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Estimates of Output, Income, Value Added and Employment Multipliers for the Maltese Economy

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BOX 4: ESTIMATES OF OUTPUT, INCOME, VALUE ADDED AND EMPLOYMENT MULTIPLIERS FOR THE MALTESE ECONOMY[1]

This Box summarises the results of a broader study conducted for the Central Bank of Malta that aims to derive and analyse industry specific multipliers based on the input-output methodological framework.[2] These multipliers portray, at a highly disaggregated industry level, how an increase in final demand to each of these industries could potentially affect the Maltese economy. A significant advantage of utilising the input-output methodology is that the resulting multipliers incorporate not only the direct effects, but also the indirect and induced effects on the economy of an exogenous shock to one of the components of final demand.

Data and methodology

In this study we describe output (production), income (income-output), value added (value added-output) and employment (employment-output) multipliers, using techniques which have their foundation in the work of Wassily Leontief, for which he was awarded a Nobel Prize in economics in 1973.[3] Only a few studies exist in this field which are applied to the Maltese economy, with the majority of these aimed at evaluating the overall impact of the tourism sector.[4,5] However, these studies either utilise input-output tables, which are not highly disaggregated, or have missing components, or which do not comply with the Eurostat System of National and Regional Accounts or with Eurostat methodological guidelines for the construction of a symmetric input-output table (SIOT).

The multipliers derived here are based on a SIOT for 2008, constructed by the author by transforming the supply and use tables for the Maltese economy published by the NSO in 2013, using the fixed product sales assumption transformation model described in the Eurostat Manual of Supply, Use and Input-Output Tables, published in 2008. The resulting SIOT has a 59-industry level of disaggregation, which follows in large part the classification according to the European Statistical Classification of Economic Activates (NACE) Rev.2.

An input-output table records the economy's inter-industry transactions via the disaggregation of the economic activity into "n" sectors or industries, representing the various producing sectors of the economy. The core data required to populate the Leontief demand driven model essentially consist of the flows of products from each of the "n" producing sectors to

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2 This study is found at http://www.centralbankmalta.org/en/working-papers-2015 and follows the approach taken by the author in, "A study of the production structure of the Maltese economy: An input-output approach" *Unpublished doctoral dissertation*, Heriot-Watt University, Edinburgh, 2013.

3 Leontief, W, *The Structure of American Economy*, 1919-1929. 2nd edn. Harvard University Press, Cambridge, 1951.

4 Bonnici, J. "Integrating Input-Output and Keynesian Models: A Case Study of Malta", *Unpublished doctoral dissertation*, Simon Fraser University, Canada, 1980, and "The Relevance of Input Substitution in the Inter-Industry Model", *European Economic Review*, 22, 1983, pp. 277-296.
Gravino, D., "Economic and Policy Implications of Industry Interdependence: An Input-Output Approach, *International Journal of Economics and Finance*, 4 (6), 2012.

5 Briguglio, L., "Tourism Multipliers in the Maltese Economy", In Johnson, P. and Thomas, B. (eds.), *Perspectives on Tourism Policy*, Mansell, London, 1992, pp. 76-80, and Blake, A., Sinclair, T.M., Sugiyarto, G. and DeHann, C., "The Economic Impact of Tourism in Malta: Input-Output Modelling", *Report* for the Malta Tourism Authority, The University of Nottingham, 2003.

each of the "n" sectors purchasing input requirements in order to undertake the production of output. An increased demand for a product or service results in an increased demand for other products and services, which serve as inputs to produce this product or service. Besides these effects on production, referred to as Type I multipliers, one also needs to consider that higher production leads to more labour input, which in turn raises household income leading to more demand, and consequently production. This broader impact is referred to as Type II multipliers.

One of the main factors, which has a significant role in determining the overall magnitude of the derived Type I multipliers, relates to the relative share of leakages from the domestic inter-industry system in terms of import use, labour use or even total primary inputs use as a share of the total input requirements for each industry. Given that Malta is a small, open economy, the extent of import use as a share of total input requirements per sector is of great significance to the relative magnitude of the multipliers for each industry. The higher the import content within the production process of a sector, the smaller the magnitude of the resulting multipliers for that sector will be. Additionally, since we will also derive the Type II multipliers, another factor which will have a significant impact in determining the size of these multipliers relates to the consumption pattern of households. The larger the share of household income that is spent on consumption expenditure, rather than being leaked out of the system via, for example savings or taxation, the larger will be the induced effects.

A realistic estimate of the true direct and indirect effects of an increase in final demand on output, income and employment generally lies half way between the Type I and Type II multipliers. This statement is motivated by the suggestion that Type I multipliers probably underestimate economic impacts, given that they omit household and factor income activities, while, on the other hand, Type II multipliers probably overestimate these impacts owing to the rigid assumptions regarding household behaviour.[6]

Estimates for Malta for selected industries

In this Box we focus our analysis on ten sectors. Two of them, electronics and pharmaceutical products, are key players in the manufacturing industry, while construction and retail trade are traditionally domestically-oriented important sectors. The public sector is represented by public administration and health (though the latter also includes private sector operators). The other four sectors – financial services, information technology services, creative arts & betting, accommodation & food services – all form part of the services sector, but are mostly export oriented. Taken together, in 2014 these ten sectors constituted 41.9% of total employment, 45.6% of total value added and 47.2% of total output.

Table 1 shows the Type I and Type II output, income, value added and employment multipliers for these ten sectors. Thus, for instance, every additional €1.0 million increase in demand for the construction sector results in a direct and indirect increase in production of €1.69 million from all sectors of the economy. This rise in production would, via the impact of additional labour income, stimulate consumption and generate further rounds

[6] Refer to Oosterhaven, J., Piek, G. and Stedler, D., "Theory and Practice of Updating Regional Versus Interregional Interindustry Tables", *Papers in Regional Science*, 59 (1), 1986, pp. 57-72.

Table 1
INDUSTRY MULTIPLIERS FOR MALTA: SELECTED INDUSTRIES[1]

	Output		Income		Value added		Employment	
	Type I	Type II	Type I	Type II	Type I	Type II	Type I	Type II
Manufacture of electronics	1.12	1.29	0.10	0.13	0.19	0.27	5	7
Manufacture of pharmaceuticals	1.31	1.60	0.17	0.23	0.70	0.83	8	12
Construction	1.69	2.19	0.30	0.39	0.60	0.82	27	32
Retail trade, except of motor vehicles	1.51	2.20	0.41	0.54	0.81	1.11	34	43
Accommodation & food services	1.63	2.25	0.37	0.49	0.65	0.93	23	30
Financial services, except insurance	1.51	2.52	0.60	0.79	0.79	1.24	20	32
Information technology services	1.61	2.10	0.29	0.38	0.65	0.87	12	18
Creative arts, gambling & betting	1.34	1.54	0.12	0.16	0.49	0.58	5	7
Public administration	1.42	2.53	0.65	0.86	0.82	1.32	26	39
Human health	1.36	2.34	0.58	0.77	0.84	1.29	21	33

[1] This table is a summarised output of the tables contained in the broader study available on the Bank's website, which classifies the industries following NACE Rev.2. The multipliers show the impact on output, income, value added and employment of a one million increase in exogeneous final demand. For instance, a one million euro increase in demand for electronics would generate €1.29 million increase in total production across the industry (€0.27 million of which from induced demand) and generate 7 additional jobs.
Source: Author's calculations.

of production activity, such that the overall Type II multiplier for the construction industry would amount to an increase in output of €2.19 million. Similarly, when one accounts for the direct, indirect and induced effects, this €1.0 million rise in demand for the construction sector would result in an additional €0.39 million in household income, €0.82 million in value added and 32 jobs.

The first thing immediately evident in Table 1 is the considerable heterogeneity in these multipliers. A sector like electronics manufacturing, which, given its importance in the productive structure of the Maltese economy, would be expected to have a significant output multiplier, but much smaller value added, income and employment multipliers. This reflects the fact that some industries are very capital intensive or can generate considerable value added using very few workers. While traditionally this tended to be a feature of manufacturing, as can be seen in Table 1, a number of fast-growing service sectors, such as information technology services, also share this trait. However, the estimated multipliers confirm that labour-intensive sectors, such as public administration and retail trade, tend to have the highest employment multipliers. The nature of the industry also affects the difference between its Type I and Type II multipliers. Thus, for instance, the induced effects of an increase in demand for the health sector and for the financial services sector are more significant than those for the construction sector, reflecting the different type of interlinkages these sectors have with the rest of the economy and the resulting change in household income.

Returning to the issue of heterogeneity in multipliers, one can notice that the output multipliers display the least variation, with the Type I multiplier for construction being one and a half times that for the manufacture of electronics. When one considers the induced effects, the gap between the two sectors grows considerably. The public administration sector, which, when excluding induced effects, has a smaller output multiplier than construction, overturns this result when one considers induced effects. The greatest variation in multipliers is found in the income and employment multipliers, and reflects the capital intensity

and/or the total employment share of the sector. A €1.0 million increase in demand for the creative arts, gambling & betting sector generates €0.16 million rise in household income, whilst the same increase in demand for accommodation & food services generates a rise three times as much. The variation in value-added multipliers, though less pronounced than in income and employment multipliers, is more than twice that in output multipliers.

It should be noted that while the ten sectors, which are analysed here, constitute a considerable part of the Maltese economy, they do not necessarily feature as having the highest multipliers amongst all 59 sectors.[7] For instance, the highest output Type II multiplier – 2.96 - is found in the insurance sector, while social work has the largest employment multiplier – 145. Employment services have the highest income and value-added multipliers, 1.11 and 1.53, respectively. The manufacture of electronics has the lowest value-added multiplier, the second lowest output multiplier, the third lowest income and employment multipliers. Similarly, the creative arts, gambling & betting sector occupies the fourth from bottom spot in all four types of multipliers. That said, it should be kept in mind that an increase of €1.0 million demand for a sector, such as employment services, is the equivalent of 1.7% of its current value added, while the same increase for creative arts, gambling & betting would represent 0.2%, or ten times less in proportionate terms.

Conclusion

Input-output analysis allows one to obtain a clear picture of the strength of inter-industry relations and how these impact the Maltese economy in terms of productive output generated, household income, value added generated and employment created. These measures can either be used for the study of the characteristics of the structure of production, or can be of crucial aid to policy makers for the identification of industry-specific policies aimed at improving Malta's competitiveness and economic resilience.

Thus, for instance, taking accommodation and food service activities as an approximation for the tourism sector, it can be inferred that, based on the reference year 2008, an additional €1.0 million worth of exogenous final demand injection for this sector through the direct, indirect and induced effects on production would have generated an average total value in production from all sectors in the economy amounting to €2.25 million, an average increase in household income of €0.49 million, a rise in value added of €0.93 million, and would have created approximately 30 new jobs.[8] Similarly, based on this study, a policymaker can understand that an increase in demand for a particular sector, such as construction, will generate much higher demand for labour than a rise in the demand for another sector, such as the manufacture of pharmaceuticals, hence requiring different labour market strategies.

This type of analysis provides a different approach to evaluating the relative significance of an industry within the context of the entire production structure. For example, if one were to look at solely the share of output or value added of a particular industry in relation to the total of the other industries, areas such as the creative arts, gambling & betting and electronics manufacturing would stand out as being the most significant productive sectors

[7] Details on the ten highest ranking multipliers for each dimension are provided in the *Working Paper* on this subject found at http://www.centralbankmalta.org/en/working-papers-2015.

[8] For further explanation of this ad-hoc approximation refer to Fletcher, J., "Input-output analysis and tourism impact studies", *Annals of Tourism Research*, 16 (4), 1989, pp. 514-529.

in the economy. However, when the potential impacts of these industries, in terms of the additional generation of domestic production, income and value-added generation, and employment creation per euro increase in final demand, are assessed, they rank consistently among the bottom quartile for each of the multiplier measures derived. On the other hand, sectors which have a relatively low share of total output, such as insurance, employment services and education, consistently rank amongst the industries which generate the highest overall multiplier effects.

It should, however, be noted that interpreting multiplier estimates in the context of modelling marginal changes in activity will implicitly invoke assumptions about how the economy behaves in response to changes in demand, since these measures would effectively be estimating the resulting impact in an economic scenario which differs from that of the given base year. Multiplier estimates tend to overestimate the real impact on the economy caused by an exogenous increase in final demand, as economies do not exhibit the levels of excess capacity assumed by the model, especially in the short run for which most impact analysis is conducted.[9] An alternative interpretation views the estimates obtained from the various multiplier measures as long-run multiplier effects on the economy.[10] While the multipliers derived here should be evaluated with caution by policy makers, they provide a useful tool to assess the possible effects on output production that can be generated as a result of an increase in exogenous final demand.

[9] Refer to Ten Raa, T. and Rueda-Cantuche, J.M., "Stochastic Analysis of Input-Output Multipliers on the basis of Use and Make Matrices", *Review of Income and Wealth*, 53, 3, 2007, pp.1-17.

[10] Refer to Charney, A. and Vest, M., "Modeling Practices and Their Ability to Assess Tax/Expenditure Economic Impacts", *Paper* prepared for the AUBER Conference, New Orleans, the University of Arizona, Tucson, AZ, October 2003.