table 1 as imports per 100 euro of output.

Table 1. Imports per hundred euro of production: 1985, 1990, 2000 and 2005

NACE Rev. 1	Sectors	1985	1990	2000	2005
		€ per €100			
1 to 5	Agriculture, Forestry, Fishing	7	7	14	18
15	Food and beverages	14	14	18	30

Data source: *Supply and Utilisation and Input-Output Tables*.

This table also demonstrates that these coefficients change over time, largely reflecting changes in the prices and in the mix of inputs and of outputs.

It was a challenge to estimate coefficients for years falling between publication of the input-output tables, which only appear every five years. The approach was to examine data on input usage, supplemented by data on the import content of these inputs. Thus the results for 2005,

published in 2008 (Riordan, 2008) were based on the input-output matrix for 2000 supplemented by estimates of the input and import coefficients for subsequent years. Errors in the estimation of these coefficients account for some of the differences between the results for 2005 published in 2008 and the revised ones in this paper, an issue mentioned again in the Analysis section.

In addition to imports used directly in the production of exports, allowance has to be made for the import content of Irish inputs used to produce these exports. This applies to imports used by suppliers in Ireland, both those supplying exporters and those supplying them and so on *ad infinitum*. These indirect impacts of exports are included along with the direct impact in what are called Leontief multipliers (CSO, 2009, Table 5). Leontief multipliers for imports arising from a €100 increase in output of various products are shown in Table 2 next to the direct multipliers from Table 1. It could be said that the lower the multiplier for imports the higher the linkage to the rest of the economy and thus the larger the impact of changes in production on the national economy.

Table 2. Imports, direct and indirect per hundred euro of production: 2005

NACE Rev. 1.1	Selected sectors	multiplier Direct	Leontief multiplier	Ratio of Leontief to direct multiplier
		€ per €100		
1 – 5	Agriculture, forestry and fishing	18	33	1.8
15	Manufacture of food and beverages	30	45	1.5
24	Chemical products and man-made fibres	55	58	1.1
30	Office machinery and computers	46	52	1.1
33	Medical, precision and optical instruments	42	47	1.1

Data source: *Supply and Utilisation and I-O Tables*.

Thus the level of imports required to produce the reported level of exports is estimated by applying the Leontief multiplier for imports of an industry to the value of its exports. The fact that for many industries a large part of production is exported, gives added credence to the underlying assumption that the import implications of exports are comparable with those for the entire output of the industry.

Estimation of the Leontief multipliers for years for which the CSO Input-Output tables are not available starts with estimates of the direct import coefficients, note above. A minimal estimate could be given by simply adding the increase in the direct multiplier to the Leontief. This approach tends to underestimate the Leontief as it does not take account of the increasing complexity of activities supporting exporters and other front line producers. However, multiplication of the coefficient for direct inputs by the historical ratio between direct and Leontief multipliers tends to overestimate the Leontief. Indeed in the case of imports the more production relies on imported inputs, the less its interaction with the rest of the domestic economy, hence the ratio between direct and Leontief would tend to unity. This paper errs towards overestimation of imports by estimating the Leontief as the historic multiple of direct

imports and this would tend to an overestimate and thus err on the side of under estimating the net contribution of exports.

Transfers to foreign based enterprises

Another source of outflows associated with exports is transfers by foreign firms to their head offices abroad. These flows appear as debit items in the Balance of Payments, however, data for many industries is not available, to protect the confidentiality of data on specific enterprises. Neither do input-output tables differentiate between net operating surplus going to Irish residents and those based abroad. However, the Census of Industrial Production (CIP) provides separate data for Irish and Foreign enterprises. Operating surpluses of foreign enterprises in each industry were thus calculated from CIP data by deducting labour costs and cost of capital consumed from the gross value added. The results were then calibrated to the aggregate data in the NIE and compared with aggregates in the BOP data, after deduction of corporation tax. Foreign owned enterprises in Agriculture, Forestry or Fishing were assumed to be so minor as to give rise to insignificant out-flows of income on equity.

Outflows of net operating surplus related to exports of each industry were estimated from data on foreign owned enterprises, by taking a proportion of their net operating surplus equal to the share of exports in the sales receipts of enterprises in the industry.³

Charge for consumption of fixed capital

Calculation of the net contribution of exports also has to take account of the import content of capital goods consumed in the production of exports, these were taken to be plant, machinery, equipment and vehicles. This was done in stages as follows:

- i. Data on acquisition of capital goods, that is to say Gross Fixed Capital Formation (GFCF), was obtained from the Census of Industrial Production for the various classes of capital assets, particularly Plant, Machinery, Equipment and Vehicles.
- ii. Capital consumption was initially estimated by straight line depreciation of the assets over their normal life, e.g. five years for plant etc. In 2008 the CSO changed to using the perpetual inventory method and this was also applied to calculate capital consumption used in the results for 2008. In all cases the results were calibrated with those in the National Income and Expenditure tables.
- iii. The BOP cost of capital consumed was estimated from the import content of capital goods and an estimate of the proportion of the acquisition cost of imported capital goods likely to be a charge on the Balance of Payments, as shown in Riordan (2008, Table 5a). This table shows that on average the BOP debit was 75 percent of expenditure on acquisition of Plant etc, a figure also used here.
- iv. The share of this BOP charge set against exports of each industry was the same as that used for allocation of the net operating surplus to exports, i.e. the share of exports in receipts from all sales by the industry.

The figure for consumption of fixed capital by foreign enterprises in each industry calculated by steps (i) and (ii) above was also used in the calculation of their net operating surplus described in the previous section.

³ All the aggregates were eventually priced to correspond with the value of the transaction to the enterprise after payment of taxes on the product and receipt of product subsidies, ie values at market prices were adjusted to those at basic prices.

Data

The methods described above require separate accounting data for Irish and foreign enterprises, aggregated by industry. The industry, and corresponding product classifications, used in the Census of Industrial Production (CIP) and other data sets are those in the NACE classification scheme.⁴ CIP data for 2008 were classified by the Revision 2 of the NACE, marking a move from NACE Rev. 1.1 that had been used for previous years. However, data for 2008 in other sources, notably the National Income and Expenditure (NIE) tables, were still classified by NACE Rev. 1.1. This impeded the usual calibration of results to those in the NIE and thus the results reported here are called ‘Provisional’ in being more tentative than those for earlier years when all the data was classified by NACE Rev.1.1. A major impact of the move to NACE Rev. 2 is that a large part of activities associated with publishing, including software, were re-classified as service activities and no longer covered by the CIP. This greatly reduced the exports under this heading (22 in NACE Rev.1.1) from a level of over €12,000 million in the 2005 CIP to €700 in the 2008 CIP using NACE Rev.2, with a consequent impact on overall totals for industries covered by the CIP.

Exports of Merchandise

Data on exports of merchandise from the Census of Industrial Production show exports of each of the industries with separate data for Irish and foreign enterprises. Table 3 compares CIP data for 2008 with total exports from BOP, the control data set, and from the *Trade Statistics*.

Table 3: Exports of Merchandise 2008:comparison of data from CIP, TS and BOP.

NACE Rev. 2	Industries : Products	2008
		€ million
1, 2, 3, 10, 11	Biosector¹	15,830
5 to 9, 13 to 39	non-biosector ¹	65,892
1 to 39	Total¹	81,722
BOP Current Account Credit ²		81,495
<i>Total Merchandise Exports³</i>		<i>86,294</i>
<i>of which</i>		
1, 2, 3, 10, 11	Agri-food³	<i>8,813</i>

Sources

1. *Census of Industrial Production*, with tobacco grouped with non-Biosector.
2. Balance of Payments
3. *Trade Statistics*

In 2008 the CIP total was quite close to that from the BOP. However, the *Trade Statistics* reports exports of biosector products was only €8,813 million relative to the CIP figure of €15,830 million. As the *Trade Statistics* figure is similar to what is often called the exports of ‘Agri-food’ it is so labelled to facilitate discussion. The reason for this huge disparity is that exports of some items only produced by a few enterprises in Ireland are not reported in the ‘Agri-food’ section of the *Trade Statistics* but aggregated with other exports in another section,

⁴ **NACE** is the acronym for ‘Nomenclature générale des activités économiques dans les communautés européennes’ (General Industrial Classification of Economic Activities within the European Communities). The version used from 1991 to 2002 was NACE Rev.1 followed by a slightly amended NACE Rev.1.1 from 1st January 2003 and then Rev. 2 starting in 2008.

so as to preserve the confidentiality of data on individual enterprises. CIP data on exports by the various industries in the biosector and on their corresponding products from the *Trade Statistics* (Table 4) points to the major source of the discrepancy being in the ‘other food products’, NACE Rev. 2 code 108. Other differences between the two sets largely reflect the fact that some enterprises falling into one CIP class may have some have products of a different class in their output. A prime example would be enterprises falling into the ‘Other food products’ class in the CIP that have farinaceous products in their range of outputs.

Table 4. Biosector exports by component industries: comparison of data from CIP and TS for 2008

NACE Rev. 2	Industries	2008	2008
		€ million	
		Trade Statistics	Trade Statistics
	Agriculture, Forestry & Fishery Products		
01	Live animals and other products of agriculture	570	570
02	Logs and forest products	6	6
05	Fish	90	90
01+ 02 + 05	Agriculture, Forestry & Fishery Products	666	666
		Census of Industrial Production	Trade Statistics
	Food <i>including:</i>		
101	Meat and meat products	2,172	2,397
102	Fish and fish products	243	243
103	Fruit and vegetables prepared and processed	30	11
104	Vegetable and animal oils and fats	1	80
105	Dairy products	1,405	1,425
106	Grain products, starches	9	21
107	Bakery and farinaceous products	264	1,149
108	Other food products	9,842	1,047
109	Prepared animal feeds	209	164
	Other products of these industries n.e.c.		355
10	All of the above food industry products	14,174	6,892
11	Beverages	990	1,180.0
12	Tobacco & tobacco products	-	75.0
01, 02, 05, 15, 16	Biosector at Purchasers' Prices	15,830	8,813

Sources:

1. *Census of Industrial Production.*
2. *Trade Statistics.*

Data from the CIP also show the role of Irish and foreign enterprises in Irish exports, Table 5. Aside from the dominance of exports by foreign enterprises, the main feature is the half share of Irish enterprises in biosector exports. The main reason why this share is not higher in the

biosector is the major role of foreign direct investment (FDI), thought to be particularly high in industries falling in the ‘Other food products’ category.

Table 5. Exports by Irish & Foreign Enterprises, 2008

NACE Rev.2	Industries and Sectors	Irish 2008	Foreign 2008	Total 2008
		€ million		
1+2	Agricultural & Forestry products	576	0	576
3	Fish	90	0	90
1 to 3	Agriculture, Forestry and Fish	666	0	666
10&11	Food and beverages	4,143	11,021	15,164
20+21	<i>Chemical products & Pharmaceutical products</i>	884	32,166	33,050
26+27	<i>Electrical and optical products</i>	420	19,652	20,071
1, 2, 3, 10, 11	Biosector	4,809	11,021	15,830
5 to 9, 13 to 39	non-biosector	5,237	60,654	65,892
1 to 39	Total	10,046	71,676	81,722
		Percentage Shares		
	Percentage of Total	12%	88%	100%
	Biosector share of total	48%	15%	19%

Source: *Census of Industrial Production*.

EU transfers

These subsidies appear as credits in the Balance of International Payments (BOP) and are from the EU for Common Agricultural Policy (CAP) measures to support agricultural products and production, as shown in Riordan (2008, p.23). National Income and Expenditure Table 23 shows these subsidies to have amounted to €1,797 million in 2008.

Imports for export without further processing

Data in the CSO *Supply and Use and Input-Output Tables* and in the Census of Industrial Production distinguish purchases that are used to produce merchandise in Ireland from those that are merely sold on, termed ‘Goods for resale without further processing’ or ‘factored goods’. It is difficult to know how much of these factored goods are imported. Table 3 of the *Supply and Use and Input-Output Tables 2000* indicates that none of the biosector imports were sold on as exports. However from 2000 to 2005 there was a steep rise in the value of ‘Goods for resale without further processing’ in CIP data for the food and beverage industries and a figure of €1,723 million was used for 2005 in Riordan (2008). Amendment of this figure to nil in the revised results for 2005, Table A.3, had a considerable role in accounting for the difference between the initial results for 2005 and the revised results.

Imports for production of exports

These were estimated using Leontief multipliers to give the value of imports made directly and indirectly to produce a year’s exports. The Methods section noted that these multipliers were available for 2005 from the *Supply and Use and Input-Output Tables for Ireland 2005*. For 2008 the Leontief was estimated by:

- i. Estimation of the direct multiplier for each industry in 2008; then

- ii. Multiplication of these direct multipliers by the ratio between the direct and Leontief multipliers for the relevant industry in 2005, as discussed under methods.

There are other ways for updating mentioned in the literature but in O'Connor's view use of relevant data, as here, is preferable to the use of updating systems (O'Connor and Henry, 1975).

The cost of inputs used in agriculture was particularly high in 2008 and the import content shot up to 40 percent from 28 percent in 2005, according to data from the CSO *Output, Input and Income in Agriculture* allied with data from the *Trade Statistics*. This is just the situation where the ratio of the Leontief multiplier to the direct was likely to decline, as noted in the Methods section and the ratio was reduced from 1.8 in 2005 to 1.6 for 2008. The direct import coefficient for the food and drink sector was derived from CIP data. The resulting multipliers used for the biosector in 2008 are shown in Table 6.

Table 6. Leontief Multipliers to calculate imports for biosector exports 2005 and estimates for 2008

NACE Rev.2	Industries : Products	Import multipliers			
		Direct multipliers		Leontief Multipliers.	
		2005 ^a S&U&I-O	2008	2005 S&U&I-O	2008 estimated
1 to 3	Agric. Forest and Fish	0.1827	0.2600 ^b	0.3349	0.4216
10&11	Food and beverages	0.2989	0.2775 ^c	0.4509	0.4185

Data sources: ^a *Supply and Utilisation and I-O Tables*;

^b *Output, Input and Income in Agriculture*;

^c *Census of Industrial Production*.

Similar calculations were made to estimate the Leontief multipliers for every other industry covered by the CIP. These estimations for industries in the non-biosector were complicated by the fact that the data for 2005 were classified by NACE Rev.1.1 while the data for 2008 were classified by NACE Rev.2. This had very little effect on the data for the biosector because the constituents of the relevant classes hardly changed between NACE Rev. 1.1 and Rev. 2. In contrast, there were some very large changes for many other classes and the removal of software exports from a manufacture to a service has already been mentioned.

Operating surpluses of foreign enterprises

These are reported in the BOP as debit items (outflows) of income on equity from Foreign Direct Investment (FDI). These BOP figures for 2008 were available for all manufacturing industry in aggregate and for the biosector (Table 7). The same source shows that inflows of income on equity of Irish biosector enterprises from their operations abroad was €149 million in 2009. Outflows from the biosector reflect the large scale of exports by foreign enterprises in the sector, (Table 5). Outflows were then allocated to exports in proportion to their share in the turnover of foreign enterprises.

Table 7. Income on equity BOP inflows and outflows: 2008

NACE Rev.2	Sectors	Debit (outflow)
		million euro
1, 2, 3, 10, 11	Biosector	2,958
5 to 9, 13 to 39	non-biosector	12,804
1 to 39	Total	15,762
	Biosector share of total	19%
Memorandum items:		
	Non-IFSC Income on Equity	23,195
	IFSC Income on Equity	5,474
	Total income on equity	28,669

Note: 'c' denotes confidential.

Source: Balance of International Payments (BOP).

Balance of Payments debit for exporters' imports of capital goods

Estimates in Table 8 were made by using the approach mentioned in the Methods section. It is interesting that although the biosector is a relatively heavy user of plant etc, the charge to exports is close to its export share.

Table 8. Capital Consumption Charge, 2008

NACE Rev.2	Sectors	Plant, Machinery & Equipment		
		Capital consumption	Import content	Charged to exports
		million euro		
1 to 3	Agric. Forest and Fish	453	340	30
10&11	Food and beverages	300	225	147
1, 2, 3, 10, 11	Biosector	753	565	177
5 to 9, 13 to 39	non-biosector	1,214	911	655
1 to 39	Total	1,967	1,475	832
Percentage Shares				
	Biosector share of total	38%	38%	21%

Source: Census of Industrial Production.

Provisional Results for 2008

Using the methods and data, described above, results were generated for all the industries selling merchandise, listed in Appendix Table A.1. The aggregate figures for Balance of International Payments (BOP) flows into and out of Ireland, Table 9, were then dis-aggregated into those for the biosector and non-biosector, Table 10. Examination of these Provisional estimates for 2008 indicates:

- A net inflow of approximately €21 billion from merchandise exports of €82 billion;
- Biosector exports accounted for €8 billion of this net inflow, 40 percent of the total, though the sector's exports only amounted to 19 percent of the total.
- Outflows of operating surpluses of foreign enterprise from biosector exports were surprisingly large, reflecting the large role of these enterprises in the biosector (Table 5).

Table 9. Summary of balance of payments flows arising from exports of merchandise, 2008

Items	2008 Provisional
	€ million
<i>Inflows</i>	
Exports of enterprises	81,722
EU Transfers related to exporting industries ¹	1,797
<i>Deductions</i>	
Imports exported without further processing	2,900
Imports for production of exports in Ireland	45,127
Operating surplus of foreign businesses from exports ²	13,969
Net Balance of Payments inflow from exports	21,523
Balance of Payments debit for exporters' imports of capital goods	832
Net foreign earnings from exports	20,690

¹ All Payments to these industries from the EU including subsidies on exports.

² Operating surpluses stated after deduction of corporation tax at 12.5 percent.

Source: Estimates derived from CSO data.

Table 10. Summary of balance of payment flows arising from exports of the biosector and non-biosector, 2008

Items	2008 Provisional		
	Biosector Industries NACE: 1, 2, 3, 10, 11	Non-Biosector Industries NACE: 5-9, 12-39	All Merchandise Industries NACE: 1 - 39
	€ million		
Inflows			
Exports of enterprises	15,830	65,892	81,722
EU Transfers related to exporting industries ¹	1,797	0	1,797
Deductions			
Imports exported without further processing	0	2,900	2,900
Imports for production of exports in Ireland	6,631	38,496	45,127
Operating surplus of foreign businesses from exports ²	2,630	11,339	13,969
Net Balance of Payments inflow from exports	8,366	13,157	21,523
Balance of Payments debit for exporters' imports of capital goods	177	655	832
Net foreign earnings of exports	8,189	12,501	20,690

¹ All Payments to these industries from the EU including subsidies on exports.

² Operating surpluses stated after deduction of corporation tax at 12.5 percent.

Source: Estimates derived from CSO data

Analysis of the Provisional Results

Reasons for net inflows from biosector exports being out of proportion to their export share will be examined by analysis of the results in terms of BOP flows arising from each hundred euro of exports. This will then be taken a step further by looking at the relative contribution of a sector per hundred euro of exports. This ratio may well be a statistic that is of greatest relevance to discussion of policies to expand the production and exports of a sector.

This section will also note results for the years 2000 to 2005 in addition to those for 2008 to see how robust these are.

Notable features of the net flows per €100 of exports, Table 11, are:

- The augmentation of biosector export receipts by EU transfers attached to the products or the way they are produced, amounting to an inflow of €11 per €100 of exports;
- An import content of biosector exports held to €42 per €100 of exports despite increases in the import dependence of agriculture, however these were considerably below the non-biosector figure of €58 per €100 of exports;
- Overall, there was a net inflow of €52 per €100 of biosector exports, while the comparable figure for the non-biosector was €19 per €100 of exports.

Table 11. Balance of payment flows per €100 of biosector and non-biosector exports, 2008

Items	2008 Provisional	
	Biosector Industries	Non-Biosector Industries
€ per €100		
Inflows:		
Exports of Enterprises at purchasers' prices	100	100
EU Transfers related to exporting industries ¹	11	0
deduct outflows as follows:		
Imports exported without further processing	0	4
Imports for production of exports	42	58
Operating surplus of foreign businesses from exports ²	17	17
Balance of Payments debit for exporters' imports of capital goods	1	1
Net foreign earnings of Biosector exports	52	19

¹ All Payments to these industries from the EU including subsidies on exports.

² Operating surpluses stated after deduction of corporation tax at 12.5 percent.

Source: Estimates derived from CSO data

In comparing these figures with those for earlier years, Appendix Table A.4, there are two issues:

- 1) Results for 2000 and 2005 are more reliable than those for other years in using data from the CSO *Supply and Utilisation and Input-Output* tables for those years and thus they are distinguished by being in bold type.
- 2) Some of the variation in figures for other years from those for 2000 and 2005, reflects inaccurate estimations, particularly errors in estimates of the Leontief multipliers. This same problem could arise with estimates for 2008, presented here, especially in view of the difficulties arising from changes in the classification of industries and products from NACE Rev.1.1, for 2005 to Rev. 2 in 2008.

Relative net inflow per €100 exports of one sector or industry compared to others would be very relevant to assessment of their competing claims for development. Here, data constraints limited coverage to just two sectors, the biosector and the non-biosector. In 2008 the ratio of net inflow per €100 exports of the biosector relative to the non-biosector was 2.7 (52/19) and in the key years of 2000 and 2005 it was 4.4 (61/14) and 3.8 (53/14) respectively. Within each sector there would have been industries with notably higher ratios, thus within the biosector, the large group of Irish enterprises would be likely to have had a higher than average ratio. Conversely other biosector industries would have had a lower ratio and these are likely to have been those with a large element of the foreign enterprises. This view can only be inferred as the sector is not disaggregated in some of the key data sets that are available. The inference is based on the following observations on the rise of foreign owned enterprises in the biosector between 2000 and 2008:

- Exports of foreign enterprises in the biosector nearly doubled, going from €5.6 billion to €11 billion raising their share in biosector exports from 62 percent to 73 percent.
- Outflow of their income on equity from exports rose from €0.9 billion to €2.9 billion.

This large change in the structure and performance of the biosector could well account for the decline in the sector's relative net inflow per €100 of exports between 2000 and 2008, noted above. In other words the foreign owned part of the biosector has characteristics closer to those of the non-biosector, than to Irish owned enterprises in the sector and as its share of the sector increased the sector moved towards the profile of the non-biosector. If these strong inferences are correct, then the case for paying particular attention to growth in exports of Irish owned enterprises in the biosector is even stronger than that based on the relatively high level of net inflows per €100 of biosector exports.

Two other aspects of net inflow into the international Balance of Payments from exports warrant mention;

- 1) Its resonance with Gross National Product (GNP), and ;
- 2) Its leveraged relationship with GNP, through a 'Keynsian' export or foreign trade multiplier⁵.

Net inflow into the BOP from exports is to exports, as GNP is to GDP, in so far as both differ by the outflow of factor incomes payable abroad. In fact, the resonance with Gross National Income is even closer as the net inflow calculations in this paper also include EU subsidies arising from production in the sector. In the past, and still in many contexts, GDP is taken as a convenient proxy for national income and it is a fair indicator in most countries. Ireland is the exception due to the very large role of Foreign Direct Investment (FDI) in the economy separating growth in GDP from GNP growth. The corollary of this is that there should be a similar shift in discourse from exports to net inflows from exports.

In practice, most attention is given to exports of merchandise, reported monthly in the *Trade Statistics*, and it is these exports that have been the focus of this paper and its demonstration of the practicality of estimating net inflows.

Multipliers of the Keynesian sort are now less invoked than in earlier years, where they were over used to boost the claims of projects for support from the public purse. However, net inflows into the economy are a fundamental element in an analysis of influences on national income. The fact that Ireland is a very open economy with high levels of leakage from any stimulus, reduces the size of the foreign trade multiplier yet it is still positive and in excess of unity. Thus in addition to 'balancing the books', net inflows from exports would play a disproportionate role in countering contraction in the economy.

Summary and Conclusions

International Balance of Payments net inflows from merchandise exports were estimated and those from biosector exports found to be twice as large as their share in total exports. The paper describes the methods and data used to arrive at the results and provides some further analysis.

A key finding was that in 2008 net inflows from biosector exports amounted to €8,200 million or 40 percent of total net inflows from all exports of merchandise of €20,700 million. In contrast, the share biosector exports in total merchandise trade was half that at 19 percent. These are Provisional results due to data constraints specific to 2008, and thus similar calculations are planned for subsequent years as data becomes available.

⁵ 'Keynsian' is used to distinguish this foreign trade multiplier from the Leontief type of multiplier used earlier in the paper. Blaug (1962) noted that the concept of such a multiplier is to be found in works far before its use in Keynes' General Theory (Keynes, 1936) and these earlier works included Marshal (1890). However, introduction of a quantitative approach is credited to Kahn (1931). This multiplier is defined in Black (2003).

Analysis of the results focused on net inflows per €100 euro of exports. This showed that while every €100 of biosector exports generated a net inflow of €52 euro, those of the non-biosector only generated a net inflow of €19 euro. Thus in 2008 biosector exports were more than 2.7 times more effective at generating net inflows than those of the non-biosector. Further, the relative effectiveness of biosector exports was found to be even higher in earlier years. There was also a strong indication that net inflows per €100 of exports would have been higher for exports from Irish owned enterprises in the sector than for the sector as a whole.

It is suggested that the relative size of an industry's net BOP inflows per €100 exports in comparison with those of another industry, would be a highly appropriate statistic to use in assessing the benefits to be gained from policies to expand of one versus the other.

Further, just as analysts of the performance of economy of Ireland have tended to shift from a focus on GDP to GNP, so too it would be appropriate to give more attention to net inflow of funds generated by exports than to export data. Secondly, credit should be given to the positive impact of net inflows on the economy, especially as their impact would exceed the size of the injection, reflecting an export multiplier larger than one.

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Appendix

Table A.1 Exports of Biosector and non-Biosector goods industries in 2008

NACE Rev.2	Industries and Sectors	Irish	Foreign	Total
	Biosector	€ million of exports		
1	Agricultural products	570	0	570
2	Forestry products	6	0	6
3	Fishing	90	0	90
1 to 3	Agric. Forest and Fish	666	0	666
10	Food	3,959	10,216	14,174
11	Beverages	184	805	990
10&11	Food and beverages (excluding tobacco⁶)	4,143	11,021	15,164
1, 2, 3, 10, 11	Total Biosector	4,809	11,021	15,830
	non-Biosector			
	<i>Extractive industries</i>			
5 to 9	Mining and quarrying	106	325	431
	<i>Manufacturing industries</i>			
13	Textiles	60	89	148
16	Wood and wood products (excluding furniture)	189	79	267
17	Paper, paper products	57	29	86
18	Printed matter and reproduction of recorded media	204	453	657
20	Chemical products	317	5,431	5,747
21	Basic pharmaceutical products and preparations	568	26,735	27,303
22	Rubber and plastics	234	391	625
23	Other non-metallic mineral products	147	129	276
24	Basic metals	344	38	382
25	Fabricated metal products except machinery and equipment	272	265	537
26	Manufacture of computer, electronic and optical products	184	19,367	19,551
27	Electrical Equipment	236	285	520
28	Machinery and equipment n.e.c.	399	1,540	1,939
29	Motor vehicles and trailers	106	374	480
30	Other transport equipment	11	44	55
33	Repair and installation of machinery and equipment	21	32	53
12,14, 15,19, 31, 32	Tobacco⁶, Wearing apparel, Leather, Coke & petroleum, Furniture and Other manufacturing.	1,282	4,912	6,194
	<i>Utilities</i>			
35 to 39	Electricity, Gas and Water Supply	503	137	640
5 to 9, 13 to 39	Total non-biosector	5,237	60,655	65,892
1 to 39	Total Biosector and non-biosector	10,046	71,676	81,722
	Biosector share of total	48%	15%	19%

 Source: *Census of Industrial Production*.

⁶ Data for the Tobacco industry are not separately reported in the CIP, however, its exports are in Table 4, above.

Table A.2. Summary of balance of payments flows arising from exports of the biosector, 2005 (published 2008), 2005 (revised), 2008 (provisional)

Balance of Payments Flows	2005 Published	2005 Revised	2008 Provisional
€ million			
Biosector industries (NACE 1, 2, 3, 10, 11)			
Exports of enterprises	14,299	14,299	15,830
EU Transfers related to exporting industries ¹	2,239	2,239	1,797
<i>Deductions</i>			
Imports exported without further processing	1,723	0	0
Imports for production of exports in Ireland	5,495	6,453	6,631
Operating surplus of foreign businesses from exports ²	2,185	2,185	2,630
Net Balance of Payments inflow from exports	7,135	7,901	8,366
Balance of Payments debit for exporters' imports of capital goods	277	277	177
Net foreign earnings of biosector exports	6,858	7,624	8,189
All merchandise producing industries (NACE 1 - 39)			
Exports of enterprises	91,929	92,145	81,722
EU Transfers related to exporting industries ¹	2,239	2,239	1,797
<i>Deductions</i>			
Imports exported without further processing	2,774	2,900	2,900
Imports for production of exports in Ireland	50,588	53,556	45,127
Operating surplus of foreign businesses from exports ²	17,405	17,405	13,969
Net Balance of Payments inflow from exports	23,402	20,523	21,523
Balance of Payments debit for exporters' imports of capital goods	1,669	1,669	832
Net foreign earnings from all exports	21,733	18,854	20,690
Biosector as a percentage of all merchandise producing industries			
Exports	16%	16%	19%
Net inflow from exports	30%	38%	39%
Net foreign earnings of exports	32%	40%	40%

¹ All Payments to these industries from the EU including subsidies on exports.

² Operating surpluses stated after deduction of corporation tax at 12.5 percent.

Source: Estimates from CSO data including *Supply and Utilisation and Input-Output Tables 2005*.

Table A.3 Balance of payments flows per €100 of merchandise exports, 2005 (published 2008), 2005 (revised), 2008 (provisional)

	2005 Published	2005 Revised	2008 Provisional
€ per €100			
Biosector industries			
<i>Inflows:</i>			
Exports of Enterprises at purchasers' prices	100	100	100
EU Transfers related to exporting industries ¹	16	16	11
<i>deduct outflows as follows:</i>			
Imports exported without further processing	12	0	0
Imports for production of exports	38	45	42
Operating surplus of foreign businesses from exports ²	15	15	17
Balance of Payments debit for exporters' imports of capital goods	2	2	1
Net foreign earnings of Biosector exports	48	53	52
Non-Biosector Industries			
<i>Inflows:</i>			
Exports of Enterprises at purchasers' prices	100	100	100
EU Transfers related to exporting industries ¹	0	0	0
<i>deduct outflows as follows:</i>			
Imports exported without further processing	1	4	4
Imports for production of exports	58	61	58
Operating surplus of foreign businesses from exports ²	20	20	17
Balance of Payments debit for exporters' imports of capital goods	2	2	1
Net foreign earnings of non-biosector exports	19	14	19

¹ All Payments to these industries from the EU including subsidies on exports.

² Operating surpluses stated after deduction of corporation tax at 12.5 percent.

Source: Estimates derived from CSO data

Table A.4 Outflows per 100 euro of Exports of Biosector and non-Biosector

	2000	2001	2002	2003	2004	2005 Rev	2008 Prov
€ per €100							
Biosector industries							
<i>Inflows:</i>							
Exports of Enterprises at purchasers' prices	100	100	100	100	100	100	100
EU Transfers related to exporting industries ¹	16	15	18	14	12	16	11
<i>deduct outflows as follows:</i>							
Imports exported without further processing	0	0	0	5	12	0	0
Imports for production of exports	44	43	43	41	39	45	42
Operating surplus of foreign businesses from exports ²	9	12	15	17	16	15	17
Balance of Payments debit for exporters' imports of capital goods	2	2	2	2	2	2	1
Net foreign earnings of Biosector exports	61	57	57	49	44	53	52
Non-Biosector Industries							
<i>Inflows:</i>							
Exports of Enterprises at purchasers' prices	100	100	100	100	100	100	100
EU Transfers related to exporting industries ¹	0	0	0	0	0	0	0
<i>deduct outflows as follows:</i>							
Imports exported without further processing	2	3	2	2	1	4	4
Imports for production of exports	61	53	51	53	55	61	58
Operating surplus of foreign businesses from exports ²	21	22	26	23	21	20	17
Balance of Payments debit for exporters' imports of capital goods	2	2	2	2	2	2	1
Net foreign earnings of non-biosector exports	14	20	19	20	21	14	19

¹ All Payments to these industries from the EU including subsidies on exports.

² Operating surpluses stated after deduction of corporation tax at 12.5 percent.

Source: Estimates derived from CSO data.

Years for which there are *Supply and Utilisation and Input-Output Tables* are in **Bold**.