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Apostolides, Alexander

London School of Economics, University of Warwick

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Economic Growth or Stagnation during the Interwar Period: Reconstruction of Cypriot GDP 1921-1938

Alexander Apostolides, London School of Economics and University of Warwick¹
(a.apostolides@lse.ac.uk)

1. Introduction

The overall objective of the paper is to evaluate the growth performance of Cyprus during the interwar (1921-38) period. Pamuk and Williamson (2000) assure us that with the exception of Mandated Palestine, the economic performance of Mediterranean states was poor. In order to evaluate the performance of Cyprus, we construct Gross Domestic Product (GDP) estimates. Estimating the GDP of Cyprus will indicate whether the island was a typical lacklustre growth performer or a non-typical success story.

Understanding the economic development during the interwar period will enhance our understanding of Cyprus' rapid growth after World War II (WWII). The island's post-war growth was very dynamic, despite bleak predictions of dire economic prospects. Writing on the eve of the independence of Cyprus, Mayer (1959) stated that the Cypriot economy was a 'copra-boat' economy that was totally dependent on its status as a British air force base. Mayer believed that independence would result in terminal decline, since 'Cyprus will contain a million people, a fact best appreciated by those who have lived on an aircraft carrier' (1959; pp.49-50). This sentiment was shared by a UN technical mission which reported that 'the Cyprus Economy...seemed to be running along a downhill and rather bumpy road' (Thorp, 1961; p.5).

The development of Cyprus during the past fifty years has refuted such bleak predictions. When Cyprus joined the European Union in 2004 its per capita GDP was already at 82.8% of the EU average (Eurostat, 2006). Cyprus has a higher per capita GDP than

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Greece and Portugal, who have been members and significant beneficiaries of the EU for almost two decades.

The rapid convergence of Cyprus to EU income levels took place despite starting from significantly lower levels. The current high level of per capita GDP was achieved due to very rapid rates of economic growth after WWII: in the period 1950–2003 Cyprus had the second highest rate of GDP growth in Europe, second only to Spain². Thus, despite the pessimistic predictions about the future state of economic development, Cyprus has been successful in converging to the income levels of the rest of Europe. The estimation of Cyprus' GDP in the period 1921 – 1938 will allow a longer-term perspective of the island's growth performance, and facilitate an assessment of whether such rapid growth rates were in part attributed to developments in the interwar period.

The estimation of GDP for this period will narrow a substantial gap in the economic history of Cyprus. The historiography of the island for the interwar period has been focused on political rather than economic issues. The island's strategic importance and the Greek-Cypriot demands for *enosis* have gained the most attention of interwar historians. As a result, the economic history of the period has been sidelined.

During the interwar period of 1921-1938, Cyprus was transferred from a British protectorate to a British colony. Cyprus was occupied by Britain in 1878 under the Cyprus Convention, whereby the island remained nominally under Ottoman Suzerainty but all power was transferred to the British (Hill, 1952). Outdated Ottoman laws and high taxation were essentially maintained and superimposed by a relatively limited constitution (Georghallides, 1979). In addition, the occupation imposed additional heavy taxation on Cyprus. An annual payment of ST£92,799 was to be commuted to the Sultan and raised by Cypriot taxation. Instead, the British Treasury used the money to amortise its burden of defaulted Ottoman loans. The island was annexed in 1914 and declared a

² The annual average growth rate of Cyprus was 4.27%. Source: Groningen Growth and Development Centre (GGDC), *Total Economy Database*, <http://www.ggdc.net> as viewed on 1 May 2006; Heston, A., Summers, R. and Bettina A., *Penn World Table Version 6.2*, Centre for International Comparisons at the University of Pennsylvania (CICUP), as viewed on 6 September 2006; comparisons made with real GDP per capita (PPP)-Chain series.

crown colony in 1925. Despite the annexation of the island, the amount was still debited from Cypriot government expenditure. This was considered a severe constraint on development. The need to maintain a large surplus in revenue prevented any attempt to reduce taxation, and siphoned away any surplus that could be used for development projects (Georghallides, 1979, 1985).

At the same time the relationship between the island's subjects and the British colonial overlords deteriorated to the point of violence. In October 1931, popular riots against British rule took place throughout the island. Such riots were unprecedented in the history of British Cyprus: until then the island had been so trouble free that there was only one under-strength infantry company to suppress it. The proximate cause of the riots was the resignation of the Greek-Cypriot members of the legislative assembly. The riots led to the destruction of the Governor's house, the death of at least ten people and the suspension of the constitution until Cyprus' independence in 1960. As Holland and Markides (2008) argue, "the rupture of October 1931 was to define the polarities of colonial Cyprus for a long time ahead" (p. 186).

The cause of the riots is contested in Cypriot historiography. The colonial government insisted that their cause was purely economic in nature since rural Cyprus was experiencing a serious drought and the effects of the Great Depression. Greek-Cypriot historians argue that the riots were motivated by nationalistic sentiment for union with Greece (Georghallides, 1985).

3. Methodology

The International Association of Income and Wealth (IAIW) was established after WWII for the purpose of formulating a common method of estimating output. By 1953 a general nomenclature and methodology was adopted by the United Nations. These national accounting principles are collectively known as the System of National Accounts (SNA).

The creation of national accounts based on SNA practices allowed for comparative research to evaluate the proximate causes of economic growth and productivity. The

adoption of the SNA by most nations was pivotal in advancing development economics and empirical practice: it enabled economists to search for the reasons rather than evidence of growth (Maddison, 1995). Pioneers of output estimation such as Kuznets and Lindhal saw the creation of historical national accounts (HNA) as equally important to the standardization of current methodological procedures, in order to take a long-term view of economic development (Kuznets, 1975). However, due to the variation in the quality of written records from country to country, no homogenised system of HNA creation has been developed. Most European states have constructed HNA and efforts to improve them are ongoing (Van Ark, 1995). This is the first attempt to estimate HNA for Cyprus: the focus in this first estimate was to collect and collate information from primary sources within a national accounting framework.

There are some spot estimates of the income of Cyprus prior to 1950, but none has been attempted using best practice, thus making the results questionable. Fairfield estimated the national income of Cyprus in 1896 as ST£981,900 (Georghallides, 1975; p.21)³. A committee was set up in 1930 to evaluate the tax burden of the population (Cyprus, 1930). The committee estimated a national income of CY£3,500,000 (CY£2,431,107 in 1938 prices⁴) for 1927, but stated that “it is manifestly next to impossible in the absence of proper statistics to arrive at an accurate estimate” (Cyprus, 1930, paragraph 6). Christodoulou (1992) estimated the income of Cyprus in 1930 as CY£2.8 million (CY£2,615,781 in 1938 prices), but without revealing his methodology (Christodoulou, 1992). Clark (1940) considered Cyprus’ national income in this period to be in the lowest European income band along with Turkey, Bulgaria, Romania and Albania. Maddison (1995) estimated the joint GDP of Cyprus and Malta for 1929, but using a questionable methodology⁵.

The creation of HNA is fraught with difficulties, since output is created using historical sources. The primary data sources that have been used for this estimate of Cyprus were

³ The Cyprus pound was linked through a currency board to the pound sterling. The board was very strict with less than 0.5% variation from the par.

⁴ The conversion to 1938 was made using the Consumer Price Index (CPI) which I have constructed. The (CPI) is deflationary in the 1930s due to the decline in food prices, which constituted 49% of the index.

⁵ The joint per capita GDP level was GK\$1,727 (1990 Geary-Khamis dollars).

not collected with a national accounts framework in mind. Thus, understanding the quality and nature of the underlying data allows one to appreciate the limitations of the estimate we present. The study largely centers on the published reports of the British colonial authorities. The colonial authorities were obliged to collect a significant amount of quantitative information in order to construct the various annual reports demanded by the colonial office in London. Although some of these reports presented the collected data in an ad hoc manner, major exercises such as census reports and the yearly blue books followed a particular nomenclature. Departmental information and annual statistical blue books were the primary sources of information for the period. Additional information was collected from the annual reports of the colonial government's departments and offices. Such information was combined with data from reports published by the colonial governments in response to a particular issue. Occasionally useful information about the interwar period was integrated in post-WWII publications.

However, information remained woefully short for some industries, such as construction. In order to further enrich the dataset, research was undertaken in the national archives of Cyprus and the United Kingdom. The archival research was mainly concentrated on various government files: drafts of annual reports of departments, files of colonial departments and their correspondence⁶. A product by product account of the sources and the estimation method can be found in the Appendix.

Another important information source was the decennial census reports. Cyprus had a census in 1921, 1931 and 1946. The census results were particularly important in evaluating the occupational structure of the economy and providing information on the housing stock as well as useful agricultural sector data.

The research has primarily focused on estimating the output of each sector through the production approach. However, this was not always possible due to data scarcity. In the case where data has been limited the value added of the industry has been estimated from the income side. Industries have been arranged on the basis of the new 2008 Eurostat

⁶ For example, National Archives, Nicosia. File: SA1/1277/1919 "Houses for Government Officials in Nicosia" provided valuable information on the construction and rental income sector.

NACE, rev.2 nomenclature of economic activities to classify the output in sub-groups. Where direct volumes have been estimated, their value has been estimated in 1938 prices. Where deflation was necessary we used Laspeyres volume indexes with Paasche price indexes, with 1938 as the benchmark. The benchmark year for the estimates and the base year for all price indexes was chosen due to the greater availability of both price and volume data.

Work is currently taking place to evaluate error bands of the sectoral and aggregate output. Feinstein and Thomas (2001) argue that the estimation of historical GDP suffers from three types of non-random errors: errors of measurement, of omission and of procedure.

The errors of measurement have been extensively analysed, and the conclusion argues that the underlying data published by the colonial government were quite robust, especially since efforts were made to improve reliability in 1921. Errors of omission in manufacturing have been minimized by including output estimates for the handicraft sector. By comparing the agriculture output of 1960 with the input-output table of 1938 the percentage of agricultural products omitted is 9.6%; this is largely due to the omission of poultry⁷. The errors of procedure have been estimated for animal production: it was found that the current model of animal production shown in the appendix has a stronger correlation with rainfall and available fodder than estimating meat production directly from the yearly stock of animals. The error band for the estimates of agriculture, using Feinstein and Thomas' method, is 7.1%; however, the aggregate error band is bound to increase as the less reliable service sector estimates are included.

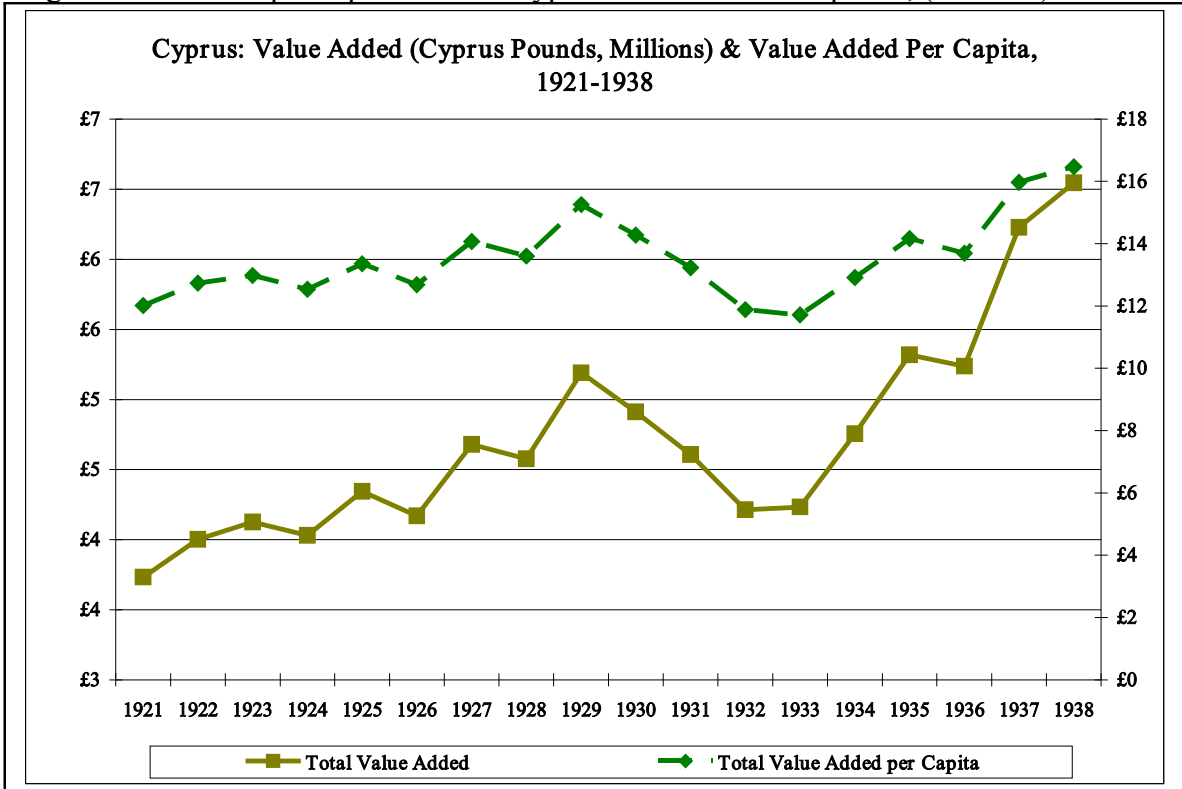
4. Overview of the GDP estimates: GDP and GDP per capita

Figure 1 indicates the estimated GDP and per capita GDP of Cyprus for the period 1921-38. It shows an increase of GDP during the 1920s; however the output was very cyclical. The Great Depression created a recession in Cyprus which was prolonged: per capita GDP in 1933 was 23.2% lower than the 1929 level. Per capita output only recovered to

⁷ The error of omission is less than 9.6% since the greatest omission was poultry and eggs. These categories were less important in 1938 due to the slow diffusion of mass poultry production in Europe prior to WWII.

its pre-depression level in 1937. A comparison between the value added and the per capita value added indicates that the rapid natural increase of the population made it increasingly difficult for Cyprus to maintain positive economic growth.

Figure 1: GDP and per capita GDP of Cyprus in 1938 constant prices, (1921-38)



Source: Own calculations.

Table 1 shows that the average growth rate of GDP in the 1920s was 1.93%, confirming that growth was slow after the 1921 slump (Angelides, 1996). The effect of the depression coincided with a serious drought: this explains the catastrophic reversal of GDP growth, with GDP in 1932-33 being lower than in 1921. The recovery after 1934 was very rapid and by the end of 1938 per capita GDP had risen beyond its 1929 peak. Thus the development of Cyprus prior to WWII was quite poor considering that the starting year was one of recession due to the demobilisation of the British Empire after the First World War. In 1937 growth accelerated, since the demand for Cypriot copper was dramatically increased by Germany’s rearmament. Cypriot copper was in great demand in Germany, since its chemical properties were ideal for the smelting processes used there (Lavender, 1962).

The results fit-in well with the historiography of Cyprus' development. They help explain the disagreement between the optimists and the pessimists of Cypriot economic development. Optimists were looking at the end of the 1930s and the rapid increase of output, while historians interested in the long-term welfare of the population were pessimistic due to the slow recovery of per capita income back to its pre-depression level.

The per capita income of Cyprus does seem to vindicate those historians that were pessimistic about development prior to WWII. Although the optimists can point out that the average growth rate (Table 1) would double the income of Cyprus in 37 years, the pessimists can point out that the growth rate was less than other Mediterranean countries (Table 2), and lower than post-WWII rates of growth. The variability of growth, due to the dependence of Cyprus on weather based agriculture, was also detrimental to economic development, since the violent fluctuations of output had a disproportionate effect on the poor agricultural labour force. The 1930s was a tale of two-halves: sharp decline until 1933 and rapid growth in the second half of the decade.

The recovery of GDP and GDP per capita after 1934 did not percolate to the large rural base of the population as it was localised. The recovery was underpinned by a rapid expansion of the copper mining sector which was concentrated in the west of the island. The recovery would also be deflated in GNP terms. Although a direct GNP estimate could not be calculated, the existence of large profits by the largest mining corporation (the Cyprus Mining Corporation, an American company) implies an increase of expatriated profits (Lavender, 1962), while any remittances from Cypriots working abroad were minor due to the small level of migration out of Cyprus before 1946 (Veropoulou, 1997) .

Table 1: Per capita GDP growth rates, Cyprus (1921-38)

	Change in per capita GDP (%)
1921-38	1.87
1921-30	1.93
1930-38	1.80

1929-33	-6.40
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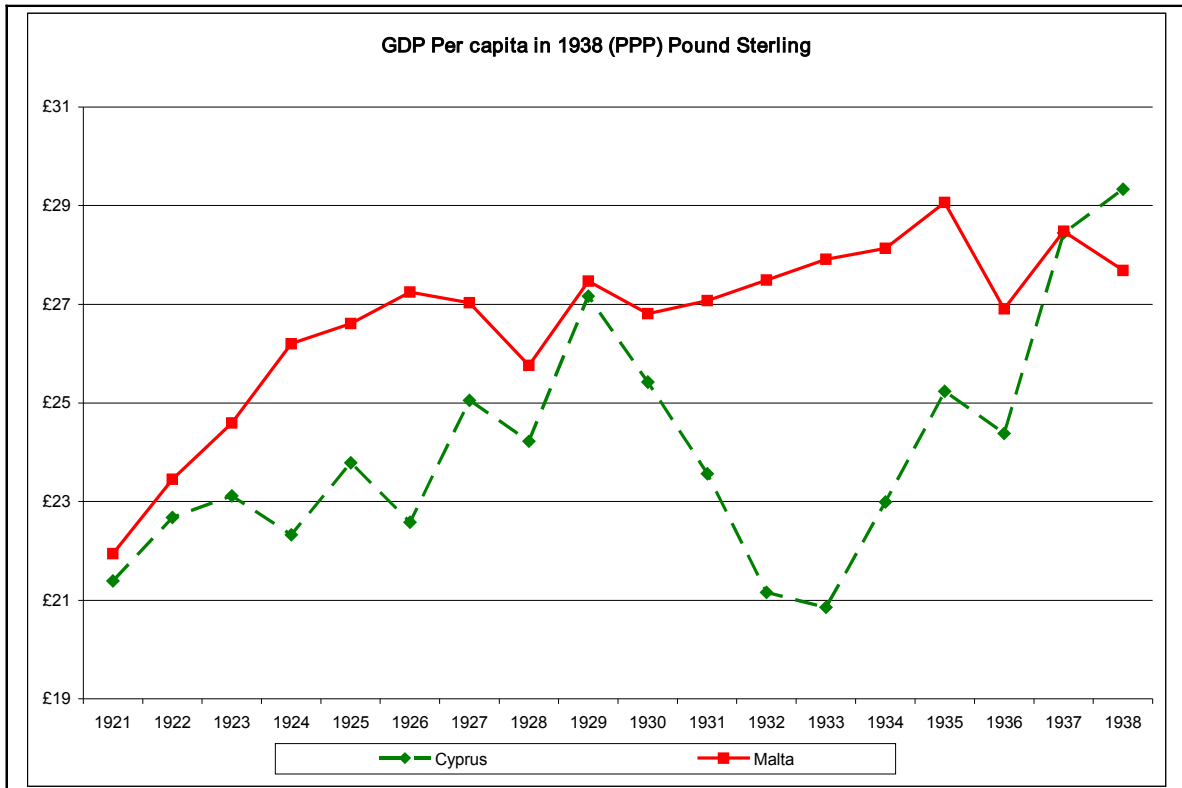
Source: Own calculations.

The experience of Cyprus was similar to other economies, but certainly very different from another British European colony, that of Malta. Figure 2 indicates the GDP per capita of Cyprus and Malta in purchasing power parity of the pound sterling⁸. Malta had a different economic structure since it was overwhelmingly dependent on British defence expenditure. As a result, Malta experienced great income stability, but did not really participate in the post-depression European recovery. Thus, Malta's growth performance was one of stability at the expense of prosperity: per capita output in 1938 was just 2.4% higher than in 1927.

Although by 1938 Cyprus overtook Malta in terms of per capita GDP, its dramatic reductions of output during the interwar period indicates that the welfare of Cypriots was less than that of the Maltese, whose average incomes were not squeezed during the Great Depression.

⁸ The purchasing power parity was calculated using Maltese prices, which were in pound sterling. The parity was created using a common GDP deflator based on the method of Bassino and Van der Eng (2002).

Figure 2: Per capita GDP of Cyprus and Malta in 1938 PPP constant prices (1921-38)



Source: Own calculations.

GDP growth in Cyprus during the period 1921-1938 can be compared with the growth rates of other Mediterranean countries, even though the comparison of GDP levels is not yet complete due to the lack of a pan-European purchasing power parity converter for the period. The results are provided in Table 2 below.

It is clear that Cyprus was in the same group of countries such as Bulgaria, Greece and Malta, which displaced steady but unexceptional growth. The growth rate of Turkey is somewhat misleading since it measures a trough with a peak, thus overstating the growth rate. GDP growth in South European states could have reached higher levels if population growth had been checked. Yet, the expansion of medical provision, combined with the reduction of immigration to the new world, ensured that the natural increase of the population was rapid, thus eroding economic growth.

Table 2: Yearly per capita GDP growth of South European states in the interwar period

	Period	Currency	Growth rate %
Turkey	1923 – 1939	Geary-Khamis Dollar 1990	5.4
Greece	1921 – 1938	1914 Drachma	1.6
Bulgaria	1921 – 1938	1911 Leva	1.7
Cyprus	1921 – 1938	1938 British Sterling (Maltese Prices)	1.87
Malta	1921 – 1938	1938 British Sterling (Maltese Prices)	1.38

Source: Martin Ivanov "Bulgarian National Income 1892 - 1924: 60 Years Later of Quarter of a Century Earlier" (forthcoming) Table AO; Sevket Pamuk, "Intervention during the Great Depression - Another Look at Turkish Experience", Ch.12 in Pamuk and Williamson (2000), page 321; Table 12.1; Kostelenos, *et al*, *Ακαθάριστο Εγχώριο Προϊόν 1830 – 1939* (2007), CD Disk, Table 8-Ib; Own calculations.

5. Sectoral Breakdown of the GDP estimates

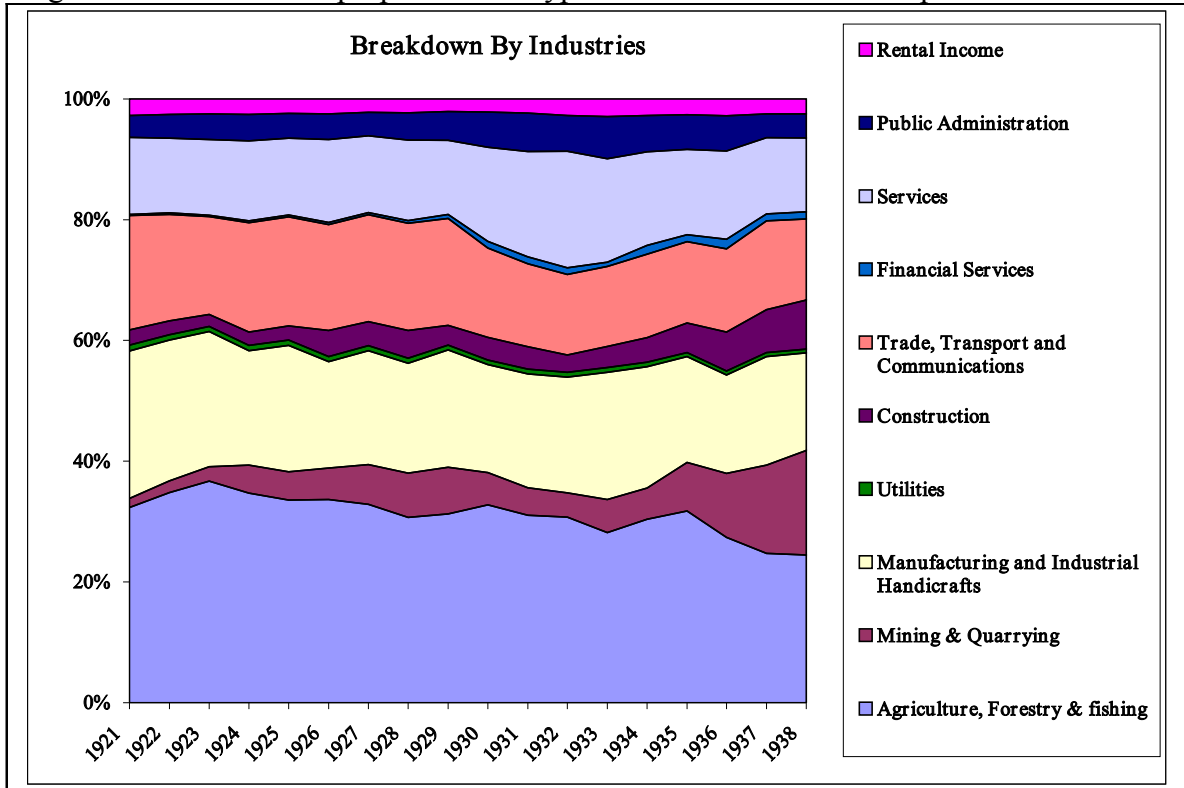
Figure 3 shows the GDP of Cyprus disaggregated into its industrial sectors. The primary sector was the largest sector followed by the services sector. It is clear that the economic growth of the 1920s took place across the board: no single industry surged ahead of the others. That suggests that growth in the 1920s took place without any structural change in the economy.

However, a rapid structural change did take place in Cyprus during the 1930s. The Great Depression, combined with the drought that afflicted the island, led to the relative decline of agriculture.

Manufacturing was at that time largely dependent on the processing of agricultural products and was negatively affected by the relative decline of the agricultural sector. The manufacturing sector did not begin a process of industrialisation. During industrialisation there is usually a shift of value added away from other sectors to the manufacturing sector as well as a shift within the manufacturing sector from handicraft production to factories. Examples include the movement of weaving from households to factories, and the baking of bread from the household to the bakery. Such shifts imply quite rapid productivity gains for the economy as a whole. Neither took place in Cyprus during the interwar period.

Although there was an increase in the value added produced by the chemical, construction materials, metal processing and general manufacturing sectors, these industries started from a very low base and thus remained small in comparison to the food processing industry. At the same time, the share of handicraft output to total manufacturing value added remained very stable at 49% in the period 1921- 1928.

Figure 3: Industries as a proportion of Cypriot GDP in constant 1938 prices



Source: Own calculations.

The lack of structural transformation during the 1920s contrasts dramatically with the rapid structural change of the economy after 1934. The recovery from the Great Depression did not come from the traditional sectors. The catalyst for the dynamic recovery was the rapid growth of the mining and construction sectors. In 1921 mining and construction accounted for 1.5% and 2.5% of GDP, respectively. By 1938 these sectors produced 17.3% and 8.3% % of GDP. The rapid growth of these industries was due to the discovery of new seams of copper ore and the release of the pent-up demand for housing. One cannot understate the impact of these two industries, since they were the most dynamic engines of growth during the rapid growth experienced by Cyprus after

WWII. Thus, the conditions for post-war rapid growth were in place prior to the war: what was dragging the economy down during the interwar period was the large agricultural sector, which employed the overwhelming majority of the population. The failure of agriculture to keep up with other sectors was due to a lack of credit that would allow a shift away from grain production. This lack of credit was aggravated by issues of bad debt and the poor institutional framework that was in place during the interwar period (Apostolides, 2008).

The solution to the problem of rural credit took place during WWII. The colonial government reformed the institutional structure underpinning the agricultural sector by tackling the issue of rural debt and by reforming the co-operative sector into an efficient medium of credit to farmers. WWII provided a huge demand for products in which Cyprus had a comparative advantage, creating an incentive to shift away from grain production (Apostolides and Apostolides, 2007). As a result the agricultural sector was able to rapidly increase output while shedding workers to other sectors after the war, providing the basis for the rapid economic catch-up of the 1950s and 1960s.

6. Policy impact of the Great Depression

Economic growth does not just depend on global economic conditions: domestic governmental decisions within the island had an impact on its rate of economic growth. However, the options for dealing with the turbulent conditions of the interwar period were constrained: British governors could not decide on matters of currency convergence, trade policy or the budget deficit without first consulting the colonial office in London, who in turn had to consult the Treasury. Thus, the concerns of London could overrule the wishes of the local Governor: this led to calamitous results during the Great Depression, since the Governor's wish for expansionary fiscal policy contravened the Treasury's demand for fiscal tightening.

The problems facing the Cypriot economy were significant, and needed a proactive administration that was keen to promote development. This was contrary to traditional

tenants of stability and non-intervention seen as the responsibility of the colonial administration. This policy aggravated the tense situation in Cyprus during the Great Depression and led to the 1931 riots. However, Sir Ronald Storrs, the Governor of Cyprus, was quite willing to break the policy of minimal intervention, but failed in his attempt to alleviate the impact of the depression. Sir Ronald's failure was due to many reasons: his deceitful nature, the Treasury's reluctance to fund development projects, hostile nationalistic opposition, and the poor choice of projects. These factors led to government intervention in the economy and deterioration in relations between Britain and her Cypriot subjects.

The government tried to address the major issues blighting agriculture with various measures, but such measures were insubstantial and ineffectual in alleviating the combined calamities of drought and depression. The failure of the Governor to consider the wishes of the local legislative assembly for even greater government intervention in the economy, acted as a catalyst for the anti-British movement for union with Greece.

The decision by London not to give back to Cyprus the accumulated surplus from the additional taxation mentioned in Section 1 provided the spark that ultimately led to the riots. Although the government was facing a revenue shortage, the Cypriot legislative council refused to approve any tax increases. Thus the government ruled through arbitrary orders-in-council that needed the consent of the king. The increasing use of such orders by the colonial government in order to continue the ordinary business of the island was becoming increasingly difficult for the colonial office to sanction by 1931.

In frustration, the Greek-Cypriot elected members published a manifesto, arguing for cuts in British salaried expenditure and explicitly linking the issue to union with Greece. The members argued that Britain had lost its legitimacy in ruling Cyprus, since it failed to provide economic prosperity for its population. The resulting riots in October 1931 permanently polarised the Greek-Cypriots against the British colonial government (Holland and Markides, 2008).

Although the failure of cooperation between the government and the legislature was due to nationalistic tensions, it is clear that the background to the October 1931 riots was rooted in economic disagreements. The perceived failure of the colonial government to achieve economic growth, combined with the sustained reversal of per capita GDP during the Great Depression, acted as a catalyst for the outbreak of violence in Cyprus.

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Appendix: Methodology

Gross Domestic Product (GDP) derived using the production approach is defined as “the value of all goods and services produced in a period, minus the goods and services consumed in the production process during that period”⁹. Gross Value Added is defined “as the value of goods and services produced during a production period but not immediately used up in the production process of that period”¹⁰. Thus:

$$\text{GVA} = Y - \text{IC} \quad (1)$$

Where:

GVA = Gross Value Added = GDP at Factor Prices (GDP_{fp})

Y = Output

IC = Intermediate consumption.

$$\text{GDP} = \Sigma (\text{GVA} + \text{T} - \text{SUB}) \quad (2)$$

GDP_{mp} = Gross Domestic Product = GDP at Market Prices

T = Taxes (on products)

S = Subsidies (on products)

In order to estimate the GDP using the production approach, the value added of each industry is calculated separately and then combined in the general framework expressed in equation (2). The aim was to estimate the physical volume produced in each industry and multiply it by the product’s price in 1938 in order to estimate the gross output per industry at 1938 prices¹¹. It was only possible to estimate intermediate consumption for the benchmark year, and assume that the value added share to gross output remained constant for the period 1921-1938.

Due to data limitations, double deflation was not feasible. Current best practice argues for a conversion of gross output to constant prices by two separate price deflators. Thus in

⁹ United Nations, *National Accounts...* (2003), p.5, p.16.

¹⁰ United Nations, *National Accounts...* (2003), p.5.

¹¹ The methodology was based on: Schulze, M. (1997) “Re-estimating Austrian GDP, 1870 – 1913: Methods and Sources,” *Economic History Working Paper*, No. 36, London School of Economics, pp.5-14.

order to estimate constant price value added, gross output should be estimated at current prices and deflated by an end-product price index, and then subtracted by the intermediate consumption in current prices deflated by an intermediate-product price index. This was not possible due to the lack of sufficient price series, particularly of intermediate consumption. The majority of output estimated was based directly on 1938 prices. Where deflation was necessary an appropriate end-product deflator was used¹².

The value added per industry was summed up for the total value added. Indirect taxes that were not already enumerated (such as excise and customs duties) were added to calculate the GDP. Thus, the GDP estimate can be shown as whole and subdivided by industries, which can be subdivided into digits as explained above. The industries estimated are listed below¹³.

$$\text{GDP} = w_{ag} \text{AG} + w_{mg} \text{MG} + w_{mf} \text{MF} + w_{ct} \text{U} + w_{nd} \text{CT} + w_{ttc} \text{TTC} + w_s \text{S} + w_{sf} \text{SF} + w_{hi} \text{HI} \quad (3)$$

Where:

GDP = Estimate of Cypriot / Maltese GDP in Factor Prices

$w_{ct}, w_{mg}, w_{ag} \dots$ = Value Added of Sector / Gross Domestic Product 1938 (the sum of all weights =1)

Value added per Industry (in 1938 Constant Prices):

AG = Agriculture, Forestry and Fishing (Nace Code: A).

MG = Mining and Quarrying (Nace Code: B).

MF = Manufacturing and Handicrafts (Nace Code: C).

U = Electricity, Gas and Water Supply (Nace Codes: D & E).

CT = Construction (Nace Code: F).

TTC = Trade, Transport and Communications (Nace Code: G, H, J).

SF = Financial Services (Nace Code: K)

S = Other Services and Administration (Nace Code: I, M, N, O, P, Q, R, S, T, U)

HI = Rental Income from Housing (Nace Code: L)

The sources available vary from sector to sector. As a result each industry necessitated different estimation procedures, informed by HNA estimates of other Mediterranean countries such as Spain, Greece and Italy in order to ensure comparability with other studies¹⁴. A brief summary of the methodology per sector is provided below:.

¹² There is debate on how important is double deflation in HNA creation: Fenoaltea argues that a general deflator also captures the relative price changes. Source: Fenoaltea, S. (1976) "Real Value Added and the Measurement of Industrial Production" *Annals of Economic and Social Measurement*, Vol.5 no.1, pp.111-137, p.113.

¹³ Adapted from Schulze, M. "Re-estimating Austrian GDP..." (1997) pp.5-14; Schulze, M (2000) "Patterns of growth and stagnation in the late 19th century Habsburg economy" *European Review of Economic History*, Vol.4, pp.311-340, pp.331-336.

¹⁴ Sources: Prados de la Escosura, L. (1993) "Spain's Gross Domestic Product, 1850 – 1990: A New Series" *Ministerio de Economía y Hacienda, Documentos de Trabajo*; Kostellenos, G.C. (1995) *Money and Output in Modern Greece: 1858 – 1938* (Athens: Centre of Planning and Economic Research); Kostellenos, et al, (2007) *Ακαθάριστο...*; Fenoaltea, S. (2005) "The growth of the Italian economy, 1861-1913: Preliminary second-generation estimates" *European Review of Economic History*, vol. 9, no.03, pp.273-312.

AG = Agriculture, Forestry and Fishing (Nace Code: A).

The estimate of agricultural production was the most extensive in terms of products estimated and sources used. For Cyprus the gross output of 85 products was estimated. The products were grouped into 6 two-digit categories, which are sub-divided into 26 three-digit categories.

The primary sources of Cyprus did not provide enough farm-gate prices. A farm-gate price dataset was constructed by combining retail, export and import prices. The prices were adjusted in order to take account of the trade and transport margin and create a farm-gate price database for Cyprus¹⁵. This was checked with spot estimates of farm gate prices, and found to be compatible.

Some interpolation and extrapolation was necessary to fill in data gaps. For example, the volume of Cypriot tomatoes was not recorded yearly. In some cases there was sufficient auxiliary information from government farms (such as annual yields) in order to estimate output. In order to check these methods of extrapolation and interpolation the estimates were also constructed without any assumptions, thus reducing the amount of products that were estimated. The largest effect is a drop in level, but it would seem that the extrapolations aid in minimizing volatility that would be plausible on a product level, but irrational of an aggregate GDP level.

When such information was not available the missing output of a product interpolated based on a complete product series that was highly correlated. An example may elucidate the procedure. Thus the Cypriot cowpeas had a correlation of 0.828 with sesame output for the period 1925-1938, but cowpeas output for 1921-1924 was missing. The average ratio of sesame to cowpeas was used to extrapolate the production of cowpeas for 1921 – 1924. Thus the level is based on the average comparison of cowpeas to sesame output and the trend is provided by the sesame data for 1921-1924. If no significant correlation existed the missing yearly output was linearly interpolated (as for Cypriot grapes) or if the data gap was at the beginning of a series, the output of the missing years was equal to the 5 year average. Thus, the estimate of Cyprus flax for 1921-1923, which showed no correlation with a complete series, was assumed to equal the 5 year average output of flax for 1924–1927.

The production of grape products was very important to all Mediterranean countries. The overwhelming majority of grape processing took place within rural households, and thus their output is included in the agricultural sector. The ratio of grape usage was not known. Thus the local consumption of grapes was estimated by converting the export of grape products into grape units. It was assumed that the use of grapes implied by the 1938 export of grape products was indicative of the use of grapes in domestic consumption. This enabled the estimation of wine, spirit, table grapes, raisins, grape juice

¹⁵ In most cases a margin of 25% was provided for trade and transport as estimated for the Republic of Cyprus for the 1960s. Source: National Archives, Nicosia. File V53/26 “Gross Output and Inputs – Indirect Taxes and Value Added in the Agricultural sector during the period 1959 – 1968”, Table 6.

and vinegar output. The estimates were checked for plausibility both by comparing with post-WWII data as well as comparing the results with other countries.

For Cyprus it was not possible to differentiate between modernised wineries from rural production. The output of semi-processed tobacco and cotton was also not possible to disaggregate into agricultural output and agricultural processing. As a result the manufacturing sector's share in GDP is underestimated, but the overall assessment of grape and vine products output is considered representative.

The production of citrus was also pivotal in post-war agricultural development in Cyprus. However, the Cypriot citrus data was sporadic and unreliable. Citrus production was estimated based on data on the area under irrigation and of citrus trees provided in the Cypriot censuses¹⁶. This necessitated strong assumptions. It was assumed that the product mix of the irrigated area, the number of trees, the yield of trees and the type of citrus products was constant over time. As a result the output of citrus production was linear over time. The estimate of other tree crops was based on the estimates of citrus trees: the methodology seems to accurately capture that citrus products were less affected by drought than other products due to reliance on water table irrigation rather than surface aquifers. However, there might be some overestimation on citrus production from 1931 onwards due to the plausibility of increased transformation of land to citrus orchards during the WWII.

For marginal products it was only possible to construct spot estimates. Their production was considered constant throughout the period. However, such cases were limited to less than 1% of the agricultural gross output. For a small range of products, there was no information available and thus no attempts were made to estimate their output¹⁷.

Estimating the output of animal production was fraught with difficulty because the animals were both the unit of production and the product. The annual stocks of animals were available in the blue books, but the conversion of the animals into animal products was unknown. In order to estimate the output of animal products, a model of animal production was based on primary sources by adapting the methodology used by Kostellenos *et al* for Cyprus¹⁸.

The model has a weakness because it assumes that the births, deaths and the composition of a flock were constant. However, it is much more effective in capturing the vagaries of output than a direct transformation on the animal stock since it indirectly takes into

¹⁶ Sources: Percival, (1947) *Cyprus Census... 1946*; Cyprus, *Cyprus Blue Book for the year 1946* (Nicosia: GPO)

¹⁷ Products not enumerated include honey, chickens, rabbits, hunting goods, eggs, cucumbers, bananas, asparagus, artichoke and fresh salad herbs.

¹⁸ Kostellenos, *et al*, (2007) *Ακαθάριστο...*, pp.47–58, pp.50-51. This was adopted using qualitative and quantitative information from: Republic of Cyprus, (1978) *Cyprus Agricultural census 1977*, (Nicosia: Ministry of Agriculture), Bevan, W. (1919) *Notes on Agriculture in Cyprus and its Products*, (Nicosia: GPO); Maule, J.P. and Shevki, M. (1935) "The Breeding and Management of Sheep in Cyprus", *The Cyprus Agricultural Journal*, Vol. XXX, Part 4, p.88; Maule, J.P. (1938) "The Milk Yield of the Maltese and Native Goats" *The Cyprus Agricultural Journal*, Vol. XXXIII, Part 4; Constantinou, A. (unpublished, 1981) *Ruminant Livestock Genetic Resources in Cyprus*; Gambles, R. M. (1936) "Diseases of Sheep and Goats," *The Cyprus Agricultural Journal*, Vol.XXXI, part.4

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account the needs of fodder and reproduction. It also assumed that the milk yield and slaughter weight were constant. As a result the output of animal products is somewhat overestimated in periods of drought and underestimated in times of plenty. The model used to estimate animal products is provided in Table A1 below.

Table A1: Modeling Animal Production in Cyprus

Stage	Explanation	Notation	Source:
(1)	Number of animals Year t	$(1) = Y_t$	Blue Books 1921-1938
(2)	Number of animals Year t -1	$(2) = Y_{(t-1)}$	Blue Books 1921-1938
(3)	Gross increase / decrease	$(3) = Y_t - Y_{(t-1)}$	$(3) = (1) - (2)$
(4)	Ratio of males to flock	$(4) = R_m$	Cyprus, <i>Agricultural Census</i> (1977); Bevan (1918); Kostellenos <i>et al</i> (2007)
(5)	Number of Males Year t-1	$(5) = Y_{(t-1)} * R_m$	$(5) = (2) * (4)$
(6)	Number of Females Year t-1	$(6) = Y_{(t-1)} * (1 - R_m)$	$(6) = (2) * (1 - (4))$
(7)	Reproduction Transformation Coefficient	$(7) = B$	Maule & Shevki (1935); Maule (1938) Constantinou (1981)
(8)	Total Lamb / Kids born	$(8) = B * (Y_{(t-1)} * (1 - R_m))$	$(8) = (7) * (6)$
(9)	Survivors from Natural Deaths / Disease / Culling of Y_{t-1} population	$(9) = S$	Maule & Shevki, (1935) Gambles (1936)
(10)	Number of Lost Animals during Y_t	$(10) = Y_{(t-1)} * S$	$(10) = (2) * (8)$
(11)	Net exports Y_t	$(11) = X_t$	Cyprus Blue Book 1938
(12)	Number of Lambs / Kids to make the Y_t population and Net Exports X_t	$(12) = (Y_t - Y_{(t-1)}) + (Y_{(t-1)} * S) + X_t$	$(12) = (3) + (9) + (11)$
(13)	Number of Lambs / Kids for born to be used for meat / skin	$(13) = [B * [Y_{(t-1)} * (1 - R_m)]] - [(Y_t - Y_{(t-1)}) + (Y_{(t-1)} * S) + X_t]$	$(13) = (8) - (12)$
(14)	Number of Adult Animals culled for meat	$(14) = (Y_{(t-1)} * S) / 2$	Maule & Shevki (1935)
(15)	Net number of animals killed for meat and skin	$(15) = [[B * [Y_{(t-1)} * (1 - R_m)]] - [(Y_t - Y_{(t-1)}) + (Y_{(t-1)} * S) + X_t] + [(Y_{(t-1)} * S) / 2]$	$(15) = (13) + (14)$
(16)	Adult Meat per Carcass in kg	$(16) = M_a$	Γεώργιος Κωστελένος, <i>et al</i> , (2007)
(17)	Lamb / Kid Meat per Carcass in kg	$(17) = M_y$	Γεώργιος Κωστελένος, <i>et al</i> , (2007)
(18)	Total meat produced in kg	$(18) = [[B * [Y_{(t-1)} * (1 - R_m)]] - [(Y_t - Y_{(t-1)}) + (Y_{(t-1)} * S) + X_t] * M_y] + [(Y_{(t-1)} * S) / 2] * M_a]$	$(18) = [(13) * (17)] + [(14) * (16)]$
(19)	Av. Wool per surviving adult male (Kg.)	$(19) = W_m$	Maule & Shevki (1935); Cypriot Goats of a short hair variety- Greek data adjusted downwards
(20)	Av. Wool per surviving adult female (Kg.)	$(20) = W_f$	Maule & Shevki (1935); Cypriot Goats of a short hair variety- Greek data adjusted downwards

(21)	Total Wool (Kg.)	Estimated	$(21) = [Y_t - (Y_t - Y_{(t-1)}) + (Y_{(t-1)} * S) + X_i] * (1 - R_m) * W_i + [Y_t - (Y_{(t-1)}) + (Y_{(t-1)} * S) + X_i] * R_m * W_m]$	$(21) = [(1) - (12)] * [1 - (4)] * (20) + [(1) - (12)] * (4) * (19)]$
(22)	Adult hide weight per Slaughtered Animal (kg.)		$(22) = H_a$	Γεώργιος Κωστελένος, <i>et al</i> , (2007); pp.50 - 51 (1914 - 1940)
(23)	Lamb / Kid hide weight per Slaughtered Animal (kg.)		$(23) = H_y$	Γεώργιος Κωστελένος, <i>et al</i> , (2007); pp.50 - 51 (1914 - 1940)
(24)	Total Skin Produced kg		$(24) = [(Y_{(t-1)} * S) / 2] * H_a + [B * [Y_{(t-1)} * (1 - R_m)]] - [(Y_t - Y_{(t-1)}) + (Y_{(t-1)} * S) + X_i] * H_y]$	$(24) = [(14) * (22)] + [(13) * (23)]$
(25)	Milk per Adult (Kg.)	Surviving	$(25) = M_f$	Cyprus Agricultural Journal (1932 - 1938); adjusted downwards based on Greek data
(26)	Total Estimated Milk		$(26) = [Y_t - (Y_t - Y_{(t-1)}) + (Y_{(t-1)} * S) + X_i] * (1 - R_m) * M_f]$	$(26) = [(1) * (12) * (1 - 4)] * (25)]$

The output of forestry was only estimated based on government forests. The forest cover of Cyprus was extensive, with 18% of the land area in Cyprus under the administration of the forestry department¹⁹. The forestry department was one of the first departments set up by the British administration; thus substantial amount of quantitative information was provided by forestry department reports. Forest products were important due to the dependence on wood fuel and as crucial inputs for the construction and mining industry²⁰.

MG = Mining and Quarrying (Nace Code: B).

There was ample information on the volume and value of mining exports and total sales of quarrying products in the blue books and in the annual reports of the mining department in Cyprus. Due to the plentiful information available only the output of sand was unremunerated.

The estimation of annual mining output creates certain difficulties since it is not always clear if the output recorded is the ore sold rather than the ore extracted. GDP estimation requires that the volume of ore extracted in a given year since the mining rather than ore sold. Some of the primary information seems to record the sale rather than the extraction of ore: the partial closure of the largest copper mines in Cyprus in 1931 and 1933 appear to effect copper production with a one year lag²¹.

Fenoaltea argues that the estimation of the volume based on the weight of the ore extracted is unreliable as the very nature of the ore changes “from year to year, from batch to batch”. Thus, the production of ore can be more variable than the sales of ore²². Where the information was available the production rather than the sales of minerals were used to estimate the output of mining.

¹⁹ Waterer, R.R. (1946) *Cyprus: Empire Forests during the War 1939 – 1945* (Nicosia: GPO) chapter 1.

²⁰ Lavender, (1962) *The History of the Cyprus Mines...* p.178, p.192. The demand for wood was so great that the Government placed a ban on exports of domestic wood products Cyprus, (1939) *Annual report of the Forest Administration in Cyprus: 1938* (Nicosia: GPO) pp.13-14.

²¹ For the closures see: Lavender, *The Story of...* (1962), p.241.

²² Fenoaltea, S. (forthcoming) *Italian Industrial production 1861-1913: A Statistical Reconstruction. B. Extractive Industries, Section B01.03 Output and Value Added.*

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It was not possible to estimate the intermediate consumption of the mining sector: all quarries and mines on the island were private companies, whose business files have not survived in any archive. Other European HNAs seem to agree that mining in peripheral countries led to a proportion of value added to gross output. Ivanov (forthcoming) calculates the value added to gross output ratio as 71.2%, while Schulze (1997) calculates the ratio of Austrian mining activities as 82%²³. Kauppila's (2007) thorough input-output analysis of the Finnish mining sector for 1924 estimates the value added to gross output of mining at 83.6%²⁴. Fenoaltea did not estimate a conventional gross output to value added ratio, arguing that the specific attributes of the extractive industries will lead to an overestimation of intermediate production. Thus, Fenoaltea constructed value added directly from wages, returns on horsepower, and a residual surplus²⁵. The income approach used by Fenoaltea cannot be constructed for Cyprus and Malta due to the lack of information on the machinery used, as well as the average company profit.

There is some information on the intermediate consumption of mining and quarrying for the post-WWII period. The first Cyprus GDP ratio of value added to gross output was estimated as 41.2%²⁶. It is argued that the ratio of national accounts for Cyprus in the 1950 is too low and unsuitable for use in this study due to the decline in ore quality in the copper mines and the increase of the intermediate consumption after 1945 with the mechanisation of the industry. The mechanisation of the mining and quarrying sector during the late 1940s increased the gross output while increasing intermediate consumption (fuel, repairs of machinery ect.) as capital replaced labour. The low rate of value added to gross output in the post war GDP estimates of Cyprus is due to the higher technological level that existed in the period which reduced labour and increased intermediate inputs. Based on other European HNA a conservative estimate of 75% for Cyprus was used to estimate value added²⁷. The share of value added to gross output is assumed constant throughout the period. This will underestimate any technological improvements in the mine's operations, thus possibly underestimating the value added of the mining industry over time.

MF = Manufacturing and Handicrafts (Nace Code: C).

There were various and abundant sources of data on manufacturing, but not necessarily compatible with each other. As a result the estimation of manufacturing did not follow the common approach and the approaches used varied in order to use the best data possible. As a result some industries were estimated by the output approach, some by the expenditure approach while the handicrafts sub-sector was estimated by the income approach.

The statistical blue books provided sufficient information for the largest industries. This allowed for an estimation of the value added of these industries from the output side. There was no information on the yearly change of stock of inputs and final products or the percentage of goods that were bought from other companies. Thus it was necessary to assume that companies began and ended the accounting period with a constant level of inventories, and that all goods sold were constructed on site. Fourteen

²³ Schulze, (1997) "Re-estimating Austrian GDP 1870-1913...", p.6; Ivanov, (forthcoming) *Bulgarian National Income...* Appendix Table W.

²⁴ Kauppila, J. (2007) *The Structure and Short-Term Development of Finnish Industries in the 1920s and 1930s: An Input-output Approach* (Helsinki: Statistics Finland) pp.234-235.

²⁵ Fenoaltea, S. (Forthcoming) *Extractive Industries* Sections: B01.02 The Employment Data and Value Added estimates; B01.03 Output and Real Value Added, B02.01 Introduction.

²⁶ Cyprus, (1951) *National Income, Product, Expenditure 1950* Appendix I.

²⁷ Schulze, (1997) "Re-estimating Austrian GDP..." p.6; Kostelenos, et al, (2007) *Ακαθόριστο Εγγώριο Προϊόν* pp.80-85; Hjerpe, (1996) *Finland's Historical National Accounts...*, Appendix p.32; Prados de la Escosura, (1993) "Spain's Gross Domestic Product, pp.26-28.

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Cypriot industrial sectors were estimated in this way²⁸. Output was estimated yearly and the value added and intermediate consumption was estimated for 1938. The disadvantage of not estimating the yearly intermediate consumption is the assumption that no technological change took place in those industries in the period 1921 – 1938, but there is not enough information to allow the annual calculation of intermediate consumption for alternative benchmark years.

Where there was insufficient information available to provide estimates as above, estimates were based on their industrial inputs²⁹. The statistical blue books also provided sufficient information in order to estimate value added for the 1938 benchmark for thirteen other industries, but not yearly output due to gaps in the data series³⁰. A yearly value added estimate was extrapolated from the benchmark year by assuming that the growth rate of these industries was similar to the average of the industries described above. Such industries did not constitute a large section of the total manufacturing output: their proportion to the total manufacturing and handicraft sector was only 3.4% in Cyprus.

A thorough analysis of yearly exports and qualitative sources was undertaken to evaluate the starting year of such production in Cyprus; as a result yearly output of such industries was only calculated if sufficient evidence was available that such industries commenced production during the calculated year. Value added was extrapolated backward from the benchmark year by assuming the growth rate of these industries was similar to the average for which yearly value added was known. Such industries did not constitute a large section of the total manufacturing output as the proportion to the total manufacturing and handicraft sector was only 3.4%. Thus there was sufficient material for a relatively accurate estimation of output using the production approach for thirty four industries.

The output of the handicraft sector was also estimated. The handicraft sector important as it provided complimentary income to agricultural activities. The handicraft sector was estimated based on occupation statistics based on method of Hjerppe, Niitamo and Siltari³¹. Thus information was collected on employment and wages, in order to estimate the wage bill of the handicrafts industry. Handicrafts were divided into industries. Using primary information and information from Felner the total wage bill was converted to the value added in 1938 prices³².

U = Electricity, Gas and Water Supply (Nace Codes: D & E).

There was not enough information to estimate any private provision of utilities. This was problematic for Cyprus, where utilities were provided by municipal authorities and private companies. As no information was available for utility industries in Cyprus, the production of utilities was estimated as 2.5% of the combined manufacturing and trade output.

²⁸ The sixteen industries were: Gypsum Factories, Potteries, Brick and Tile factories, Oregano Oil Factories, Tanneries, Cotton ginning, Tobacco, Mineral Water Factories, Soap Factories, Macaroni Factories, Ice Factories, Carob Crushing Factories, Jam Factories, Citrus Oil and Juice Factory, Wine production and Cheese making. Wine and cheese making were estimated in the Agricultural sector as it was not possible to separate farmer production from modern distillery production.

²⁹ The six industries are: Flour Milling, Bread making, Rope Factories, Ship building, Silk spinning, weaving and goods manufacture, and cotton spinning.

³⁰ For these thirteen industries some or all quantity estimates except in 1938 were missing: Boot cream factories, Button manufacture, Broom Manufacture, Artificial Teeth manufacture, Foundries, Cement tile factories, Toothpaste & Cleaning Powder Factories, Hosiery Factories, Sumac processing Factories, Flax Schutching Mills, Oil Works, Breweries, and Gum manufacture.

³¹ Hjerppe, R., Hjerppe, R., Mannermaa K., Niitamo, O.E., Siltari, K. (1976) *Suomen Teollisuus ja Teollinen Käsityö 1990-1965* [Industry and Industrial Handicraft in Finland] (Statistics Finland, Helsinki), p.210.

³² Felner, F. (1915) "Das Volksvermögen Österreichs and Ungarns" [The national Wealth of Austria and Hungary] Bulletin de L'Institut International de Statistique" Tomme XX – 2e Livraison, pp.503 – 573.

CT = Construction (Nace Code: F).

The census reports provided substantial information on the number of inhabited and uninhabited dwellings on urban and rural districts. Yearly construction data were not available for Cyprus, but the total stock of housing for 1921, 1931 and 1946 was known from the censuses. Thus the sum of rural and urban houses constructed for the period 1921-1931, 1931-1948 was known. Following the methodology of De La Escosoura, the imports and domestic production of construction materials were added to create a construction index³³. Then the construction materials for 1921-1931 and for 1931-1938 were summed. The yearly shares to the sum of total construction materials 1921 – 1931/ 1946 were used to allocate yearly construction. The construction of agricultural buildings was linked to the construction of rural dwellings, and the construction of commercial buildings was linked with the construction of urban dwellings.

The value added of public construction was estimated using information provided by government expenditure deflated a construction of materials index (CMI). The share of value added to gross output was estimated for the benchmark year and assumed constant for the period. Thus public works construction is included in construction and not in the government sector.

TTC = Trade, Transport and Communications (Nace Code: G, H, J).

Trade output is estimated by comparing factory prices with retail prices, and multiplying the total tradable volume of goods by the trade mark-up³⁴. This was a sector for which the least amount of information could be collected. This is hardly surprising as this is a sector dominated by private companies, and thus government archives do not provide sufficient information on wholesale and retail prices.

The trade and transport margins were estimated based on post-WWII statistics: it was not possible to collect sufficient wholesale and retail statistics to estimate a margin estimate for the benchmark year. It was assumed that half of the agricultural production was traded, and the rest consumed by farmers³⁵. The value of the traded agricultural and manufactured goods was multiplied by the trade and transport margin to estimate the total output. The total import, export and re-export margins were also calculated in constant prices, and added to the volume of domestic trade and transport to achieve an estimate of total output.

The proportion of intermediate consumption was estimated using post-WWII figures³⁶. It was not possible to disaggregate this further into all the transport sectors. Only railroad traffic was disaggregated, which was a not a significant part of transport output.

Rail, postal and telephone services on the island were government controlled; thus ample information for the estimation of their value added was estimated from the annual reports of their departments. The value added of the rail and postal services was used to estimate telegraph output. It was not possible to estimate the output of other communication services.

³³ Prados de la Escosura, (1993) “Spain’s Gross Domestic Product... p.30-32. The construction index was a 3-year average of construction material in order to negate stock keeping.

³⁴ Lequiller, (2006) *Understanding National Accounts* p.107

³⁵ Research ongoing to see if that was sufficient to feed the rural agriculturalists.

³⁶ Source: National Archives, Nicosia. File V53/26 “Gross Output and Inputs – Indirect Taxes and Value Added in the Agricultural sector during the period 1959 – 1968,” Vassiliou, (1959) *Input – Output Analysis...* p.69

SF = Financial Services (Nace Code: K)

The output of financial services requires information over the total deposits of the banks, as well as information on the base rate and lending rates. The Cyprus blue books provided information over the yearly total balances of the economy; base and lending rates, and were included as intermediate consumption costs, the detailed data being provided from the Cypriot branch of a British multinational bank³⁷. The co-operative sector's was estimated on the basis of primary information as 15% of the formal banking sector in the benchmark year of 1938. Output was estimated as a constant 15% of the formal banking sectors value added.

S = Other Services and Administration (Nace Code: I, M, N, O, P, Q, R, S, T, U)

This category includes a diverse range of occupations. Despite the growing awareness of the services importance in the development of economies, and thus the need to more accurately reflect their output in HNAs, it is difficult to estimate the direct output of such services³⁸.

The government sector's value added was estimated by calculating the wages and pensions of government employees in current prices and deflating it to constant prices. Government doctors and teachers were not included in the government sector but in the relevant sectors of health and education³⁹.

The value added of professional, entertainment and personal services was estimated using the occupational statistics provided by the censuses. The yearly number of practitioners was assumed to follow a linear growth rate from 1921-1931 and from 1931-1946. The yearly number of practitioners was multiplied by the yearly wage. The yearly wage level per profession was varied based on the number of men, women and apprentices as recorded by the census, and by using differential rates for servants, entertainers and professionals.

The estimation procedure for the private sector assumes that the productivity of the service sector employees remained constant throughout the period. This might underestimate value added of the service sector as profits of service industries are not included with the wage bill. Census occupation statistics are not an accurate indicator of current employment as it states the profession of a person, but not if he is in employment during the census. The services estimated on the occupational censuses are large enough that their linear growth can influence the economic cycle: such services constitute 12% of Cypriot GDP in 1938. Thus the estimation methodology results in an underestimation of the peaks and troughs of the economic cycle by the overall GDP measure.

HI = Rental Income from Housing (Nace Code: L)

³⁷ Lending rates were a constant 3% above the base rate. Source: British Library of Political and Economic Science Archive, Ionian Bank Papers, File: 6/64 Luard to Court of Governors, 12th January, 1927; File 6/100 General Manager to Chairman, 18th December 1929.

³⁸ Broadberry, S. and Sayanthan G. (2002) "From the Counting House to the Modern Office: Explaining Anglo-American Productivity Differences in Services, 1870-1990," *Journal of Economic History*, Vol.62, No.4, pp.967-998, p.967, p.968. Estimating output of services through the census occupation data assumes constant productivity.

³⁹ United Nations, (2003) *National Accounts: A Practical Introduction* pp.43-48.

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The implied rental income from housing was estimated based on dwelling information in the censuses, as well as archival resources. The censuses provided decennial information over rural and urban housing construction. Estimates were made of the value of the dwellings based on archival material in the Cypriot national archives as well as using other governmental sources. The number of dwellings was annualised by linear interpolation, and the yearly volume of housing was multiplied by the value of houses in 1938 to get the value of the whole stock of housing in 1938.

The stock of housing loses its value overtime in national accounting terms in order to take account of depreciation⁴⁰. The best method of depreciation is the perpetual inventory method where the total stock of housing is depreciating at a constant rate according to its age⁴¹. Based on primary sources it was estimated that the average lifetime of a house was 50 years. Thus, the 1901 housing stock was extrapolated back to 1861 based on census reports. The yearly housing stock was added to the total housing stock and depreciated using the perpetual inventory method.

Based on government sources the implied value added from housing was estimated as a constant percentage of the housing stock value. The yearly proportion of rent for urban and urban areas was estimated and applied to the yearly housing stock to estimate the implied rental income from housing for the period⁴².

GDP at Factor Prices and Market Prices

The addition of all sectors results in the estimation of the GDP at factor prices i.e. the income of the island in the prices of the producers. This does not equal GDP constructed from the expenditure approach, which records the expenditure by consumers⁴³. Consumers purchase goods and services at the consumer price, which includes any taxes on products as well as any subsidies. In order to estimate GDP at market prices one needs to add the taxes of products such as import excise duties and subtract any subsidies on products⁴⁴.

However due to the different estimation procedures used to estimate the GDP for Cyprus, estimating GDP at market prices is difficult⁴⁵. One of the main problems is the fact that the estimation procedure of trade, mining, or transport might lead to double counting as the prices of product specific taxes might have been already present in the prices used to estimate their value added share. In addition the provision of taxes and subsidies in the island was complex as not all taxes and subsidies were controlled by the central government: in Cyprus, local communities added their own taxes on products to pay for education. Thus GDP at market prices is only estimated for 1938 largely for completeness, the estimates shown here are recorded at factor prices.

⁴⁰ Depreciation of the stock of dwellings is undertaken to calculate the implicit rent of ownership of dwellings.

⁴¹ Meinen, G., Verbiest, P. and De Wolf, P. (1998) *Perpetual Inventory Method: Service Lines, Discard Patterns and Depreciation Methods* (Voorburg, Statistics Netherlands) pp.6-7.

⁴² National Archives, Nicosia, File: SA1415/1920/1 "Construction of Dwelling houses For Government Officials"; National Archives, Rabat, File: PW534/1929 "Rent Evaluation of Urban Tenements".

⁴³ The difference between the two is the taxes less subsidies on products (including non-deductible value added taxes) on consumers. United Nations, (2003) *National Accounts: A Practical Introduction* p.22.

⁴⁴ United Nations (2003), *National Accounts: A Practical Introduction* p.5.

⁴⁵ Nicolson, J.L., (1955) "National Income at Factor Cost or Market Prices," *The Economic Journal*, Vol.65, No.258, p.216-224, p.221.