

Sectoral linkages and economic crisis: An input-output analysis of the Cypriot economy

Elias Giannakis^{*,a} and Theofanis P. Mamuneas^b

^a *Energy, Environment and Water Research Center, The Cyprus Institute*

^b *Department of Economics, University of Cyprus*

Abstract

The objective of this paper is to analyse the inter-industry linkages and interdependencies in Cyprus economy during the recent economic crisis. The input-output multiplier analysis indicates that the food manufacturing industry and the transportation sector are the sectors with the highest backward linkages in the Cypriot economy overtime. The food manufacturing industry and the agricultural sector achieved to increase their positive economy-wide effects in the economy during the recession. Supporting the partnership of these sectors can enhance the whole agri-food chain and invigorate economic growth in both good and bad times. The banking-financing sector, although it suffered the brunt of the economic recession impacts, also managed to increase its multiplier effect, thus confirming its important role on the stability of the Cypriot economy. The size of the economy-wide multiplier effect of economic sectors is a key criterion in judging industries' potential on promoting economic growth.

Keywords: Economic crisis, Input-output analysis, Inter-industry linkages, Agri-food sector, Banking-financing, Cyprus.

1. Introduction

Economic shocks negatively affect national and regional economies in terms of gross domestic product (GDP) and employment generation. However, the impacts of the economic downturn are not homogeneous across economic sectors indicating the capacity of some production sectors to better withstand the recessionary effects. The sectoral composition of the economy, that is, the mix of industries and their interrelationships, significantly affects the magnitude of the economic crisis at both national and regional level (Boschma, 2015). Given the volatility and unpredictability of the recent economic crisis, a better understanding of how economic sectors interact with each other is rather important (Giannakis, and Bruggeman, 2017a). The aim of this paper is to analyze the inter-industry linkages within Cypriot economy during growth and

* Corresponding Author, Address: Energy, Environment and Water Research Center, The Cyprus Institute, P.O. Box 27456, 1645 Nicosia, Cyprus, Tel. +357 22208683 , E-mail: e.giannakis@cyi.ac.cy.

recession periods. We focus on the sectoral composition of the economy and how the purchaser-supplier relationships among the economic sectors altered during the recession.

The world economy has experienced great volatility and uncertainty during the last decade. The global economic downturn that erupted in 2008 was triggered by the collapse of the US housing bubble and the excessive expansion of credit. The financial crisis was immediately transmitted across the Europe, although its depth has been highly uneven across the Continent (Christopherson et al., 2015). Significant differences in the ability of countries to withstand the impact of the recessionary shock were revealed between the continental northern-central countries and the southern periphery (Giannakis and Bruggeman, 2017b). For example, in terms of GDP generation, Germany had already returned to its pre-crisis levels in 2011, while Greece witnessed a decline of 26.3% between 2008 and 2013, and Cyprus of 10.3% between 2012 and 2014 (Eurostat, 2018a). Similarly, in terms of unemployment, Germany had already fallen back to 2008 levels from 2011 (5.8%), while by 2016, almost eight years after the onset of the crisis, unemployment remains very high in Greece (23.6%), Spain (19.6%) and Cyprus (13%) (Eurostat, 2018b).

Zenios (2013) describe the economic crisis in Cyprus as the 'perfect crisis', which is the result of a confluence of sovereign and private sector debt crisis and a banking crisis. However, Cyprus has been experienced a prolonged period of stability and economic growth in the pre-crisis period (see Section 2). Although the uninterrupted growth of Cypriot economy the previous decades, substantial economic vulnerabilities were emerging and building up; the economy was gradually losing its competitiveness that resulted in widening current account deficits, while the financial sector was rapidly growing exceeding several times country's size (Hardouvelis and Gkionis, 2016). During the economic growth period, which was characterized by a great credit expansion, Cyprus under-invested in machinery and equipment, which are important drivers of economic growth, and over-invested in physical structures (Clerides, 2014). Thus, the accumulated domestic and foreign capital was not directed into productive investments but rather to consumption and investment in real estate and construction sectors. Simultaneously, the rise in domestic demand led to a huge property bubble. In other words, Cyprus was living beyond its means and the high economic growth rates were mainly attributable to external borrowing (Hardouvelis and Gkionis, 2016). So, when the global financial crisis came, Cyprus was vulnerable and more exposed than other countries.

In this paper an input-output model is employed to analyse the inter-industry linkages and interdependencies in Cyprus economy during the recent economic crisis. The size of the economy-wide multiplier effect of economic sectors is a key criterion in judging industries' potential to recover and promote economic growth. The input-output multiplier analysis indicates that the food manufacturing industry and the transportation sector are the sectors with the highest backward linkages in the Cypriot economy overtime. The banking-financing sector, although it suffered the brunt of the economic recession impacts, managed to increase its multiplier effect to the rest economic sectors in terms of output and employment generation, thus confirming its important role on the stability of the Cypriot economy.

The paper is organized as follows: Section 2 outlines the methodological framework of the study, namely, the input-output analysis, and the available data. Section 3 presents the results, while the paper ends with the discussion of the results and conclusions drawn from the analysis.

2. Methodology and Data

Input-output (IO) analysis is a quantitative technique for studying the interdependence of production sectors in an economy over a stated time period, usually a year (Miller and Blair, 2009). An IO table identifies the major sectors of economic activity in a national and/or regional economy, and records the financial flows among them. The rows of the table show how the output of the sectors is distributed throughout the economy, while the columns show how each sector obtains inputs from the other sectors to produce its commodities and services. The value of production consists of the intermediate consumption of inputs plus the value added; the higher the level of intermediate inputs, i.e., those purchased from local firms, the stronger the linkages within the economy through the indirect effects created in the output of the supplying sectors (Giannakis and Bruggeman, 2017a). The backward linkages of a sector indicate the interconnection of that particular sector with those (“upstream”) sectors from which it purchases inputs. On the other hand, the forward linkages of a sector indicate the interconnection of that sector with those (“downstream”) sectors to which it sells its output (Miller and Blair, 2009). Economic sectors with strong backward and forward linkages are termed as “key” or “leading” sectors, and play an important role in the economic development of a country (Hirschman, 1958).

IO models have been extensively applied for policy impact evaluation, technical change analysis and forecasting (Giannakis and Efstratoglou, 2011; Giannakis et al., 2014). IO multipliers provide an effective tool for impact analysis by estimating the economy-wide effects of an initial change in the final demand for the output of a particular sector. They express the difference between the initial effect of the exogenous change and the total effects of that change. The multipliers that encompass direct and indirect effects are called Type I multipliers (estimated from an IO model that is open with respect to households); Type II multipliers capture in addition the induced effects stimulated by household income generation through payments for labour services and the associated consumer expenditures on goods produced by the various sectors (estimated from an IO model that is closed with respect to households). However, Type 2 multipliers tend to overestimate economic impacts (Miller and Blair, 2009). Here, Type 1 output and employment multipliers are estimated. The IO methodology is briefly reviewed in the Appendix I.

GDP and employment data were obtained by the Statistical Service of Cyprus (CYSTAT 2017a; CYSTAT, 2017b). The 2010 IO table for Cyprus was also obtained by the Statistical Service of Cyprus (CYSTAT 2017a). The Cyprus economy grew between 1999 and 2011 with an annual growth rate in real GDP of 3.5% (constant prices 2005). Cyprus entered in recession in 2012 and the economic output was in decline for three consecutive years (2012-2014) with a total loss of 10.3%, while the recovery of the economy began in 2015. During the recession period, the unemployment rose at unprecedented rates, i.e., from 7.9% in 2011 to 16.1% in 2014.

Figure 1 presents the sectoral GDP and employment trends from 1999 to 2016. Studying the real GDP dynamics (constant prices 2005), we observe that during the economic growth period (1999-2011), the Banking-Financing sector achieved the highest annual growth rate of 9.1% followed by the sectors of Trade (7.2%) and Real Estate (5%) (Figure 1). On the contrary, the economic output of Agriculture was shrinking with an annual rate of 2.1% followed by the Manufacturing industry (-1.5%). During the recession period (2012-2014), the Mining sector lost cumulatively 23.9% of its economic output followed by the Construction sector (-15.1%) and Manufacturing industry (-7.4%). The recovery phase of the economy (2015-2016) is characterized by the large increase of the

economic output of the Mining sector (31.9%)¹ followed by the Accommodation and Food services sector (7.2%) and Agriculture (5.4%); the Banking-Financing sector is the only one with negative growth rates (-1.3%).

Similarly, during the economic growth period, the sectors that achieved the highest annual employment growth rates were Electricity Gas and Water (10.7%), Mining (10.5%) and Education (8.5%). On the contrary, the Transportation sector and the Manufacturing industry were losing employment at an annual rate of 2.1% and 1.5%, respectively (Figure 1). The Construction sector bore the brunt of job losses (-45%) during the recession period highlighting the collapse in the property bubble. The Banking-Financing sector also lost in the recession period around 25% of its workforce, while its economic output was shrunk by 9% implying labour productivity gains. On the contrary, economic sectors such as Accommodation and Food Services and Public Administration exhibited rather resilient behavior increasing their workforce by 6% and 4.2%, respectively. The recovery period is characterized by the substantial increase of employment of the Real Estate sector (71.1%) followed by the Mining (23.2%), Electricity Gas and Water (20.5%) and Construction (20.1%) sectors.

The changes in the inter-sectoral structure of the Cypriot economy from the economic growth to the economic downturn period were assessed on the basis of the 2010 and 2016 symmetric IO tables. The 2010 symmetric IO table for Cyprus, which is the latest available by the Statistical Service of Cyprus, is assumed to represent the structure of the economy in the growth period. The RAS method, a widely known and commonly used technique for balancing and updating IO matrices, was used to update the 2010 symmetric IO table to 2016², which is assumed to encompass the impact of the economic crisis on the structure of the economy. The initial scheme of 65 sectors of economic activity was aggregated into 19 economic sectors (see Appendix III).

3. Results

The input-output multiplier analysis identified the most important sectors of economic activity with regards to their capacity to enhance the economic output and employment generation. Table 1 depicts the output and employment multipliers for the 19 sectors of economic activity, while Figure 2 presents the percentage change of multipliers between 2010 and 2016.

During the economic growth period (2010), the Transportation sector created the highest direct and indirect effects on the output of the Cypriot economy (2.39). The meaning of this multiplier is that for a 1 million euro increase in the final demand for the products and services of the Transportation sector, the total output of the economy will be increased by 2.39 million euro. Significant backward linkages were created also by the Food Manufacturing industry (1.95), the Construction (1.85) and the Accommodation and Food Services sector (1.68). Examining the changes from 2010 to 2016, it can be seen that Food Manufacturing industry increased its positive economy-wide effects in the rest economic sectors (4.9%), having in 2016 the highest output multiplier (2.05). The Transportation sector had in 2016 the second highest output multiplier (1.79) although its impact on output generation declined significantly (-25.2%). Real Estate and all manufacturing sectors (with the exemption of Food Industry) noticed a significant decline of

¹ We have to mention here the small share of the Mining sector in the total GDP of the Cypriot economy, that is, 0.1% in 2015.

² The application of the RAS technique is briefly presented in the Appendix II.

their impact on the generation of economic output (Figure 2). Interestingly, the Agriculture and the Banking-Financing sector managed to increase their backward linkages during the recession period by 5.4% and 3.3%, respectively.

TABLE 1

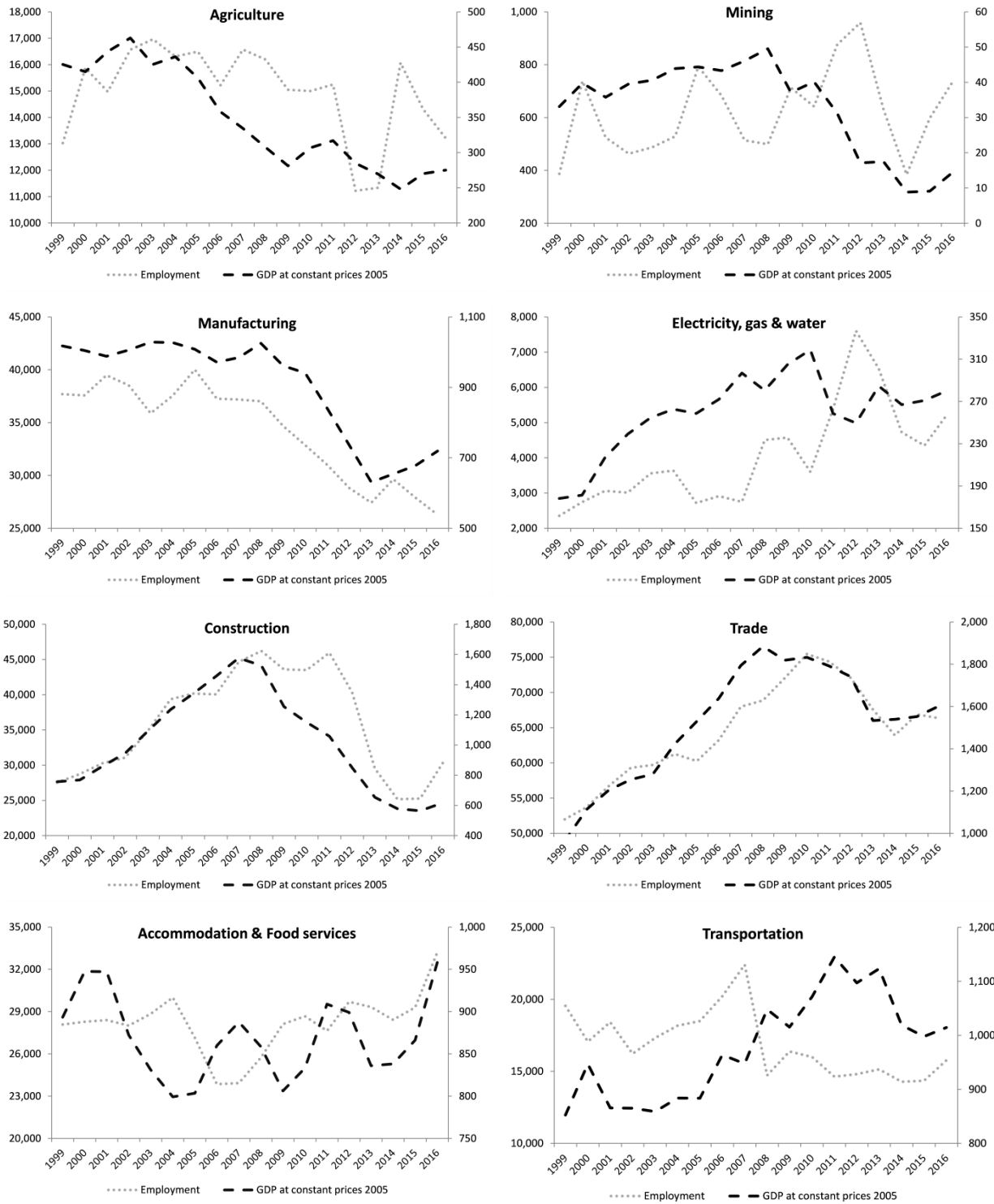
Output and employment multipliers for Cypriot sectors of economic activity (2010 and 2016)

Sectors of Economic Activity	Output Multipliers		Employment Multipliers	
	2010	2016	2010	2016
Agriculture	1.56	1.65	1.36	1.44
Mining	1.51	1.77	1.59	1.76
Food Manufacturing	1.95	2.05	2.54	2.69
Textile	1.50	1.45	1.31	1.22
Wood and Paper	1.58	1.50	1.51	1.36
Chemical and Plastic Products	1.59	1.47	1.42	1.30
Metal and non-metal products	1.61	1.43	2.28	1.59
Machinery and equipment	1.49	1.37	1.46	1.24
Electricity, gas and water	1.42	1.34	2.51	1.89
Construction	1.85	1.71	1.75	1.49
Trade	1.55	1.42	1.24	1.22
Accommodation and Food Services	1.68	1.66	1.49	1.40
Transportation	2.39	1.79	3.15	3.13
Banking - Financing	1.60	1.66	2.17	2.72
Real Estate	1.42	1.28	5.89	3.25
Public administration	1.22	1.34	1.16	1.19
Education	1.10	1.20	1.05	1.09
Health	1.31	1.48	1.20	1.23
Other Services	1.32	1.35	1.27	1.24

Regarding the employment multiplier effects of economic sectors, in 2010, the Real Estate sector had the highest multiplier (5.89), which means that for each new job created in the sector, 5.89 jobs were created in the economy (Table 1). The Transportation sector and the Food Manufacturing industry also created high backward employment linkages, having the second (3.15) and third (2.54) highest multipliers, respectively. During the economic crisis period, the highest losses in terms of sectors' ability to create employment multiplier effects took place in the Real Estate sector (-44.9%) and the manufacturing sectors (Figure 2). On the contrary, the Food Manufacturing industry (5.8%), Agriculture (5.7%) and the Banking-Financing sector (25.6%) managed to increase their multiplier effects in employment generation. Despite these changes, the sectors with the highest employment multiplier effects remained almost the same compared to 2010; the Real Estate sector has the highest employment multiplier (3.25), followed by the Transportation sector (3.13), the Banking-Financing sector (2.72) and the Food Manufacturing industry (2.69).

FIGURE 1

Sectoral GDP (at constant prices 2005) and employment (persons) trends, 1999-2016



Sectoral GDP (at constant prices 2005) and employment (persons) trends, 1999-2016

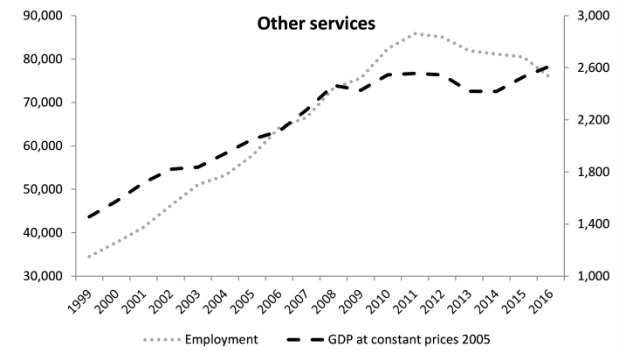
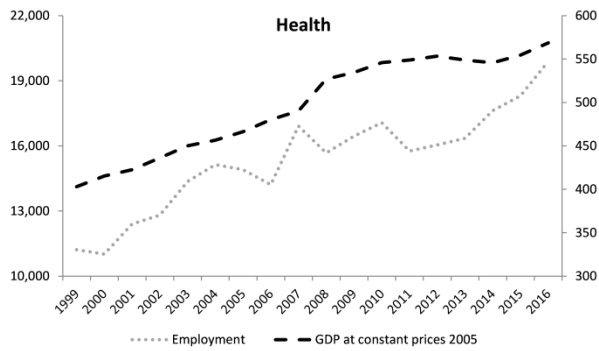
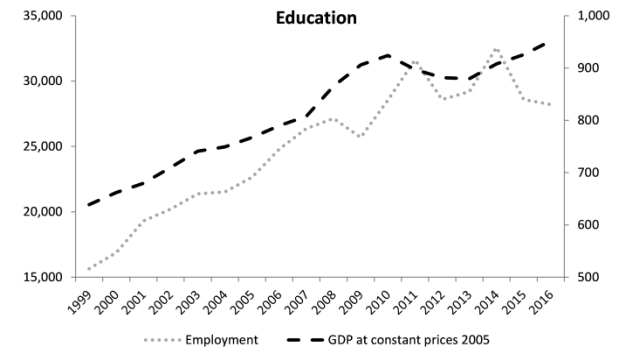
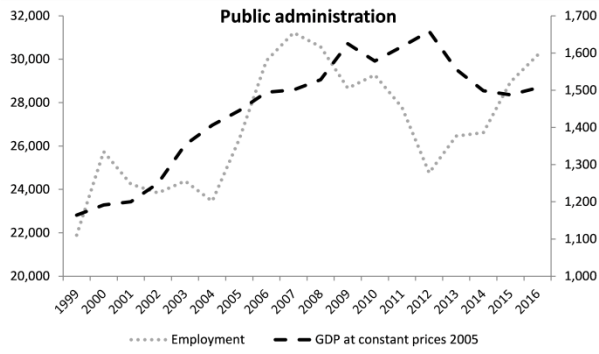
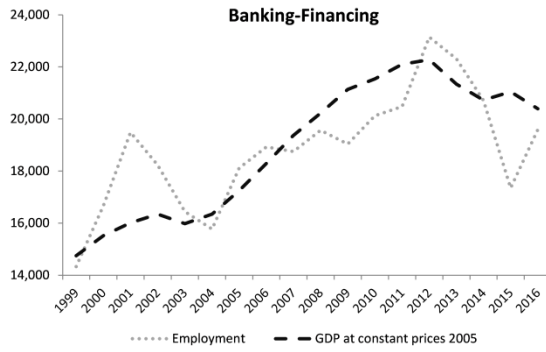
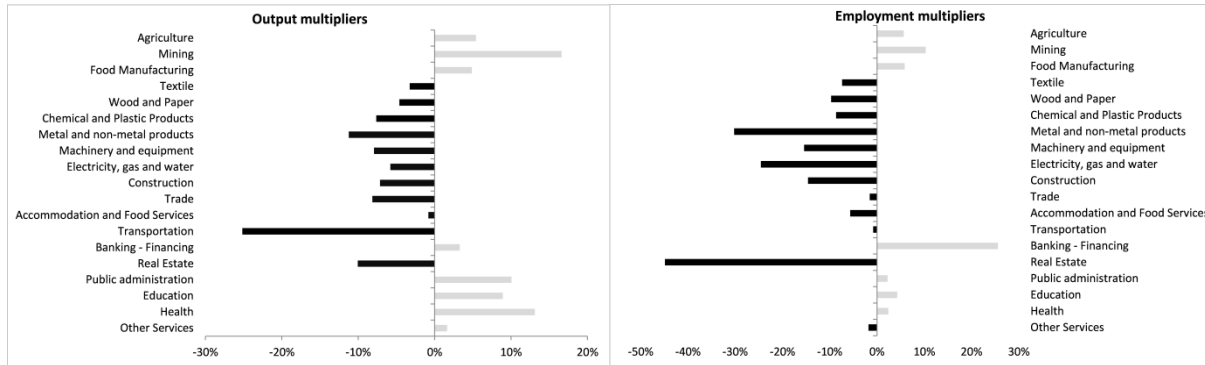


FIGURE 2

Percentage change in output and employment multipliers between 2010 and 2016



4. Discussion and Conclusions

Cyprus is slowly and robustly emerging out of the recession; the economy has been growing from 2015 onwards, the unemployment is declining, while the country has access to the international markets and can borrow at relatively low interest rates. The recent economic crisis exposed the vulnerabilities of the Cypriot economy but also shed new light on the way the economic system functions. The recovery of Cyprus from the severe economic downturn suggests that the country should follow a different and better focused economic model compared to the pre-crisis path. The overinvestment in the Real Estate and the Construction sectors in the pre-crisis period had crowded out productive investments in other sectors of economic activity that could have strengthened the productive capacity of the economy (Clerides, 2014).

The input-output multiplier analysis revealed that the Food Manufacturing industry and the Transportation sector are the sectors with the highest backward linkages in the Cypriot economy overtime. Especially, the performance of the Food Manufacturing industry in the recent recession highlights its important role in the economy that either has been neglected or undermined. Mattas and Tsakiridou (2010) provide evidence on the crucial role of Food industry as an employment 'stimulator' throughout the supply chain in Europe during recessionary periods, while Giannakis and Bruggeman (2017a) highlight the resilience of the Food Manufacturing industry to economic crisis and its high multiplier effects in Greece. Moreover, the Agricultural sector in Cyprus managed to increase its impact on generating economic output and employment between 2010 and 2016. Considering the strong linkages of Agriculture with Food Manufacturing industry, the support of this partnership can enhance the whole agri-food chain and invigorate economic growth in both good and bad times. Significant is also the contribution of the agri-food sector in the viability of the rural areas of Cyprus (Giannakis, 2014). The Common Agricultural Policy provides the regulatory framework and tools to further empower the linkages between the two sectors (Giannakis and Bruggeman, 2015). The Cyprus government should further support farm education schemes and advisory services including issues such as short food supply chains, which could further improve the economic performance of the sector.

It's worth mentioning that the Banking-Financing sector managed to maintain and increase its multiplier effect although it was severely hit by the closure of Laiki Bank, the restructuring of the Bank of Cyprus and the imposition of a haircut on depositors. The increase of the sector's positive economy-wide effects in the other economic sectors, mainly in terms of employment generation, confirms the important role of the sector on the stability and development of the Cypriot economy. Even though the employment of the Banking-Financing sector largely decreased during the recession, the output level of the sector declined proportionately less implying labour productivity gains. As a result, the increase of the competitiveness of the sector generated positive economy-wide effects. As long as the Banking-Financing sector continues to have productivity gains and output growth, its positive multiplier effect will stimulate economic growth to the other economic sectors. The government should continue to provide the appropriate institutional framework and legislation that promotes and ensures the reliability of the banking system.

The Accommodation and Food Services sector has the fifth highest output multiplier in 2016 and only the tenth employment multiplier with marginal losses of its capacity in generating output and employment in the remaining sectors between 2010 and 2016. The tourism sector is a stable pillar for the growth of the Cypriot economy, but as Mamuneas and Ketteni (2016) point out, the sector should enhance its competitiveness through primarily investing in safety and culture and to a lesser extent in infrastructure and quality of services.

Considering the major economic and social costs of recessionary shocks, the stimulation of economic activity in the high output and employment generating sectors of Cyprus economy could ameliorate those effects. The results of the paper are driven by changes in the final demand, therefore the government should promote a stable macroeconomic environment that stimulates final demand through reduction of taxation and investment in new technologies and innovations. Increases in capital spending and new investment are necessary for achieving high and sustainable growth paths in the long-run and this calls for decisive policy actions. The size of the output and employment multiplier effect of the economic sectors is a key criterion in judging the dynamics and the ability of an industry to invigorate economic growth. However, further research is needed to better understand the backward and forward linkages of the leading economic sectors over time.

Appendix I

Input-Output Methodology

Assume an economy with n sectors; the basic structure of an input-output model is a system of linear equations, which captures the interdependencies of intermediate goods and final demand as follows:

$$\begin{array}{rcccccccc}
 x_1 & = & x_{11} & + & \dots & + & x_{1j} & + & \dots & + & x_{1n} & + & y_1 \\
 \vdots & & \vdots & & & & \vdots & & & & \vdots & & \vdots \\
 x_i & = & x_{i1} & + & \dots & + & x_{ij} & + & \dots & + & x_{in} & + & y_i \\
 \vdots & & \vdots & & & & \vdots & & & & \vdots & & \vdots \\
 x_n & = & x_{n1} & + & \dots & + & x_{nj} & + & \dots & + & x_{nn} & + & y_n
 \end{array} \tag{I1}$$

Each row contains the total output (x_i) of an economic sector i ($i = 1, \dots, n$) as the sum of the interindustry sales of sector i to all sectors j (x_{ij}) and the final demand (y_i) for sector i 's product.

The technical or direct input coefficients (a_{ij}) measure the relationships between a sector's output and its inputs, i.e., relate the output x_j of sector j to its inputs from sectors i as follows:

$$a_{ij} = \frac{x_{ij}}{x_j} \tag{I2}$$

$$x_{ij} = a_{ij}x_j \tag{I3}$$

The system of linear equations (I1) can be written in matrix notation as follows:

$$X = AX + Y \tag{I4}$$

Where A is the technical coefficients matrix.

Solving equation (I4) for X , we obtain equation (I5):

$$X = (I - A)^{-1}Y \tag{I5}$$

Where $(I - A)^{-1} = L$ is known as the Leontief inverse (Leontief, 1966) or the total (direct and indirect) requirements matrix.

The L matrix is a central tool in multiplier analysis as it quantifies the impact that changes in Y (ΔY) have on X (ΔX). L captures, in each of its elements (l_{ij}) all the infinite series of round-by-round direct and indirect effects exerted by a given final demand vector (Y) on the output of each sector (Miller and Blair, 2009).

The Type I output multiplier for a particular sector j is defined as the column sums of the L matrix, that is, $\sum_{i=1}^n l_{ij}$.

The Type I employment multiplier of an industry j is calculated as the ratio of the direct and indirect effect, expressed by the multiplication of direct employment/output ratios $\left(\frac{E_j}{x_j}\right)$ by the L matrix to direct employment coefficients.

For a detailed explanation and numerical examples of the input-output methodology see Miller and Blair (2009, p. 22).

Appendix II

RAS Technique

The aim of the RAS technique used in this study is to estimate the technical coefficient matrix A for the target year, that is, 2016 based on the 2010 IO table. Three pieces of information are required for the target year 2016, namely, (a) total gross outputs, (b) total sectoral inter-industry sales, which can be derived as total output of sector i less i 's sales to final demand, (c) total interindustry purchases per sector, which can be derived as total output less value added less imports³.

The vector of gross outputs for year 2016 is denoted by $x(1)$; the vector of total sectoral inter-industry sales is designated by $u(1)$; the vector of total sectoral inter-industry purchases is designated by $v(1)$.

The first step in RAS is to make the assumption that technical coefficients have remained stable over time, that is, $A(0) = A(1)$. The initial estimate of the target transaction matrix is calculated as follows:

$$Z(0) = A(0) * \hat{x}(1) \quad (\text{II.1})$$

The row sums of $Z(0)$ become then the u^0 vector and the column sums the v^0 vector. The vector r^1 calculated as the ratio of $u(1)$ to $u(0)$ is then multiplied to the rows of the $A(0)$ to make them equal to $u(1)$ as follows:

$$A^1 = \hat{r}^1 * A(0) \quad (\text{II.2})$$

Where \hat{r}^1 is the diagonal matrix of r^1 .

In the A^1 matrix the row sums are now equal to $u(1)$. Similarly, column sums are scaled up or down to the values given by $v(1)$ as follows:

$$Z^1 = A^1 * \hat{x}(1) \quad (\text{II.3})$$

The vector s^1 calculated as the ratio of $v(1)$ and v^1 is then multiplied to A^1 to correct column sums as follows:

$$A^2 = A^1 * \hat{s}^1 \quad (\text{II.4}) \text{ or}$$

$$A^2 = \hat{r}^1 * A(0) * \hat{s}^1 \quad (\text{II.5})$$

Where \hat{s}^1 is the diagonal matrix of s^1 .

The right-hand side of (II.5) reads "RAS", where R is the diagonal matrix of elements modifying rows, A is the coefficient matrix being modified and S is a diagonal matrix of column modifies (Miller and Blair, 2009).

A^2 is the second estimate of $A(0)$ before reaching the target year coefficient matrix $A(1)$.

Following the steps described above n times computes estimates r^n and s^n . The procedure normally quickly converges to a stable estimate (Jackson and Murray, 2004).

³ For more details on the application of the RAS technique see Miller and Blair (2009).

Appendix III

TABLE III.1

NACE¹⁸ codes of sectors of economic activity of input-output tables for Cyprus, 2010 and 2016

n/n	Sector	Description NACE ⁴
1	Agriculture	A01, A02, A03
2	Mining	B
3	Food Manufacturing	C10, C11, C12
4	Textile	C13, C15
5	Wood and Paper	C16, C17, C18
6	Chemical and Plastic Products	C19, C20, C21, C22
7	Metal and non-metal products	C23-C25
8	Machinery and equipment	C26--C33
9	Electricity, gas and water	D35, E36, E37-39
10	Construction	F
11	Trade	G45-G47
12	Accommodation and Food Services	I
13	Transportation	H49-H53
14	Banking - Financing	K64-K66
15	Real Estate	L68
16	Public administration	O84
17	Education	P85
18	Health	Q
19	Other Services	J58, J59, J60, J61, J62-63, M69-70, M71, M72, M73, M74, M75, N, RS, T, U

Source: Eurostat (2008).

References

- Boschma, R., (2015), 'Towards an evolutionary perspective on regional resilience', *Regional Studies*, 49(5): 733-751.
- Christopherson, S., Clark, G.L., and Whiteman, J., (2015), 'Introduction: The Euro crisis and the future of Europe', *Journal of Economic Geography*, 15(5): 843-853, DOI:10.1093/jeg/lbv026
- Clerides, S., (2014), 'The collapse of the Cypriot banking system: A bird's eye view', *Cyprus Economic Policy Review*, 8(2): 3-35.
- Eurostat, (2008), 'Statistical classification of economic activities in the European Community. NACE Rev. 2', Luxembourg: Office for Official Publications of the European Communities.
- Eurostat, (2018a), 'GDP and main components (output, expenditure and income) [nama_10_gdp] '. Available at: http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=nama_10_gdp&lang=en
- Eurostat, (2018b), 'Unemployment by sex and age - annual average [une_rt_a]'. Available at: http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=une_rt_a&lang=en

⁴NACE: Statistical classification of economic activities in the European Union.

- Giannakis, E., and Efstratoglou, S., (2011), 'An input-output approach in assessing the CAP reform impact of extensive versus intensive farming systems on rural development: the case of Greece', *Agricultural Economics Review*, 12(1): 81-90.
- Giannakis, E., Efstratoglou, S., and Psaltopoulos, D., (2014), 'Modelling the impacts of alternative CAP scenarios through a system dynamics approach', *Agricultural Economics Review*, 15(2): 48-67.
- Giannakis, E., (2014), 'The role of rural tourism on the development of rural areas: The case of Cyprus', *Romanian Journal of Regional Science*, 8(1): 38-53.
- Giannakis, E., and Bruggeman, A., (2015), 'The highly variable economic performance of European agriculture', *Land Use Policy*, 45: 26-35, DOI: 10.1016/j.landusepol. 2014.12.009
- Giannakis, E., and Bruggeman, A., (2017a), 'Economic crisis and regional resilience: Evidence from Greece', *Papers in Regional Science*, 96(3): 451-476, DOI: 10.1111/ pirs.12206.
- Giannakis, E., and Bruggeman, A., (2017b), 'Determinants of regional resilience to economic crisis: a European perspective', *European Planning Studies*, 25(8): 1394-1415, doi: 10.1080/09654313.2017.1319464.
- Hardouvelis, G.A., and Gkionis, I., (2016), 'A Decade Long Economic Crisis: Cyprus versus Greece', *Cyprus Economic Policy Review*, 10(2): 3-40.
- Hirschman, A. O., (1958), 'The Strategy of Economic Development'. Yale University Press, New Haven.
- Jackson, R., and Murray, A., (2004), 'Alternative input-output matrix updating formulations', *Economic Systems Research*, 16(2): 135-148, DOI: 10.1080/0953531042000219268.
- Leontief, W., (1966), *Input-Output Economics*, Oxford University Press, New York.
- Mamuneas, T., and Ketteni, E., (2016), 'Comparisons of productivity among European sectors and Cyprus: The case of tourism Sector', *Cyprus Economic Policy Review*, 10(1): 57-70.
- Mattas, K., and Tsakiridou, E., (2010), 'Shedding fresh light on food industry's role: The recession's aftermath', *Trends in Food Science & Technology*, 21(4): 212-216, DOI: 10.1016/j.tifs.2009.12.005.
- Miller, R.E., and Blair, P.D., (2009), *Input-output analysis: Foundations and extensions* (2nd Ed.), Cambridge University Press, New York.
- Statistical Service of Cyprus, (2017a), 'National Accounts of Cyprus', CYSTAT, Nicosia, Cyprus.
- Statistical Service of Cyprus, (2017b), 'Labour Force Survey, 1999-2016', CYSTAT, Nicosia, Cyprus.
- Zenios, S. A., (2013), 'The Cyprus debt: Perfect crisis and a way forward', *Cyprus Economic Policy Review*, 7(1): 3-45.