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ASSESSING STRUCTURAL CHANGE IN THE MALTESE ECONOMY VIA THE APPLICATION OF A HYPOTHETICAL EXTRACTION ANALYSIS

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BOX 1: ASSESSING STRUCTURAL CHANGE IN THE MALTESE ECONOMY VIA THE APPLICATION OF A HYPOTHETICAL EXTRACTION ANALYSIS[1]

This Box summarises the results of a broader study conducted for the Central Bank of Malta that aims to assess the extent of change in the production structure of the Maltese economy from the 2000's to date via the application of selected input-output techniques.[2] Over the recent decades, the Maltese economy has passed through a number of significant structural changes such as the shift from manufacturing to service oriented activities leading to greater diversification, as well as to very rapid changes in the labour market. The application of methods which have their foundation in input-output analysis will enable the assessment of the structural change in the Maltese economy making it possible to obtain a deeper understanding of the importance of each sector, in terms of its inter-linkages with the rest of the economy and how this has changed over time.

Data and methodology

The first method employed in this study assumes a full hypothetical sectoral extraction and illustrates the impact that such an extraction would have on the Maltese economy in terms of the percentage loss in total GVA, total labour income and total employment.[3] The latter has been disaggregated in terms of loss in employment of Maltese nationals and loss in employment of foreign nationals, which are caused by the hypothetical extraction of an industry. The magnitude of the resulting extraction effects will therefore depend on both the underlying inter-industry relations but crucially also on the size of the industry itself.

The second method applies the non-complete hypothetical extraction method, proposed by Dietzenbacher and van der Linden, to derive separate backward and forward linkages indicators (which remove sectoral size effects) for each sector in the economy.[4] Sectoral linkages captures the interrelations between production sectors, reflecting the notion that a sector simultaneously purchases inputs from other industries for its production process (the sector's backward linkage) and that the same sector also supplies inputs to other industries (its forward linkage). The analysis of these backward and forward linkages enables researchers to identify the industries that are regarded as key to the economic development strategy of a country. These linkages indicators were utilized for the identification of the key sectors in the Maltese economy across the specified time period. In order to assess the extent of change in the production structure of the Maltese economy the study employed three symmetric input-output tables (SIOTs) for the reference years 2000, 2008 and 2010.[5] The three SIOTs were compiled at the following seventeen industry level of sectoral disaggregation (see Table 1).

[1] Prepared by Dr Ian P. Cassar, who was engaged by the Central Bank of Malta to conduct the research under the editorial supervision of Mr Brian Micallef, Manager of the Research Office. Dr Cassar is a lecturer in the Economics Department of the University of Malta. Helpful comments and suggestions by Dr A. G. Grech are gratefully acknowledged. The views expressed in this Box are those of the author and do not necessarily reflect those of the Central Bank of Malta. Any errors are the author's own.

[2] This study is found at https://www.centralbankmalta.org/en/working-papers-2017.

[3] The seminal studies in the literature are: Strassert, G. (1968). Zur Bestimmung strategischer Sektoren mit Hilfe von Input-Output-Modellen. *Jahrbücher für Nationalökonomie und Statistik*, 182, 211-215; Dietzenbacher, E., & Lahr, M. (2013). Expanding Extractions, *Economic Systems Research*, 25(3).

[4] Dietzenbacher, E., & van der Linden, J.A. (1997). Sectoral and spatial linkages in the EC production structure. *Journal of Regional Science*, 37(2), 235-257.

[5] Further details on the data sources used in this study are available in Cassar, I.P. (2017). Assessing structural change in the Maltese economy via the application of a hypothetical extraction analysis. Working Paper WP/01/2017, Central Bank of Malta.

Table 1
CLASSIFICATION OF INDUSTRIES UTILISED FOR THE SECTORAL AGGREGATION

Sector No.	NACE Rev. 2 Code	Sector
1	A	Agriculture, forestry and fishing
2	C	Manufacturing
3	D, E	Electricity, gas, water supply and waste management
4	F, B	Mining, quarrying and construction
5	G	Wholesale and retail trade; repair of motor vehicles and motorcycles
6	H	Transportation and storage
7	I	Accommodation and food service activities
8	J	Information and communication
9	K	Financial and insurance activities
10	L	Real estate activities
11	M, N	Professional, scientific and technical activities and administrative and support service activities
12	O	Public administration and defence
13	P	Education
14	Q	Human health and social work activities
15	R[(1)]	Arts, entertainment and recreation
16	S	Other service activities
17	T,U	Households as employers and activities of extraterritorial organisations

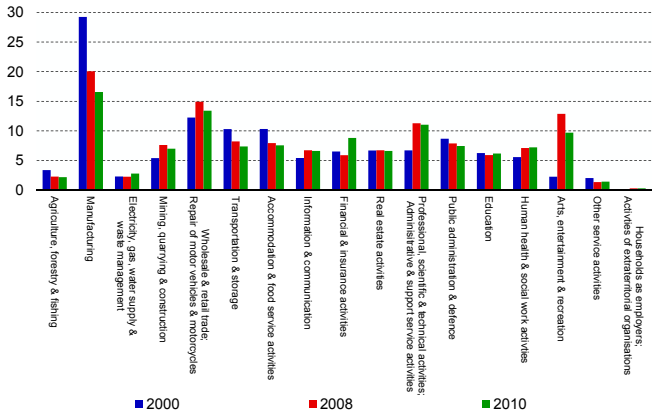
[(1)] This sector includes gambling and betting activities.

Summary of results

The main results are summarized in Charts 1, 2 and 3, which illustrate the impact that the extraction of each sector would have on the Maltese economy in terms of the percentage loss in total GVA, total labour income and total employment (disaggregated in terms of loss in employment of Maltese, as well as foreign nationals), respectively.

Between 2000 and 2010, the manufacturing sector generates the largest extraction effects in terms of total GVA, total labour income and total employment. However, these extraction effects have been declining over time reflecting the increased level of sectoral diversification which has occurred in the production structure of the Maltese economy since 2000. Indeed, over the

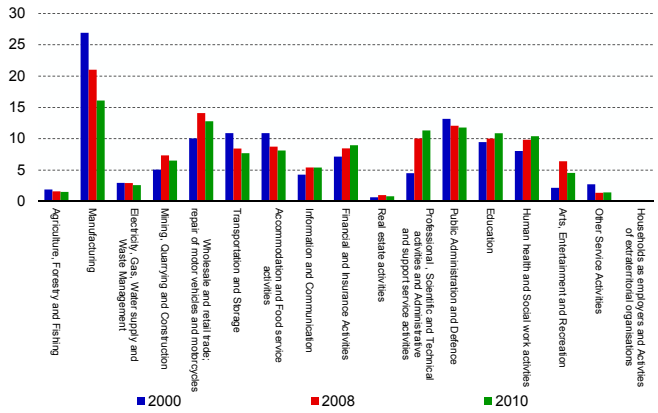
Chart 1
PERCENTAGE LOSS IN TOTAL GROSS VALUE ADDED RESULTING FROM THE HYPOTHETICAL EXTRACTION OF EACH SECTOR
(per cent)



Source: Author's calculations.

same period, a number of sectors experienced significant increases in all three extraction effects. The two sectors with the most significant growth in all three extraction effects are the [11] Professional, scientific and technical activities and administrative and support service activities sector and the [15] Arts, entertainment and recreation activities sector. Other sectors that also experienced a sizable increase in all three extraction effects are the [9] Financial and insurance activities sector, the [14] Human health and social work activities sector and the [8] Information and communication activities sector.

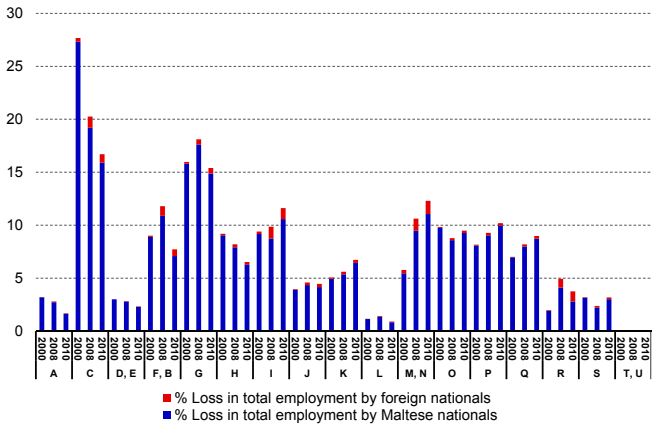
Chart 2
PERCENTAGE LOSS IN TOTAL LABOUR INCOME RESULTING FROM THE HYPOTHETICAL EXTRACTION OF EACH SECTOR
(per cent)



Source: Author's calculations.

According to Chart 3, the largest extraction effects on the employment of foreign nationals were generated by the [11] Professional, scientific and technical activities, and administrative and support service activities followed by the [7] Accommodation and food service activities sector and the [15] Arts, Entertainment and Recreation activities sectors. The growth in these extraction effects and the impact on foreign nationals observed in nearly all sectors, across all three SIOTs, reflects the increased importance of foreign nationals to the production activities of the Maltese economy.

Chart 3
PERCENTAGE LOSS IN TOTAL EMPLOYMENT RESULTING FROM THE HYPOTHETICAL EXTRACTION OF EACH SECTOR
(per cent)



Source: Author's calculations.

An assessment of the forward and backward linkages, for each sector and across the three SIOTs, provides significant insights into the changes which have occurred in the production structure of the Maltese economy between 2000 and 2010.[6] Table 2 presents a summary of the resulting sectoral linkage classifications obtained for

[6] For the full set of backward and forward linkages results refer to the full study which can be found at https://www.centralbank-malta.org/en/working-papers-2017.

Table 2
A SUMMARY OF THE VARIATION IN SECTORAL LINKAGES OVER THE THREE SIOTs[(1)]

	Strong backward and forward linkages (Key Sector)	Only strong backward linkages	Only strong forward linkages	Weak linkages
SIOT 2000	1, 2, 8, 9, 11	6, 7, 12, 15	3, 5	4, 10, 13, 14, 16, 17
SIOT 2008	3, 4, 5, 6 ,8, 9, 11	1, 7, 12, 16		2, 10, 13, 14, 15, 17
SIOT 2010	1, 3, 4, 5, 6, 8, 11	7, 12, 16	10	2, 9, 13, 14, 15, 17

(1) The sector numbers shown in this table correspond with those listed in Table 1.

Source: Author's calculations.

each of the three SIOTs and derived from the application of the non-complete hypothetical extraction method. It should be noted that a sector is classified as a key sector if it is found to have both strong forward and backward linkages. An initial assessment of the results obtained illustrate that between 2000 and 2010 there was an increase in the number of sectors classified as key sectors, from five to seven, indicating a higher degree of sectoral interdependence that reflects greater sectoral diversification.

Across all three SIOTs, only two sectors were found to be consistently classified as key sectors, the [11] Professional, scientific and technical activities and administrative and support service activities sector and the [8] Information and communication services sector, highlighting the importance of these two sectors within the context of the economic development strategy of the Maltese economy. Two other sectors which, based on the linkages analysis, should also be regarded as strategically important are the [7] Accommodation and food service activities sector[7] and the [3] Electricity, gas, water supply and waste management sector, which exhibited the strongest backward and forward linkages, respectively, across all three SIOTs.

Conclusion

The results obtained indicate that the production structure of the Maltese economy has passed through a number of significant structural changes over the last fifteen years. As expected, these changes were more pronounced between the 2000 and 2008 SIOTs than between the 2008 and 2010 SIOTs. It should be noted that although hypothetical exaction analysis is subject to the limitations of standard input-output methodology, the results are to an extent also affected by changes in statistical compilation methodologies and the degree of aggregation used.[8]

The measures obtained from the hypothetical extraction analysis undertaken in the study should be viewed by policy makers as a robust indication of how the production structure of the Maltese economy has evolved since 2000. Thus, these indicators, which account for the sectors' degree of interdependence, may be utilized to assess the role of each sector in promoting growth and strengthening Malta's overall competitiveness.

7 This sector is often used as an approximation for the tourism industry.

8 For instance, the manufacture of food and beverages, the manufacture of electronics and the manufacture of pharmaceuticals, along with other industries, have all been aggregated within the manufacturing sector. This implies that it was not possible to derive estimates that capture the strength of the sectoral linkages exhibited by these aggregated sectors.