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ASPECTS OF LONG RUN GROWTH IN 19th CENTURY/ PRE-WWI GREECE (1833-1910): A TENTATIVE APPROACH

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Abstract

The purpose of this work is to shed some light on the characteristics of the growth experienced in Greece during the first eighty years of its existence. In this respect it is argued that Greece appears to have experienced a rather moderate growth in per-capita terms during this period. Furthermore, assuming a steady state economy, there are indications that education expenditure played a relatively important role in the process.

JEL Classifications: N13, N14, N33.

1. Introduction

The study of the long run economic developments in pre-WWI Greece has lagged considerably in comparison to similar studies regarding other European countries. This is not entirely unexpected given that, until up to very recently, there was an almost complete lack of relevant quantitative information referring to macroeconomic magnitudes for the period in question[1].

This is not to say that there has been no interest whatsoever for this the period. On the contrary there have been quite a few efforts that have indulged into the study of various aspects of the Greek economy before WWI. These, however, have been mostly of a qualitative nature which essentially used whatever limited quantitative data were available without this being a central focus of the work. Where certain data were available, these usually referred either to small periods of time or to particular aspects, and not to the whole, of the economy. Furthermore, in most of these cases the analysis undertaken was statistical in nature. In this context one can indicatively refer to works such as

those by Dertiles' discussion of taxes[2]. Thomadakis' discussion of banking magnitudes[3] and Pizanias and Mitrofanis' discussion of price movements[4].

Perhaps closer to our present area of interest are the works of Sakellaropoulos, who examines an economic crisis in a shorter period[5], and Petrakis and Panorios who tried to approach the question of the existence of a cycle in the Greek economy using banking magnitudes[6]. These analyses, however, did not have national accounting data to use so the approaches are essentially indirect ones.

The present approach tries to make use of the fairly recently constructed series of national accounting data[7]. In particular, this is a first attempt to indulge into the general question of long run growth in Greece by using national accounting data and applying modern quantitative techniques to obtain answers. The present paper is an initial report of the first findings of the research which must be seen as tentative and ongoing.

2. Concise Historical Outline of the Period

Greece became an independent state in 1830 after a long occupation period of approximately 400 years by the Ottoman Empire. Independence was achieved at the end of a ten year revolution which started in 1821 and left the country in ruins as both its productive structure and overall infrastructure were destroyed and its population decimated.

A quick survey of the economy during the earlier years of the independent state, since its establishment and up to the end of the reign of King Otto (October 1862), reveals the following general features: a continuous budgetary deficit, extensive borrowing from abroad to pay for it, increased military spending and small public investment. In fact, these features remained more or less dominant for the whole duration of the period under examination. In addition, one has to note the large payments made for the expenses of the monarchy, the low standards of the management of public finances and the backwardness of infrastructures and human capital levels relative to normal European standards of the period. These developments consist a particularly negative context within which public finances were managed and taxpaying citizens functioned and made the achievement of the state's objectives very difficult. It is therefore not surprising that in September 1843 the country defaulted and suspended payments of the debt and in 1848 a forced currency regime was implemented.

The fall of Otto's regime in 1862 obviously created turmoil both as far as the administration of the country is concerned as well as in regard to its economic perspectives. Thus, in 1862 and 1863, a sharp decline in state revenues, both from taxes as well as overall, was observed. The budgetary deficit increased from 1.500.000 current drs in 1861 to 7.000.000 in 1862, this being more than half of that year's tax revenues. Invariably this led to a great increase in borrowing in 1863. Overall, tax revenues as a percentage of total government revenues dropped from 67% in 1859 and 68% in 1861 to 63% in 1862 and 53% in 1863. This drop can be traced to the decline in revenues from direct taxation (from 10.465.314 current drs in 1861 to 7.527.856 in 1862 and 6.834.612 in 1863).

In the subsequent years the situation improved. Tax revenues increased as a percentage of total government revenues to 61% (1864) and 65% (1865). In 1864 revenues from direct taxation increased a little to 8.733.732 current drs but in 1865, in spite of the inclusion for the first time of the figures from the Ionian Islands[8] they dropped again to 7.067.300 current drs., which is the lowest per capita figure for the decade[9]. The drop in revenues from direct taxes was accompanied by a smaller one in revenues from indirect tax which, however, was reversed significantly in 1864 and 1865. In fact, this increase, which was a result of the taxing system regarding indirect taxation that was implemented in the Ionian Islands, compensated for the decline in revenues from direct taxes. It was be noted here that the tithe, as a system of direct taxing, was not implemented in the new territory.

Overall, the integration in 1864 of the new territory in Greece was accompanied by an increase of government revenues by approximately 11%. This was less than anticipated since in addition to the general increase in government revenues and expenditure expected (in accordance to Wagner's Law) the population of the Ionian Islands amounted to 21% of the total population of the previous territory of the Hellenic realm[10].

The period that followed after the integration of the Ionian Islands is characterised by political tensions. These were essentially the manifestation of the problems related to the eastern question in the Balkans. In addition one must also mention the international crisis of the agricultural sector of 1873-1896 which may have affected Greek agriculture during the period.

In 1881 Greece acquired two new territories: Thessaly and a part of Epiros. These were neglected, quite poor and underdeveloped. In addition, the tax system changed. In particular, the tithe, a tax system that brought in a very important percentage of overall tax revenues, was abolished. Subsequently, in

order to raise revenues to meet the extra demands created by increased public expenditure for public works, military purposes and debt servicing the Trikoupis administration was forced to implement, in 1884, a new customs tariffs schedule.

The next decade, the 1890s, consist a particularly bleak period for the Greek economy. In 1892 the price of currants, by far the most important export item of the country, dropped considerably. Customs duties were then increased by 15% in 1892 but the country could not avoid declaring bankruptcy in 1893. In 1897 Greece fought a losing war against the Ottoman Empire and lost Thessaly for a period a little over one year, during which the territory suffered extensive looting and enormous damages. Finally, in 1898, in order to achieve peace and the return of the lost territory, the country acquiesced to pay Great War indemnities to Turkey as well as to accept the imposition of an International Financial Commission to which various important receipts and monopolies were assigned in order to secure the repayment of the debt.

In general, the largest part of the increase in the country's public expenditure, during the period examined, is due to increased military spending, this being a result of wars as well as of the overall difficult international environment. In this respect, a more careful look of the figures reveals that Public Expenditure increased to levels higher than 30% of GDP in 1834 (a period of internal turmoil), 1879 -1881 (the years before, during and after the military mobilisation and liberation of Thessaly and part of Epiros), 1889-1890 (when the *"Cretan Question"* was prominent) and in 1898 (when the war indemnities referring to the 1897 war were paid to Turkey).

Moving on, years 1913, 1914, 1918,1919,1920,1921 and 1922, during which important military events took place, are also characterised by high military expenditure and a high ratio of public expenditure to GDP. Then, in 1926, a year associated with high expenditure for the rehabilitation of the Asia Minor refugees, the said percentage exceeds 30% again.

Finally, public expenditure as a percentage of GDP increased significantly in the years 1929-1931, i.e. a period of the great crisis. In this case, however, it was not military expenditure that was responsible for the rise.

In general, and speaking for the whole of the period, military expenditure and the servicing of the debt amounted to between 44% and 89% of all public expenditure. This obviously stifles all other types of public expenditure, i.e. public works or education that could probably be more instrumental in creating

economic growth. This negative observation becomes even more pronounced when one notes that even in those confines, public expenditure was more oriented towards consumption rather than investment.

Two exceptions, i.e. periods in which a relative shift towards expenditures enhancing overall growth can be observed, can be noted here. These are:

- Period 1887-1912, which is characterised by a relative increase in expenditure for transportation infrastructures. This, however, was not accompanied by any significant policy of industrial subsidies which remained at insignificant levels. Thus, the increased borrowing of the period did not really lead to any direct enhancement of the country's productive capabilities, which would eventually have created income and made the payment of the debt easier.

- The period following the Asia Minor Catastrophe, when a significant turn towards growth enhancing expenditure is observed. It must be noted that this was accompanied by a decline in military expenditure. Thus, expenditure on public works and education and subsidies to industry all increased considerably during these years.

In retrospect one can attribute, to some extent at least, the constant problems Greece faced on account of an excessive debt burden to the fact that borrowing started even before the country became independent, as the first loans were contracted during the revolutionary period. This was necessary in order to finance the military operations, but left the new State in a precarious position. Adding to the problems was the fact that only a small part of all the "Hellenic" lands that were part of the revolution and on account of which these loans were contracted were included in the new State and that these were less devastated from the war, one can easily see how difficult it was to create production and incomes that would suffice to service this debt, especially as the new State was forced to borrow even more to survive.

3. The Data Used - Basic Characteristics

When examining questions of long run growth the most commonly used magnitude is some version of a national income variable. This is natural as these magnitudes epitomise the performance of the economy better than any other.

In the present case there exist GDP estimates in nominal and constant prices (base years 1860, 1887 and 1914) for the whole period under consideration. Of these, the latter constant price series has been chosen for the

present analysis as it is felt that the most recent prices are slightly more accurate than the earlier ones. All values have been expressed in Latin Monetary Union drachmae in order to have a unique series[11, 12]. The figures appear in table 1[13].

APPENDIX

TABLE 1

Basic Magnitudes of the Greek Economy Used (1833-1939)

YEAR	GDP ("aver." estim.) (LMU drs)		Total Public Expenditure (LMU drs)		Various Educ. Expend.(LMU drs)		Population
	Curr. Prices	Const. 1914 Prices	Curr. Prices	Const. 1914 Prices	Curr. Prices	Const. 1914 Prices	
	1	2	3	4	5	6	7
1830							
1831							
1832							712.608
1833	49.327.592	118.348.370	13.357.096	32.046.780	115.502	277.117	719.040
1834	60.111.409	127.112.243	28.849.079	61.004.579	386.638	817.589	725.520
1835	76.038.359	167.603.782	16.084.970	35.454.497	450.164	992.251	732.070
1836	64.873.632	163.590.363	15.559.536	39.236.128	549.538	1.385.757	738.680
1837	71.130.900	169.223.932	17.814.014	42.380.422	647.789	1.541.121	745.350
1838	76.561.464	179.679.667	15.290.322	35.884.372	729.112	1.711.129	752.077
1839	82.158.944	178.274.328	15.424.063	33.468.231	690.570	1.498.448	823.773
1840	90.511.374	176.015.825	15.927.011	30.972.968	687.755	1.337.465	850.246
1841	81.524.303	176.848.306	15.971.805	34.647.174	652.591	1.415.648	861.019
1842	72.050.835	178.997.012	15.871.154	39.428.954	675.782	1.678.855	853.005
1843	70.304.740	161.973.957	14.356.188	33.074.989	425.704	980.773	915.059
1844	72.286.510	159.620.940	13.716.697	30.288.807	328.136	724.581	930.295
1845	72.555.290	158.694.644	14.060.921	30.754.377	400.132	875.178	960.236
1846	77.310.985	175.555.054	14.385.315	32.665.666	506.082	1.149.192	968.988
1847	70.202.232	150.953.672	15.277.246	32.850.185	554.767	1.192.897	977.819
1848	78.740.260	164.202.307	15.726.946	32.796.447	674.660	1.406.913	986.731
1849	81.072.203	169.835.548	15.637.746	32.759.010	697.682	1.461.552	996.302
1850	89.725.822	173.222.776	16.610.091	32.067.091	705.422	1.361.872	1.005.966
1851	93.491.567	214.242.088	15.887.844	36.408.041	772.890	1.771.127	1.015.724
1852	111.072.033	182.647.573	16.267.120	26.749.757	791.243	1.301.125	1.025.577

YEAR	GDP ("aver." estim.) (LMU drs)		Total Public Expenditure (LMU drs)		Various Educ. Expend.(LMU drs)		Population
	Curr. Prices	Const. 1914 Prices	Curr. Prices	Const. 1914 Prices	Curr. Prices	Const. 1914 Prices	
	1	2	3	4	5	6	7
1853	102.915.915	202.088.758	16.182.692	31.776.816	806.253	1.583.183	1.035.527
1854	118.870.213	213.562.124	17.494.411	31.430.443	810.562	1.456.255	1.044.482
1855	109.909.135	226.513.134	19.204.212	39.578.204	876.550	1.806.493	1.053.515
1856	151.598.737	200.050.601	19.291.806	25.457.583	913.416	1.205.349	1.062.627
1857	145.799.997	260.967.255	19.666.803	35.201.589	955.152	1.709.625	1.069.377
1858	136.394.946	253.204.713	22.769.197	42.268.927	1.019.525	1.892.656	1.076.170
1859	166.176.291	250.741.260	23.165.360	34.953.912	1.131.941	1.707.971	1.083.006
1860	152.205.786	248.017.044	23.280.796	37.935.708	1.134.808	1.849.153	1.089.886
1861	150.281.238	265.697.284	25.100.905	44.378.410	1.220.769	2.158.320	1.096.810
1862	154.490.247	271.558.280	25.413.537	44.671.145	1.279.323	2.248.756	1.110.703
1863	160.133.781	245.687.783	23.396.921	35.897.096	1.262.869	1.937.577	1.124.772
1864	187.269.130	269.801.159	24.426.227	35.191.194	1.189.743	1.714.079	1.359.064
1865	182.285.007	291.844.445	28.256.365	45.239.394	1.554.449	2.488.726	1.375.043
1866	194.257.887	281.820.291	27.866.935	40.428.051	1.331.724	1.932.003	1.391.216
1867	227.097.909	301.132.013	37.922.715	50.285.551	1.334.557	1.769.623	1.407.585
1868	217.616.329	308.205.977	44.334.620	62.790.301	1.448.823	2.051.941	1.424.152
1869	193.019.153	307.550.955	37.135.497	59.170.593	1.399.306	2.229.613	1.440.920
1870	230.486.438	302.649.525	35.732.029	46.919.383	1.521.002	1.997.213	1.457.894
1871	263.454.291	294.960.280	36.744.040	41.138.189	1.491.470	1.669.832	1.480.994
1872	221.459.580	291.045.550	32.849.970	43.171.930	1.570.177	2.063.551	1.504.460
1873	239.559.808	348.434.487	32.195.177	46.827.179	1.564.442	2.275.447	1.528.298
1874	256.489.074	334.920.676	45.189.392	59.007.822	1.751.593	2.287.212	1.552.414
1875	256.007.212	325.877.042	34.861.961	44.376.534	1.774.006	2.258.170	1.577.114
1876	246.853.109	329.567.896	34.808.178	46.471.596	1.874.709	2.502.881	1.602.103
1877	280.196.087	314.549.985	35.071.612	39.371.624	1.208.764	1.356.967	1.627.488
1878	287.893.761	351.606.869	36.476.540	44.549.080	1.912.880	2.336.215	1.653.275
1879	284.472.478	371.041.818	95.312.321	124.317.322	2.044.060	2.666.099	1.679.470
1880	294.015.339	368.270.672	88.449.179	110.787.548	2.025.309	2.536.813	1.695.161
1881	340.537.237	423.267.543	113.856.328	141.516.648	2.037.649	2.532.677	2.004.991
1882	378.493.245	455.587.756	64.260.151	77.349.169	2.612.455	3.144.581	2.026.813
1883	402.037.420	458.988.241	67.795.869	77.399.528	2.956.728	3.375.565	2.048.901
1884	409.597.771	521.668.568	91.346.784	116.340.345	3.595.864	4.579.735	2.071.257
1885	404.370.356	569.014.665	122.797.767	172.796.372	3.198.111	4.500.261	2.093.886
1886	427.884.977	550.073.110	129.717.525	166.760.055	3.295.534	4.236.616	2.116.792

YEAR	GDP ("aver." estim.) (LMU drs)		Total Public Expenditure (LMU drs)		Various Educ. Expend.(LMU drs)		Population
	Curr. Prices	Const. 1914 Prices	Curr. Prices	Const. 1914 Prices	Curr. Prices	Const. 1914 Prices	
	1	2	3	4	5	6	7
1887	445.552.567	575.372.983	107.128.254	138.342.157	3.349.954	4.326.028	2.139.978
1888	457.843.916	594.950.154	108.050.859	140.407.840	4.004.152	5.203.239	2.163.449
1889	441.011.848	560.106.569	168.739.262	214.307.097	3.498.709	4.443.531	2.187.208
1890	463.711.498	536.998.339	141.465.394	163.823.157	3.464.241	4.011.744	2.220.844
1891	506.074.775	475.333.149	122.836.386	115.374.662	3.432.339	3.223.840	2.254.997
1892	530.183.043	503.475.754	117.664.730	111.737.521	4.703.760	4.466.814	2.289.675
1893	550.345.214	544.083.531	97.016.230	95.912.405	6.932.022	6.853.151	2.324.887
1894	497.796.032	564.934.359	85.135.753	96.618.111	7.035.317	7.984.179	2.360.640
1895	519.172.168	551.800.832	91.641.968	97.401.435	9.292.601	9.876.618	2.396.943
1896	551.490.094	615.251.522	90.890.608	101.399.074	4.817.163	5.374.107	2.433.806
1897	512.247.564	526.250.876	137.043.930	140.790.300	8.347.007	8.575.190	2.451.185
1898	568.609.039	572.303.828	312.056.605	314.084.331	4.943.231	4.975.352	2.468.688
1899	542.817.095	588.433.308	104.608.513	113.399.401	5.744.753	6.227.520	2.486.316
1900	585.318.900	529.113.684	109.318.359	98.821.069	5.254.809	4.750.217	2.504.070
1901	663.880.009	510.806.749	114.130.697	87.815.162	7.592.594	5.841.942	2.521.951
1902	638.047.417	659.238.180	124.504.306	128.639.330	6.231.050	6.437.995	2.539.966
1903	623.984.536	648.889.948	116.259.581	120.899.909	6.140.577	6.385.669	2.558.097
1904	572.452.526	689.235.316	116.150.470	139.845.668	6.240.177	7.513.201	2.576.364
1905	579.591.946	711.668.688	116.321.328	142.828.498	6.296.958	7.731.902	2.594.761
1906	604.516.897	708.073.643	121.599.878	142.430.541	7.421.452	8.692.784	2.613.290
1907	646.723.396	723.079.113	119.919.093	134.077.400	5.049.117	5.645.244	2.631.952
1908	638.396.799	723.944.831	133.651.768	151.561.704	6.482.811	7.351.537	2.649.218
1909	689.464.639	743.040.958	136.789.925	147.419.477	7.167.736	7.724.720	2.666.597
1910	660.869.107	745.026.736	140.440.328	158.324.543	8.044.809	9.069.266	2.684.090
1911	847.536.747	935.285.670	181.368.628	200.146.459	7.659.615	8.452.646	2.701.698
1912	823.862.626	913.393.950	207.984.005	230.586.175	7.356.369	8.155.805	2.719.422
1913	856.722.066	968.757.971	261.973.281	296.232.249	6.914.119	7.818.298	4.819.793
1914	1.235.786.566	1.235.786.566	485.671.349	485.671.349	9.479.649	9.479.649	4.818.245
1915	1.420.876.565	1.168.280.495	385.900.088	317.296.771	13.453.155	11.061.523	4.816.998
1916	1.882.928.700	1.174.429.854	237.804.618	148.324.704	13.673.096	8.528.253	4.816.050
1917	2.689.025.077	1.130.057.389	317.024.257	133.228.807	16.787.219	7.054.795	4.815.401

YEAR	GDP ("aver." estim.) (LMU drs)		Total Public Expenditure (LMU drs)		Various Educ. Expend.(LMU drs)		Population
	Curr. Prices	Const. 1914 Prices	Curr. Prices	Const. 1914 Prices	Curr. Prices	Const. 1914 Prices	
	1	2	3	4	5	6	7
1918	4.196.152.017	1.373.319.832	1.446.062.848	473.268.552	26.883.614	8.798.490	4.815.049
1919	3.789.749.966	1.129.857.920	1.353.603.588	403.556.896	25.381.262	7.567.048	4.814.994
1920	5.361.536.871	1.410.411.674	1.682.637.700	442.636.489	67.672.586	17.802.023	5.016.889
1921	6.821.748.101	1.439.035.678	2.472.776.629	521.627.850	77.604.882	16.370.612	5.089.515
1922	10.780.134.536	1.471.597.490	3.458.422.378	472.109.664	130.563.093	17.823.184	5.943.000
1923	16.558.597.496	1.309.372.894	4.978.434.011	393.670.210	214.358.162	16.950.395	6.077.000
1924	20.718.344.368	1.484.058.299	5.497.477.016	393.785.152	345.700.767	24.762.601	5.923.000
1925	23.992.285.292	1.590.990.095	6.840.698.388	453.624.290	440.752.825	29.227.452	5.992.000
1926	28.217.011.578	1.634.905.291	8.687.190.060	503.339.376	453.687.063	26.286.816	6.091.000
1927	30.874.784.578	1.586.246.988	7.769.917.226	399.193.321	511.424.609	26.275.349	6.168.000
1928	33.618.998.228	1.729.994.082	9.446.396.554	486.100.449	614.688.250	31.631.134	6.204.684
1929	32.387.828.463	1.811.652.439	18.354.678.509	1.026.691.188	793.831.640	44.403.935	6.315.000
1930	31.089.932.899	1.950.230.284	11.176.465.973	701.084.897	800.770.926	50.231.299	6.367.149
1931	29.751.944.759	1.933.182.050	11.098.635.053	721.152.255	684.346.322	44.466.539	6.462.772
1932	33.071.900.119	1.876.030.805	9.117.017.058	517.170.310	693.335.946	39.330.053	6.543.625
1933	38.349.976.085	2.018.529.480	7.705.821.033	405.591.568	758.592.998	39.928.117	6.624.468
1934	42.085.624.562	2.197.799.686	11.151.021.469	582.329.756	901.910.287	47.099.649	6.726.891
1935	44.494.188.102	2.362.801.074	10.048.246.019	533.597.926	951.179.626	50.511.052	6.836.984
1936	46.725.383.838	2.311.371.234	12.683.391.627	627.411.145	961.904.735	47.582.679	6.936.227
1937	56.570.810.217	2.621.762.837	13.415.652.712	621.745.730	966.727.808	44.802.806	7.028.530
1938	55.688.778.517	2.588.572.416	12.634.730.057	587.298.098	996.418.311	46.316.350	7.121.753
1939	54.836.336.457		14.011.200.687		1.042.549.201		7.318.915

Choosing between the two magnitudes usually does not present a problem. The real GDP figure is a better indicator of the growth of the real economy as it takes the effects of inflation out of the picture.

True enough, as can be seen in diagrams 1 and 1A the two series convey a different message regarding the growth of GDP during the period. In diagram 1 it appears that there was no growth until the first decade of the 20th century, followed by a period of extreme increases. When, however, GDP in 1914 prices is examined[14], the picture changes. A more realistic increase of GDP emerges.

DIAGRAM 1

Basic Magnitudes (nom) (1833-1939)

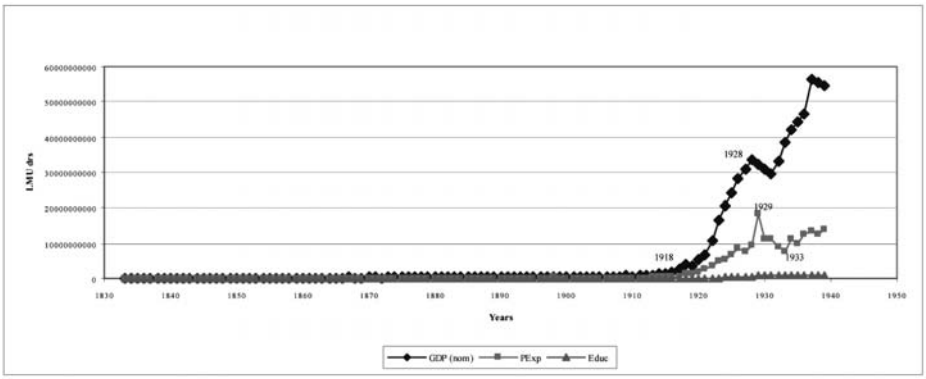
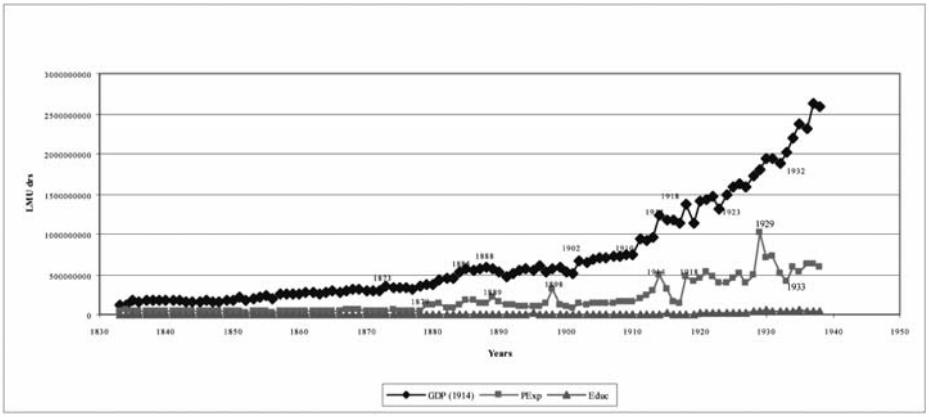


DIAGRAM 1A

Basic Magnitudes (1914) (1833-1938)



The great inflation experienced during the WWI years has been taken out of the picture.

Unfortunately, this is not the end of our complications. Greece's borders did not remain the same during the period. In fact during the period there were three major territorial changes and a couple of minor ones. The major changes were the acquisitions of the Ionian Islands in 1864, of Thessaly and a part of Epiros in 1881 and of the rest of Epiros, Macedonia and a number of islands in

the Aegean sea in 1913. These changes meant the inclusion in the country of heterogeneous territories, with different levels of development, as well as large increases in population. In addition, one must note here the large increase in population in 1922 when a large influx of refugees took place from Asia Minor.

Besides these major changes one must also note a few minor ones, minor in the sense that they were more or less temporary. These took place in 1897, when as a result of an unfortunate war Greece lost control of Thessaly for a short period and at the end of WWI when Greece initially took control of Eastern Thrace and a part of Asia Minor, only to lose them in 1922.

The implications of these changes here are that doubts are cast upon the GDP(1914) series as a true indicator of growth during the period in question. In particular, as can be seen from diagram 1A, one may doubt whether the marked increases in the 1880s, the 1910s and immediately after 1923 can be attributed to real growth or to the fact that they refer to significantly larger territories (in the first two cases) and populations (in all three cases). In fact, only in the case of 1864 there appears to be no significant change in the diagram. Here, however, the territorial and population changes could conceivably be masking a larger decline.

One way to circumvent the problem is to use per capita figures. This, of course, can be done without causing any significant problems if the territories acquired are similar in nature and development level to those of the old part of the country. Unfortunately there are no relevant empirical works to this effect. What can be said based on qualitative evidence is that the Ionian Islands had a slightly higher output per head than the mainland, the opposite being the case with the other territories acquired by the country. True enough, in the latter two cases (1881 and 1912-1913) this can be confidently accepted, as the territories experienced a disruption in production activities and a departure of populations when they were taken over by Greece essentially as a consequence of war. With the Ionian Islands the case is different as they were handed over to Greece in a peaceful manner thus experiencing no similar disruptions.

Overall, bearing in mind the shortcomings inherent in examining long run developments under circumstances as those noted above, the use of per capita figures appears to offer the best picture of long-run growth in the country. These figures appear in table 2 and are depicted in diagrams 2 and 2A.

In diagram 2 it is apparent that the use of per capita figures has no effect. The influence of price changes is too powerful[15] and the picture conveyed does

DIAGRAM 2

Basic Magnitudes/head (nom) (1833-1939)

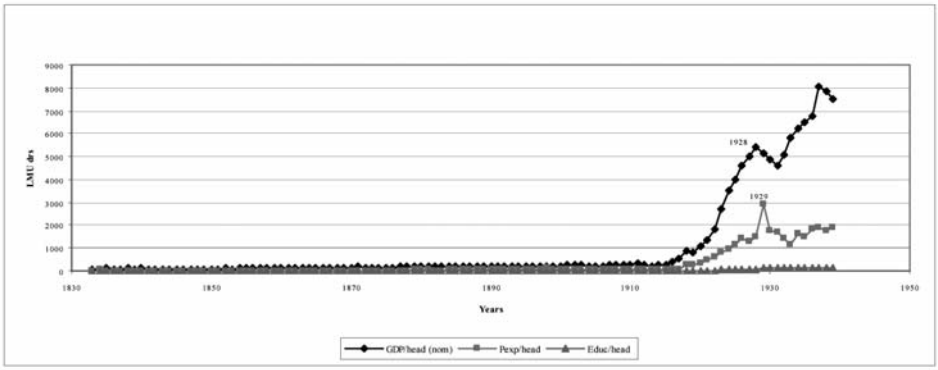
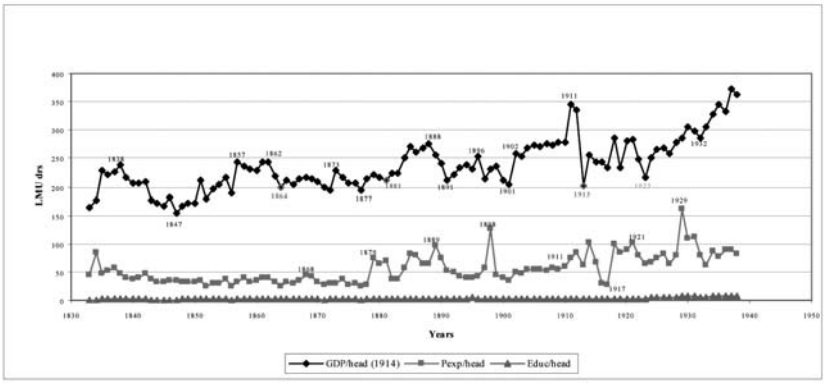


DIAGRAM 2A

Basic Magnitudes/head (1914) (1833-1938)



not differ from that in diagram 1. When, however, the price effect is removed and the magnitudes expressed in 1914 prices are used, diagram 2A shows a dramatically different picture than that depicted in diagram 1A. Growth appears to have been much more modest when per capita figures are used. In fact, whereas the totals show that GDP(1914) was 22 times larger in 1938 than in 1833, the per head figures show that it was only twice as large. Furthermore, a drop is shown in all three cases there was a major territorial change (1864, 1881 and 1913) as well as in 1923, i.e. the year the big wave of refugees arrived to the country.

TABLE 2
Per Head Magnitudes of the Greek Economy (1833-1939)

YEAR	GDP ("aver." estim.) (LMU drs)		Total Public Expenditure (LMU drs)		Various Educ. Expend. (LMU drs)		YEAR	GDP ("aver." estim.) (LMU drs)		Total Public Expenditure (LMU drs)		Various Educ. Expend. (LMU drs)	
	Curr. Prices	Const. 1914 Prices	Curr. Prices	Const. 1914 Prices	Curr. Prices	Const. 1914 Prices		Curr. Prices	Const. 1914 Prices	Curr. Prices	Const. 1914 Prices	Curr. Prices	Const. 1914 Prices
	1	2	3	4	5	6		1	2	3	4	5	6
1830							1885	193,12	271,75	58,65	82,52	1,53	2,15
1831							1886	202,14	259,86	61,28	78,78	1,56	2,00
1832							1887	208,20	268,87	50,06	64,65	1,57	2,02
1833	68,60	164,59	18,58	44,57	0,16	0,39	1888	211,63	275,00	49,94	64,90	1,85	2,41
1834	82,85	175,20	39,76	84,08	0,53	1,13	1889	201,63	256,08	77,15	97,98	1,60	2,03
1835	103,87	228,95	21,97	48,43	0,61	1,36	1890	208,80	241,80	63,70	73,77	1,56	1,81
1836	87,82	221,46	21,06	53,12	0,74	1,88	1891	224,42	210,79	54,47	51,16	1,52	1,43
1837	95,43	227,04	23,90	56,86	0,87	2,07	1892	231,55	219,89	51,39	48,80	2,05	1,95
1838	101,80	238,91	20,33	47,71	0,97	2,28	1893	236,72	234,03	41,73	41,25	2,98	2,95
1839	99,73	216,41	18,72	40,63	0,84	1,82	1894	210,87	239,31	36,06	40,93	2,98	3,38
1840	106,45	207,02	18,73	36,43	0,81	1,57	1895	216,60	230,21	38,23	40,64	3,88	4,12
1841	94,68	205,39	18,55	40,24	0,76	1,64	1896	226,60	252,79	37,35	41,66	1,98	2,21
1842	84,47	209,84	18,61	46,22	0,79	1,97	1897	208,98	214,69	55,91	57,44	3,41	3,50
1843	76,83	177,01	15,69	36,15	0,47	1,07	1898	230,33	231,83	126,41	127,23	2,00	2,02
1844	77,70	171,58	14,74	32,56	0,35	0,78	1899	218,32	236,67	42,07	45,61	2,31	2,50
1845	75,56	165,27	14,64	32,03	0,42	0,91	1900	233,75	211,30	43,66	39,46	2,10	1,90
1846	79,79	181,17	14,85	33,71	0,52	1,19	1901	263,24	202,54	45,25	34,82	3,01	2,32
1847	71,79	154,38	15,62	33,60	0,57	1,22	1902	251,20	259,55	49,02	50,65	2,45	2,53
1848	79,80	166,41	15,94	33,24	0,68	1,43	1903	243,93	253,66	45,45	47,26	2,40	2,50
1849	81,37	170,47	15,70	32,88	0,70	1,47	1904	222,19	267,52	45,08	54,28	2,42	2,92
1850	89,19	172,20	16,51	31,88	0,70	1,35	1905	223,37	274,27	44,83	55,04	2,43	2,98
1851	92,04	210,93	15,64	35,84	0,76	1,74	1906	231,32	270,95	46,53	54,50	2,84	3,33
1852	108,30	178,09	15,86	26,08	0,77	1,27	1907	245,72	274,73	45,56	50,94	1,92	2,14
1853	99,39	195,16	15,63	30,69	0,78	1,53	1908	240,98	273,27	50,45	57,21	2,45	2,77
1854	113,81	204,47	16,75	30,09	0,78	1,39	1909	258,56	278,65	51,30	55,28	2,69	2,90
1855	104,33	215,01	18,23	37,57	0,83	1,71	1910	246,22	277,57	52,32	58,99	3,00	3,38
1856	142,66	188,26	18,15	23,96	0,86	1,13	1911	313,71	346,18	67,13	74,08	2,84	3,13

YEAR	GDP ("aver." estim.) (LMU drs)		Total Public Expenditure (LMU drs)		Various Educ. Expend. (LMU drs)		YEAR	GDP ("aver." estim.) (LMU drs)		Total Public Expenditure (LMU drs)		Various Educ. Expend. (LMU drs)	
	Curr. Prices	Const. 1914 Prices	Curr. Prices	Const. 1914 Prices	Curr. Prices	Const. 1914 Prices		Curr. Prices	Const. 1914 Prices	Curr. Prices	Const. 1914 Prices	Curr. Prices	Const. 1914 Prices
	1	2	3	4	5	6		1	2	3	4	5	6
1857	136,34	244,04	18,39	32,92	0,89	1,60	1912	302,96	335,88	76,48	84,79	2,71	3,00
1858	126,74	235,28	21,16	39,28	0,95	1,76	1913	177,75	201,00	54,35	61,46	1,43	1,62
1859	153,44	231,52	21,39	32,27	1,05	1,58	1914	256,48	256,48	100,80	100,80	1,97	1,97
1860	139,65	227,56	21,36	34,81	1,04	1,70	1915	294,97	242,53	80,11	65,87	2,79	2,30
1861	137,02	242,25	22,89	40,46	1,11	1,97	1916	390,97	243,86	49,38	30,80	2,84	1,77
1862	139,09	244,49	22,88	40,22	1,15	2,02	1917	558,42	234,68	65,84	27,67	3,49	1,47
1863	142,37	218,43	20,80	31,91	1,12	1,72	1918	871,47	285,21	300,32	98,29	5,58	1,83
1864	137,79	198,52	17,97	25,89	0,88	1,26	1919	787,07	234,65	281,12	83,81	5,27	1,57
1865	132,57	212,24	20,55	32,90	1,13	1,81	1920	1.068,70	281,13	335,39	88,23	13,49	3,55
1866	139,63	202,57	20,03	29,06	0,96	1,39	1921	1.340,35	282,75	485,86	102,49	15,25	3,22
1867	161,34	213,94	26,94	35,72	0,95	1,26	1922	1.813,92	247,62	581,93	79,44	21,97	3,00
1868	152,80	216,41	31,13	44,09	1,02	1,44	1923	2.724,80	215,46	819,23	64,78	35,27	2,79
1869	133,96	213,44	25,77	41,06	0,97	1,55	1924	3.497,95	250,56	928,16	66,48	58,37	4,18
1870	158,10	207,59	24,51	32,18	1,04	1,37	1925	4.004,05	265,52	1.141,64	75,70	73,56	4,88
1871	177,89	199,16	24,81	27,78	1,01	1,13	1926	4.632,57	268,41	1.426,23	82,64	74,48	4,32
1872	147,20	193,46	21,84	28,70	1,04	1,37	1927	5.005,64	257,17	1.259,71	64,72	82,92	4,26
1873	156,75	227,99	21,07	30,64	1,02	1,49	1928	5.418,33	278,82	1.522,46	78,34	99,07	5,10
1874	165,22	215,74	29,11	38,01	1,13	1,47	1929	5.128,71	286,88	2.906,52	162,58	125,71	7,03
1875	162,33	206,63	22,10	28,14	1,12	1,43	1930	4.882,87	306,30	1.755,33	110,11	125,77	7,89
1876	154,08	205,71	21,73	29,01	1,17	1,56	1931	4.603,59	299,13	1.717,32	111,59	105,89	6,88
1877	172,16	193,27	21,55	24,19	0,74	0,83	1932	5.054,06	286,70	1.393,27	79,03	105,96	6,01
1878	174,14	212,67	22,06	26,95	1,16	1,41	1933	5.789,14	304,71	1.163,24	61,23	114,51	6,03
1879	169,38	220,93	56,75	74,02	1,22	1,59	1934	6.256,33	326,72	1.657,68	86,57	134,08	7,00
1880	173,44	217,25	52,18	65,36	1,19	1,50	1935	6.507,87	345,59	1.469,69	78,05	139,12	7,39
1881	169,84	211,11	56,79	70,58	1,02	1,26	1936	6.736,43	333,23	1.828,57	90,45	138,68	6,86
1882	186,74	224,78	31,71	38,16	1,29	1,55	1937	8.048,74	373,02	1.908,74	88,46	137,54	6,37
1883	196,22	224,02	33,09	37,78	1,44	1,65	1938	7.819,53	363,47	1.774,10	82,47	139,91	6,50
1884	197,75	251,86	44,10	56,17	1,74	2,21	1939	7.492,41		1.914,38		142,45	

Looking at the per head developments in more detail one can discern a few distinct sub periods that may be considered as suggesting a slight cyclical behavior. In particular, the cycles detected appear to be roughly 20-25 years long and are the following

- from 1838 to 1862,

- from 1862 to 1873 or to 1888, if one explains the developments in the 1860s as a slowdown in the decline that might have taken place were it not for the integration of the Ionian Islands,

- from 1888 to1911,

- from 1911 onwards the pattern seems to break down during the war years; then, after 1923 there is an increase[16].

By comparison, the total GDP (1914) figures show a continuous small increase up to 1888, practically no increase between 1888 and 1902, a small increase up to 1910 and a large one thereafter.

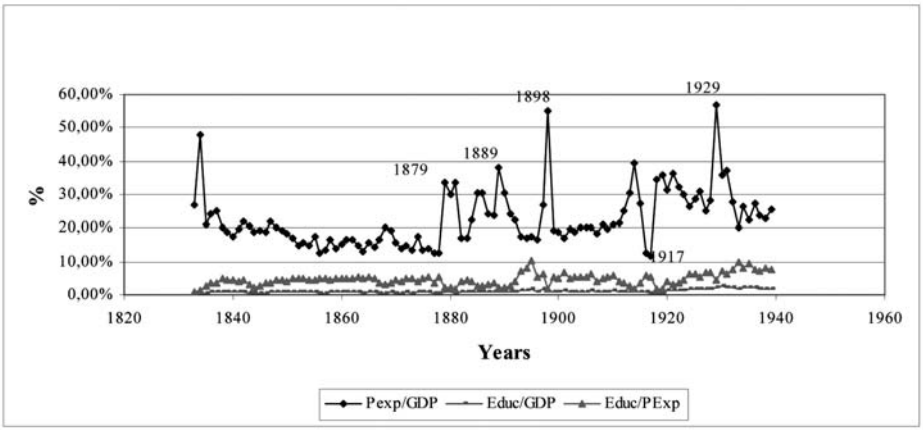
In regard to the above, one can make some interesting observations. In particular

- The sharp rise in the early years (up to 1838) reflects the (relative) normalisation of the country after the revolution. The subsequent drop appears to be related, either as a cause or as a result, to the suspension of payments in 1843. One point that must be noted here is that the recovery coincides with the implementation of a forced currency regime for eight months in 1848. The upturn, if one ignores the slight hiccup in 1858-1860, which might have been the result of the turmoil that led to the departure of King Otto, appears to have lasted until 1862.

- The drop that followed coincides with the acquisition of the Ionian Islands in 1864. Assuming that the development level in the new territory was indeed higher than that of the mainland, one must conclude that the drop would have been larger if the figures of the Ionian Islands had not been included in the totals. This argument appears to be supported by the fact that the decline appears to have commenced in 1863. If this premise is not true then one must accept that the totals reflect the true growth of GDP better and this growth lasted until 1888. In retrospect it seems difficult to accept that per head output was significantly lower in the Ionian Islands and that it alone caused the decline observed up to 1877, the increase in 1873 being an abnormality. On the

DIAGRAM 3

Ratios of Basic Magnitudes (1833-1939)



other hand, the mere fact of the acquisition does appear to have strained resources and contributed to a further decline in per capita GDP. Such a decline is also apparent in 1881 and 1913, although in those cases the indications are that the new territories were poorer than the old on both occasions. After 1877 the figures suggest a recovery, in spite of the European crises of 1873-1896. This must be a result of the administration's policies of increased public expenditure largely on account of military purposes. This increase in public expenditure[17] can be seen in diagram 1A and is more obvious in diagram 2A. It can also be seen from another viewpoint in table 3 and diagram 3[18] where the increase of public expenditure as a percentage of GDP is observed. The recovery suffered a mild setback in 1881, possibly as a result of the costs implicit in the procedures of integrating a large new territory. As noted earlier on, this is expected given the disruption of the productive process in this territory. It must be added that, in this sub period, there were three instances of forced currency implementation. The first started in September 1868 and lasted until July 1870. The second started in June 1877 and lasted until the end of 1884. Finally, the third commenced in September 1885 and continued thereafter without being lifted.

- In all, the per head magnitudes appear to have been higher in this second period, i.e. over 200 LMU drs, than in the first one when, as a rule they were closer to 175 LMU drs.

TABLE 3

Ratios between basic magnitudes of the Greek Economy (1833-1939)

Levels											
Year	PExp / GDP	Educ/ GDP	Educ/ Pexp	Year	PExp / GDP	Educ/ GDP	Educ/ Pexp	Year	PExp / GDP	Educ/ GDP	Educ/ Pexp
	1	2	3		1	2	3		1	2	3
1830				1867	16,70%	0,59%	3,52%	1904	20,29%	1,09%	5,37%
1831				1868	20,37%	0,67%	3,27%	1905	20,07%	1,09%	5,41%
1832				1869	19,24%	0,72%	3,77%	1906	20,12%	1,23%	6,10%
1833	27,08%	0,23%	0,86%	1870	15,50%	0,66%	4,26%	1907	18,54%	0,78%	4,21%
1834	47,99%	0,64%	1,34%	1871	13,95%	0,57%	4,06%	1908	20,94%	1,02%	4,85%
1835	21,15%	0,59%	2,80%	1872	14,83%	0,71%	4,78%	1909	19,84%	1,04%	5,24%
1836	23,98%	0,85%	3,53%	1873	13,44%	0,65%	4,86%	1910	21,25%	1,22%	5,73%
1837	25,04%	0,91%	3,64%	1874	17,62%	0,68%	3,88%	1911	21,40%	0,90%	4,22%
1838	19,97%	0,95%	4,77%	1875	13,62%	0,69%	5,09%	1912	25,24%	0,89%	3,54%
1839	18,77%	0,84%	4,48%	1876	14,10%	0,76%	5,39%	1913	30,58%	0,81%	2,64%
1840	17,60%	0,76%	4,32%	1877	12,52%	0,43%	3,45%	1914	39,30%	0,77%	1,95%
1841	19,59%	0,80%	4,09%	1878	12,67%	0,66%	5,24%	1915	27,16%	0,95%	3,49%
1842	22,03%	0,94%	4,26%	1879	33,50%	0,72%	2,14%	1916	12,63%	0,73%	5,75%
1843	20,42%	0,61%	2,97%	1880	30,08%	0,69%	2,29%	1917	11,79%	0,62%	5,30%
1844	18,98%	0,45%	2,39%	1881	33,43%	0,60%	1,79%	1918	34,46%	0,64%	1,86%
1845	19,38%	0,55%	2,85%	1882	16,98%	0,69%	4,07%	1919	35,72%	0,67%	1,88%
1846	18,61%	0,65%	3,52%	1883	16,86%	0,74%	4,36%	1920	31,38%	1,26%	4,02%
1847	21,76%	0,79%	3,63%	1884	22,30%	0,88%	3,94%	1921	36,25%	1,14%	3,14%
1848	19,97%	0,86%	4,29%	1885	30,37%	0,79%	2,60%	1922	32,08%	1,21%	3,78%
1849	19,29%	0,86%	4,46%	1886	30,32%	0,77%	2,54%	1923	30,07%	1,29%	4,31%
1850	18,51%	0,79%	4,25%	1887	24,04%	0,75%	3,13%	1924	26,53%	1,67%	6,29%
1851	16,99%	0,83%	4,86%	1888	23,60%	0,87%	3,71%	1925	28,51%	1,84%	6,44%
1852	14,65%	0,71%	4,86%	1889	38,26%	0,79%	2,07%	1926	30,79%	1,61%	5,22%
1853	15,72%	0,78%	4,98%	1890	30,51%	0,75%	2,45%	1927	25,17%	1,66%	6,58%
1854	14,72%	0,68%	4,63%	1891	24,27%	0,68%	2,79%	1928	28,10%	1,83%	6,51%
1855	17,47%	0,80%	4,56%	1892	22,19%	0,89%	4,00%	1929	56,67%	2,45%	4,32%
1856	12,73%	0,60%	4,73%	1893	17,63%	1,26%	7,15%	1930	35,95%	2,58%	7,16%
1857	13,49%	0,66%	4,86%	1894	17,10%	1,41%	8,26%	1931	37,30%	2,30%	6,17%
1858	16,69%	0,75%	4,48%	1895	17,65%	1,79%	10,14%	1932	27,57%	2,10%	7,60%
1859	13,94%	0,68%	4,89%	1896	16,48%	0,87%	5,30%	1933	20,09%	1,98%	9,84%
1860	15,30%	0,75%	4,87%	1897	26,75%	1,63%	6,09%	1934	26,50%	2,14%	8,09%
1861	16,70%	0,81%	4,86%	1898	54,88%	0,87%	1,58%	1935	22,58%	2,14%	9,47%
1862	16,45%	0,83%	5,03%	1899	19,27%	1,06%	5,49%	1936	27,14%	2,06%	7,58%
1863	14,61%	0,79%	5,40%	1900	18,68%	0,90%	4,81%	1937	23,71%	1,71%	7,21%
1864	13,04%	0,64%	4,87%	1901	17,19%	1,14%	6,65%	1938	22,69%	1,79%	7,89%
1865	15,50%	0,85%	5,50%	1902	19,51%	0,98%	5,00%	1939	25,55%	1,90%	7,44%
1866	14,35%	0,69%	4,78%	1903	18,63%	0,98%	5,28%				

• Both series point to a slowdown between 1888 and 1902. In this case, given the qualitative evidence from the period, it is probably more accurate to speak of a crisis. During these years there was a severe currant problem, currants being the main export item of the country, a default of payments in 1893 and an unfortunate war in 1897 which was followed by the payment of high war indemnities to Turkey. The recovery coincided with the imposition of an International Financial Commission in Greece which took over certain public receipts assigning them to the payment of the debt. In addition there were severe restrictions implemented controlling public finances and discouraging the (unlimited) issue of paper money. The recovery seems to have been spectacular and lasted until the outbreak of the Balkan Wars.

The period after 1911 is a difficult one. To begin, there are the Balkan Wars which led to a great increase of the country's territory and population. As has been noted previously, the decline in GDP per head in 1913 is expected, as is the slight growth in total GDP. Then comes WWI, which lasted until 1918, and the country's involvement in Asia Minor, which ended in a disastrous defeat and the flooding of the country with refugees in 1923. This is reflected in the 1923 per head figure in both series, i.e. in nominal and 1914 prices. Were it not for the Asia Minor events the figures appear to suggest a continuous increase starting in 1919, i.e. after the end of WWI. Furthermore, the figures reflect the financial/foreign exchange problems of the mid-1920s and the big crisis in the early 1930s.

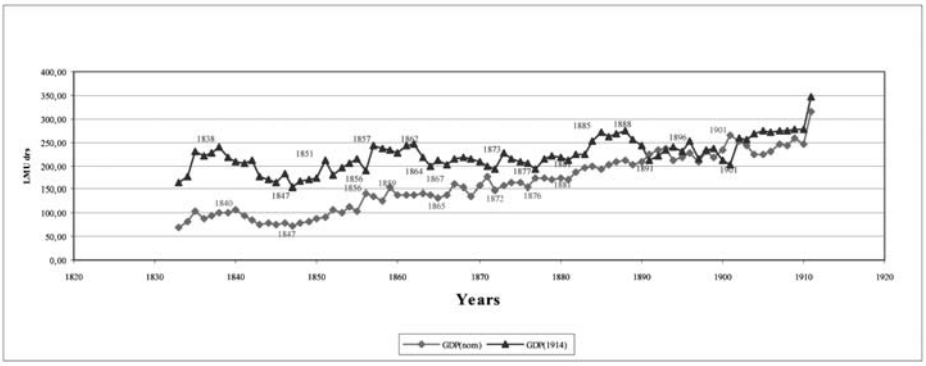
Looking at table 4, the compound annual growth rates derived for the whole period as well as for various sub periods essentially clarifies what has been argued so far. In particular one sees that for the total of the period, i.e. for 1833-1938, the annual rate of change of GDP at current prices was 6,90%, that of GDP at 1914 prices 3,00%, that of GDP per head at current prices 4,6% and that for GDP per head at 1914 prices 0,8%. Concentrating on the figures referring to the real magnitudes, one notes that although small by post-WWI standards they are more or less close to the figures that consisted the norm for the period examined. By comparison, for the same period the corresponding rates of growth of public expenditure were in all cases smaller than those for GDP. Finally, population grew at an average annual rate of 2,2% wheras the rates of change of education expenditure appear to increase faster[19].

Concentrating on the deflated magnitudes and looking at characteristic sub periods one notes the following

• Smaller growth rates, than those noted for the whole period, for the sub period 1873-1896, i.e. when Europe was at a crisis (2,9% for GDP and 0,5% for

DIAGRAM 2B

Greek GDP/head (1833-1911)



GDP/head). It must be noted, however, that the GDP and GDP per head magnitudes grew faster in this sub period than in the one preceding it (i.e. 2,3% and 0,4% in 1833-1872).

- The largest growth rates are observed in the 20th century and especially after the 1897 war which, it may be recalled, led to the establishment of the International Financial Control.

- For the three sub periods starting in 1833 and ending in each of the years 1910-1912 the differences in the rates between nominal and deflated magnitudes are much smaller, this reflecting the relatively small inflation of the earlier years. Still, although the two per head magnitudes, i.e. nominal and deflated, are much closer than in the latter part of the period, they still depict a different path, the deflated magnitudes suggesting a more or less stagnant economy up to the end of the century and a small increase thereafter, while the nominal figures indicate a mild but distinct growth throughout the period. This can be seen in diagram 2B.

Overall then, the picture depicted for pre-WWI growth in Greece appears to hinge largely on the magnitude one adopts, although it would seem that no one would use either of the two GDP magnitudes expressed in current prices, referring to the latter part of the period, for this purpose. In addition, it would seem that these figures paint an overly optimistic picture and do not represent true growth in the 19th century, i.e. up to the early 1910s.

TABLE 4
Compound Rates of Change

Μεταβλητές / Magnitudes			Periods / Length of Periods								
Levels			1833-1863	1833-1864	1833-1872	1833-1880	1833-1881	1833-1893	1833-1897	1833-1910	1833-1911
			(30)	(31)	(39)	(47)	(48)	(60)	(64)	(77)	(78)
	GDP ("aver." estim.) (LMU drs)	Curr. Prices	1,040	1,044	1,039	1,039	1,041	1,041	1,037	1,034	1,037
		Const. 1914 Prices	1,025	1,027	1,023	1,024	1,027	1,026	1,024	1,024	1,027
	Total Public Expenditure (LMU drs)	Curr. Prices	1,019	1,020	1,023	1,041	1,046	1,034	1,037	1,031	1,034
		Const. 1914 Prices	1,004	1,003	1,008	1,027	1,031	1,018	1,023	1,021	1,024
Per Head	Various Educ. Expend.(LMU drs)	Curr. Prices	1,083	1,078	1,069	1,063	1,062	1,071	1,069	1,057	1,055
		Const. 1914 Prices	1,067	1,061	1,053	1,048	1,047	1,055	1,055	1,046	1,045
	Population		1,015	1,021	1,019	1,018	1,022	1,020	1,019	1,017	1,017
	GDP ("aver." estim.) (LMU drs)	Curr. Prices	1,025	1,023	1,020	1,020	1,019	1,021	1,018	1,017	1,020
		Const. 1914 Prices	1,009	1,006	1,004	1,006	1,005	1,006	1,004	1,007	1,010
	Total Public Expenditure (LMU drs)	Curr. Prices	1,004	0,999	1,004	1,022	1,024	1,014	1,017	1,014	1,017
		Const. 1914 Prices	0,989	0,983	0,989	1,008	1,010	0,999	1,004	1,004	1,007
	Various Educ. Expend. (LMU drs)	Curr. Prices	1,067	1,056	1,049	1,044	1,039	1,050	1,049	1,039	1,037
		Const. 1914 Prices	1,051	1,039	1,033	1,029	1,025	1,034	1,035	1,029	1,027

Μεταβλητές / Magnitudes			Periods / Length of Periods								
Levels			1833-1912	1833-1938	1833-1939	1873-1896	1897-1938	1898-1938	1912-1938	1913-1938	
			(79)	(105)	(106)	(20)	(41)	(40)	(26)	(25)	
	GDP ("aver." estim.) (LMU drs)	Curr. Prices	1,036	1,069	1,068	1,043	1,121	1,121	1,176	1,182	
		Const. 1914 Prices	1,026	1,030		1,029	1,040	1,038	1,041	1,040	
	Total Public Expenditure (LMU drs)	Curr. Prices	1,035	1,067	1,068	1,053	1,117	1,097	1,171	1,168	
		Const. 1914 Prices	1,025	1,028		1,039	1,035	1,016	1,037	1,028	

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Μεταβλητές / Magnitudes			Periods / Length of Periods							
Per Head	Various Educ. Expend.(LMU drs)	Curr. Prices	1,054	1,090	1,090	1,058	1,124	1,142	1,208	1,220
		Const. 1914 Prices	1,044	1,050		1,044	1,042	1,057	1,069	1,074
	Population		1,017	1,022	1,022	1,024	1,026	1,027	1,038	1,016
	GDP ("aver." estim.) (LMU drs)	Curr. Prices	1,019	1,046	1,045	1,019	1,092	1,092	1,133	1,163
		Const. 1914 Prices	1,009	1,008		1,005	1,013	1,011	1,003	1,024
	Total Public Expenditure (LMU drs)	Curr. Prices	1,018	1,044	1,045	1,029	1,088	1,068	1,129	1,150
		Const. 1914 Prices	1,008	1,006		1,015	1,009	0,989	0,999	1,012
	Various Educ. Expend (LMU drs)	Curr. Prices	1,036	1,067	1,066	1,034	1,095	1,112	1,164	1,201
		Const. 1914 Prices	1,026	1,027		1,020	1,015	1,030	1,030	1,057

The reasons against using totals to gauge growth in the case of pre-WWI Greece have been stated earlier on and need not be repeated here. And, although one might argue in favor of accepting the magnitude for GDP per head in currrent prices for the 19th century, it is felt that the figures for GDP per head in 1914 prices seem to offer the best measure of the country's development during both the 19th century and the whole period before WWI. These figures paint a picture of very slow growth, especially in the 19th century.

Following the above, the question that arises next is what are the particular characteristics, the nature and the causes of the growth that the country experienced during the period. A first attempt to answer such questions using an established theory is made in the next section. In it, the analysis will be restricted to the period up to 1910. After that, the country went through a succession of wars (the Balkan Wars in 1912-13, WWI in 1914-1918 and the Asia Minor involvement leading to the expedition that ended in disaster and the influx of refugees in 1923) which makes the figures more erratic and the period more complicated. This period is quite complicated, a fact that calls for a separate study all by itself and is not within the tentative scope of the analysis of the present paper.

4. Estimation of the Endogenous Effect of Education on Economic Growth

4a. Introduction

The theoretical framework adopted in this section is that of a steady state growth economy as developed in Solow. Technological progress, if any, is

assumed to be Solow neutral, or labor augmenting. Furthermore endogeneity in the rate of increase of output per head is assumed, in that this rate is dependent not on a time trend but on expenditure on education services. Thus we follow the original interpretation of endogenous growth and not that found in the recent literature.

In order to ensure conditions that approximate a steady state we limit our investigation to the years 1846 to 1910. This decision is based on the following considerations. The beginning of the period was chosen in such a way in order to allow for enough time to elapse from the foundation of the modern Greek state to a situation approximating regularity. Thus, the population losses due to the war of independence would be largely alleviated by this time, while the processes inherent in the establishment of the Greek state (including the data reporting machinery) and the ensuing initial institutional experimentation period may be considered to have just about ended by 1846. By comparison, the end date of the period under investigation was chosen because the period following 1910 involves actual war, as opposed to simple military tension, international strife, an expeditionary war, defeat and the influx of a sizable number of refugees. Furthermore, an additional reason for leaving out the period after 1910, in spite of the fact that data are available, is the occurance of a major international economic crisis. Given these circumstances the assumption of a steady state for these years is stretching the facts of life a bit too much.

An economy that is the steady state would grow at the rate of labor increase. Thus output, savings and investment all grow at the rate of population increase. Output per head is then constant. In the presence of labor augmenting growth, the previous statement holds to the extent that it is now the growth of labor measured in efficiency units that regulates the growth of all key variables in the economy. Thus the actual population increase is smaller than that of all other variables, notably of output. The result is that actual output per head increases in this case by the rate of growth of labor efficiency.

Explaining the growth of labor efficiency requires that the latter is a function of some economic variable. Usually education is deemed the culprit, standing in as a proxy for human capital accumulation which in turn makes the labor force more efficient.

Thus if L is the labor force, Y the output produced, t the rate of labor augmenting technological progress, while E is the level of education expenditure, then the three cases mentioned above correspond to the following three expressions:

(1) $Y/L = c$

(2) $Y/A(t)L=c$

(3) $Y/A(E)L = c$

where c is a constant, and A(.) is a function expressing the increase in the efficiency of labor, or equivalently measuring amount of services produced by one unit of labor compared to some base year.

In what follows we shall limit our discussion to rates of growth of output and labor services, since the availability of data do not permit the examination of the behavior of other variables. Output is approximated by GDP at constant prices, while Labor is approximated by the population at large, this being a fair assumption in a predominantly agricultural society.

Taking the third relationship, and taking logs on both sides we get

$\log(Y) - \log(L) = C + \beta \text{ Log}(E)$

This is the relationship we investigate in this paper.

4b. Nature of the Series

Initially we test the two series of interest, GDP per Head and Education Expenditure for unit roots, in order to establish whether they contain a trend and if so if the trend is a deterministic or stochastic nature.

Applying the Dickey-Fuller test, both the output per head and the education series appear to contain a deterministic trend and intercept. That is the unit root hypothesis appears to be rejected in both cases. (Table 1 & 2). These results become stronger once a dummy is included, representing the initial period (1846-1862) before the successive territorial enlargements of the Greek State that occurred during the period under consideration (1863 and 1880).

The results of these tests imply that output per head is a trend stationary series[20]. If steady state growth without technical progress were present, then there should be no trend in the series. This holds true for the education expenditure series as well. Thus the working hypothesis is that labor productivity is the engine for increases of output per head. The possibility of a cyclical component in this relationship being present can be easily allowed for by estimating the appropriate structure of the residuals of this equation.

The results give a statistically significant fit for the two series as seen in Equation 1a. This equation does not include the dummy variable. The constant term indicates that output per head is 2.94, while the increase in output per head for the period under consideration due to Education expenditures seems to contribute 0.17% growth per year.

EQ 1a

GDP per head as a function of education expenditure per head

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.940378	0.439034	6.697382	0.0000
LEDU	0.168590	0.029514	5.712178	0.0000
AR(1)	0.472554	0.117404	4.025012	0.0002
AR(2)	0.251524	0.117895	2.133459	0.0371
R-squared	0.772826	Mean dependent var		5416876
Adjusted R-squared	0.761275	S.D. dependent var		0.128800
S.E. of regression	0.062931	Akaike info criterion		-2.632172
Sum squared resid	0.233658	Schwarz criterion		-2.496100
Log likelihood	86.91342	F-statistic		66.90427
Durbin-Watson stat	2.026414	Prob (F-statistic)		0.000000
Inverted AR Roots	.79	-.32		

Equation 1b is identical to eq 1a, only this time the dummy for 1846-1862 was included. Output per head is 2.72, while for the first period this increases to 2.82. Education expenditures lead to 0.18 increase per year.

EQ 1b

GDP per head as a function of education expenditure per head including a dummy variable for 1846-1862

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.715276	0.433905	6.257761	0.0000
LEDU	0.182420	0.028985	6.293641	0.0000
D3	0.117369	0.054292	2.161808	0.0348
AR(1)	0.436128	0.114452	3.810562	0.0003
AR(2)	0.303838	0.114543	2.652611	0.0103
R-squared	0.792044	Mean dependent var		5.416876

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adjusted R-squared	0.777702	S.D. dependent var	0.128800
S.E. of regression	0.060727	Akaike info criterion	-2.688816
Sum squared resid	0.213891	Schwarz criterion	-2.518725
Log likelihood	89.69769	F-statistic	55.22628
Durbin-Watson stat	2.099384	Prob (F-statistic)	0.000000
Inverted AR Roots	.81	-.37	

Education expenditures may be considered as a poor proxy for human capital. For this reason a human capital series was constructed based on the cumulative education expenditures starting from 1833. An arbitrary depreciation rate of 5% was employed, so that the human capital series was constructed as a ten year moving average. Examination of the resulting series led to the acceptance of the unit root hypothesis. Thus the forecast values of this series for the sample period were employed as a proxy for human capital. Eq 2.

EQ 2

GDP per head as a function of a human capital index and a dummy variable for 1846-1862

Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	1.755818	0.970310	1.809543	0.0757
LHC05F(-1)	0.215494	0.056678	3.802093	0.0004
D3	0.148042	0.064824	2.283732	0.0262
AR(1)	0.730280	0.140598	5.194108	0.0000
MA(1)	-0.334853	0.204824	-1.634838	0.1077
R-squared	0.651404	Mean dependent var	5.426397	
Adjusted R-squared	0.626504	S.D. dependent var	0.119309	
S.E. of regression	0.072915	Akaike info criterion	-2.320635	
Sum squared resid	0.297729	Schwarz criterion	-2.147612	
Log likelihood	75.77935	F-statistic	26.16111	
Durbin-Watson stat	2.012339	Prob (F-statistic)	0.000000	
Inverted AR Roots	.73			
Inverted MA Roots	.33			

Using this proxy for human capital we get an initial value for GDP per head of 1.76 for the whole period, while for the first period the value is 1.89. Human capital lagged by one period then contributes .22 per period. Thus the cumulative index indicates a higher contribution of education to output per head than current expenditure.

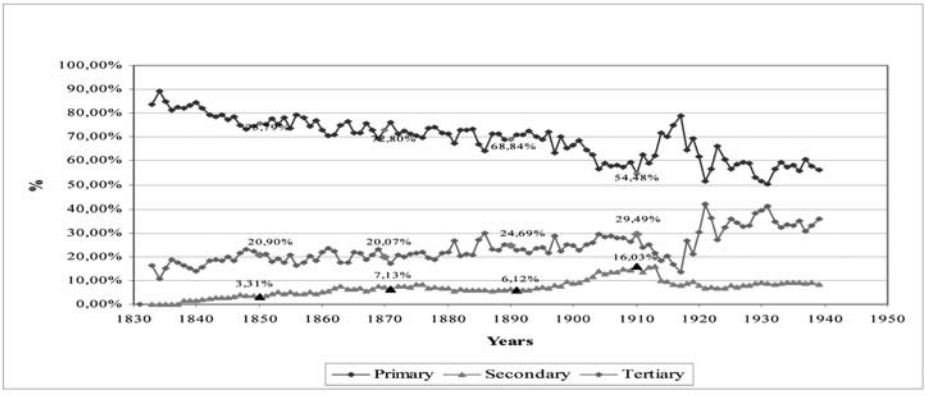
5. Concluding Remarks

In general it would appear that all the evidence presented in the earlier sections, both statistical and econometric, points to the same direction i.e. that during the period in question, i.e. up to 1910, there has been little, if any, true development in the Greek economy. More specifically, GDP (1914) grew faster than population, which, in the confines of the steady state framework, implies a certain degree of growth in addition to that attributed to population growth. True enough GDP(1914)/head appears to have grown, albeit quite slow, obviously slower than population. More specifically, for the period (1833-1897) the compound average annual growth rate of GDP (1914) was 2,4%, for GDP (1914)/head 0,4% and for population (1,9%). By comparison, for the period (1833-1910) the corresponding rates are 2,4% for GDP (1914), 0,7% for GDP (1914)/head and 1,7% for population.

The existence of an overall change in the production structure of the economy, albeit a small one, can also be surmised indirectly. In particular, if one examines the size of the shares of each sector in GDP during the period in question, one can obtain an extra indication of a distinct but small change. More specifically, as can be seen in table 5 and diagram 4, the primary sector remained the major constituent of GDP throughout the period, dropping from 76% in 1850 to 55% in 1910. More importantly more than half of this decline took place in the first decade of the 20th century and specifically after 1902.By comparison, secondary production, which would seem to be the main sector in

DIAGRAM 4

Sector share in GDP (1833-1911)



which technological advancements manifest themselves, increased by less than 9 percentage points during the whole sub period examined, more than half of this increase appearing, as in the case of the decline in the share of the primary sector, after 1902.

In both cases then it appears that most of the little growth observed took place in the first decade of the 20th century.

During the period examined Greece was adequately close to fulfilling the steady state assumptions. It was essentially an agricultural economy and not a very open one. It would appear that aside for the construction of railways, very little else happened in the way of an influx of new technologies. In fact, even in the shipping sector the sail ship was still widely used until the end of the 19th century.

As a consequence it can be argued that the adoption of the steady state hypothesis as a working framework is within the confines of acceptability. In this context it appears that the importance of spending on education, whose mildly increasing trend is depicted in diagram 5, and the creation of human capital is an important factor in achieving growth.

Spending on education has, indeed, been found to be a factor. In fact, the evidence points to this magnitude exerting a relatively important influence. Other factors such as borrowing may also have exerted influence, but this unfortunately cannot be tested with the readily available data.

DIAGRAM 5

Education Expenditure per Head (1833-1910)

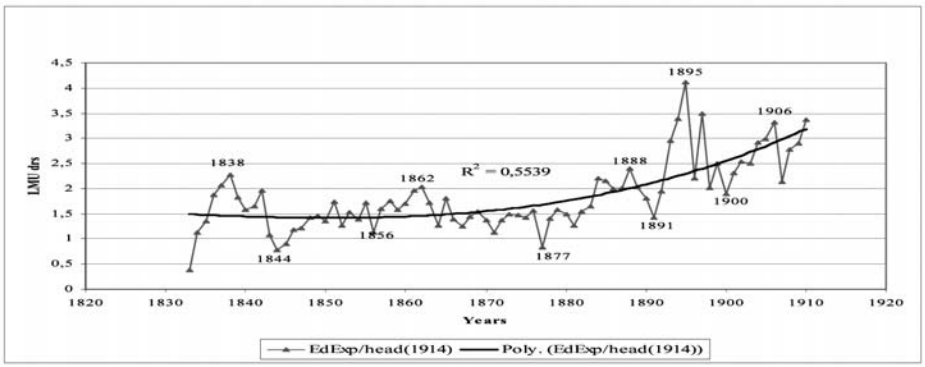


TABLE 5

Share of each sector's production value in total GDP (aver: min+max)

Year	Agricul.	Livestock	Forestry	Mining etc	Tot. Primary	Second.	Tertiary	Year	Agricul.	Livestock	Forestry	Mining etc	Tot. Primary	Second.	Tertiary
	1	2	3	4	5	6	7		1	2	3	4	5	6	7
1830								1885	41,13%	21,96%	0,97%	2,87%	66,93%	5,95%	27,12%
1831								1886	39,97%	19,59%	1,00%	3,60%	64,17%	5,85%	29,99%
1832								1887	48,93%	17,07%	0,90%	4,40%	71,30%	5,55%	23,15%
1833	55,44%	27,37%	0,50%	0,31%	83,62%	0,00%	16,38%	1888	43,06%	21,83%	0,93%	5,36%	71,18%	5,97%	22,85%
1834	55,60%	32,78%	0,46%	0,60%	89,44%	0,00%	10,56%	1889	43,26%	19,67%	1,13%	4,75%	68,81%	6,04%	25,15%
1835	55,67%	28,19%	0,41%	0,54%	84,82%	0,00%	15,18%	1890	46,43%	16,42%	0,84%	5,15%	68,84%	6,47%	24,69%
1836	47,71%	32,17%	0,52%	0,83%	81,23%	0,00%	18,77%	1891	43,00%	22,21%	0,95%	4,94%	71,09%	6,12%	22,80%
1837	51,72%	29,53%	0,53%	0,72%	82,50%	0,00%	17,50%	1892	41,79%	22,46%	0,96%	5,65%	70,86%	6,06%	23,08%
1838	50,40%	30,40%	0,58%	0,73%	82,10%	1,64%	16,26%	1893	46,23%	19,62%	0,73%	5,88%	72,45%	5,84%	21,70%
1839	55,80%	25,94%	0,64%	0,68%	83,07%	1,74%	15,19%	1894	40,70%	20,91%	0,89%	7,48%	69,98%	6,68%	23,34%
1840	55,13%	28,19%	0,65%	0,65%	84,62%	1,58%	13,80%	1895	37,53%	22,37%	1,51%	7,66%	69,08%	7,20%	23,72%
1841	52,89%	27,70%	0,81%	0,74%	82,13%	2,18%	15,68%	1896	44,72%	18,54%	2,21%	6,47%	71,94%	6,72%	21,33%
1842	46,80%	30,38%	1,05%	0,91%	79,14%	2,48%	18,38%	1897	40,49%	14,22%	1,30%	7,34%	63,35%	7,93%	28,72%
1843	44,85%	31,43%	1,20%	0,93%	78,40%	2,68%	18,92%	1898	47,90%	14,95%	1,02%	6,36%	70,23%	7,63%	22,15%
1844	48,49%	28,46%	1,29%	0,92%	79,16%	2,69%	18,15%	1899	37,31%	19,79%	0,95%	7,38%	65,43%	9,52%	25,05%
1845	42,91%	32,20%	1,41%	0,84%	77,36%	2,77%	19,87%	1900	41,24%	17,82%	0,95%	6,65%	66,66%	8,72%	24,62%
1846	51,50%	24,70%	1,40%	0,89%	78,49%	3,37%	18,14%	1901	45,23%	15,48%	1,05%	6,58%	68,33%	9,10%	22,56%
1847	38,66%	33,56%	1,65%	0,95%	74,82%	3,81%	21,37%	1902	39,31%	17,54%	1,53%	6,34%	64,73%	10,36%	24,91%
1848	42,72%	28,27%	1,54%	0,91%	73,44%	3,42%	23,14%	1903	39,80%	15,47%	1,21%	6,06%	62,54%	11,63%	25,83%
1849	44,72%	27,21%	1,57%	0,86%	74,35%	3,49%	22,16%	1904	32,33%	18,56%	0,86%	4,88%	56,62%	13,97%	29,41%
1850	46,68%	26,79%	1,48%	0,84%	75,79%	3,31%	20,90%	1905	37,66%	17,15%	0,97%	3,12%	58,90%	12,69%	28,40%
1851	43,13%	30,08%	1,47%	0,61%	75,29%	3,59%	21,13%	1906	36,00%	17,15%	0,82%	3,63%	57,60%	13,70%	28,70%
1852	44,72%	30,70%	1,49%	0,91%	77,82%	4,28%	17,90%	1907	38,08%	15,90%	0,88%	3,50%	58,36%	13,65%	27,99%
1853	47,02%	25,06%	2,37%	1,02%	75,47%	5,36%	19,17%	1908	36,53%	16,04%	1,13%	3,61%	57,31%	14,65%	28,04%
1854	52,12%	23,69%	1,60%	0,77%	78,19%	4,46%	17,35%	1909	40,16%	14,90%	0,94%	3,33%	59,33%	14,50%	26,17%
1855	46,46%	25,41%	1,31%	0,69%	73,87%	5,29%	20,84%	1910	35,40%	14,38%	0,73%	3,96%	54,48%	16,03%	29,49%
1856	56,03%	21,70%	0,97%	0,48%	79,18%	4,42%	16,40%	1911	43,34%	15,65%	0,88%	2,77%	62,63%	13,55%	23,82%
1857	50,62%	26,29%	0,69%	0,64%	78,25%	4,18%	17,57%	1912	37,14%	18,11%	0,92%	2,93%	59,10%	15,73%	25,17%
1858	44,86%	27,60%	1,41%	0,70%	74,56%	4,99%	20,45%	1913	34,81%	23,35%	0,91%	3,28%	62,35%	16,13%	21,52%
1859	46,85%	28,49%	0,89%	0,78%	77,00%	4,49%	18,50%	1914	32,47%	36,13%	1,04%	2,12%	71,75%	10,07%	18,18%
1860	40,97%	29,87%	1,07%	0,90%	72,80%	5,15%	22,05%	1915	35,15%	32,19%	1,23%	1,73%	70,30%	9,40%	20,30%
1861	42,90%	25,22%	1,84%	0,74%	70,70%	5,60%	23,70%	1916	41,50%	30,36%	1,31%	1,91%	75,07%	8,36%	16,57%
1862	38,66%	29,72%	1,79%	0,79%	70,97%	6,66%	22,37%	1917	44,80%	31,38%	1,30%	1,23%	78,71%	7,82%	13,47%
1863	47,40%	25,08%	1,38%	1,09%	74,94%	7,41%	17,64%	1918	33,18%	29,29%	1,28%	0,89%	64,65%	8,81%	26,54%
1864	51,63%	22,44%	1,63%	0,73%	76,43%	6,20%	17,37%	1919	34,82%	31,64%	1,75%	0,95%	69,15%	9,54%	21,30%
1865	48,44%	20,26%	1,96%	0,91%	71,56%	6,54%	21,91%	1920	35,03%	24,27%	1,53%	1,02%	61,85%	7,84%	30,30%
1866	48,99%	19,92%	1,00%	1,92%	71,83%	6,61%	21,56%	1921	25,58%	23,59%	1,35%	0,79%	51,31%	6,82%	41,87%
1867	52,35%	18,96%	2,10%	2,31%	75,72%	5,58%	18,70%	1922	32,02%	22,68%	1,19%	0,74%	56,64%	7,00%	36,37%
1868	48,54%	19,94%	1,65%	2,80%	72,93%	6,18%	20,89%	1923	38,30%	25,38%	1,10%	1,24%	66,02%	6,89%	27,09%
1869	42,22%	22,47%	2,12%	2,52%	69,33%	7,56%	23,11%	1924	32,18%	26,64%	0,85%	1,07%	60,74%	6,91%	32,35%
1870	49,31%	19,55%	1,18%	2,76%	72,80%	7,13%	20,07%	1925	28,79%	25,57%	0,79%	1,25%	56,41%	7,80%	35,80%
1871	55,41%	17,47%	1,23%	2,09%	76,20%	6,47%	17,33%	1926	29,72%	26,66%	0,83%	1,29%	58,49%	7,23%	34,28%
1872	48,61%	17,46%	1,47%	3,81%	71,35%	7,74%	20,90%	1927	31,18%	26,13%	0,96%	1,19%	59,47%	7,80%	32,74%
1873	48,26%	20,23%	0,55%	3,31%	72,35%	7,60%	20,06%	1928	31,49%	25,23%	0,97%	1,24%	58,93%	7,91%	33,17%
1874	50,50%	16,40%	1,71%	2,78%	71,38%	7,31%	21,31%	1929	24,54%	26,34%	0,97%	1,25%	53,10%	8,75%	38,15%
1875	48,27%	17,83%	1,40%	2,95%	70,45%	8,21%	21,34%	1930	23,80%	25,67%	0,73%	1,25%	51,46%	9,01%	39,54%
1876	47,75%	17,93%	1,41%	2,62%	69,71%	8,29%	22,00%	1931	22,56%	25,89%	0,71%	0,99%	50,15%	8,65%	41,20%
1877	52,97%	16,63%	1,33%	2,78%	73,70%	6,77%	19,52%	1932	31,26%	23,72%	0,79%	0,93%	56,70%	8,54%	34,76%
1878	52,20%	17,21%	1,30%	3,21%	73,92%	7,26%	18,82%	1933	34,30%	23,10%	0,85%	1,07%	59,32%	8,57%	32,11%

continues on next page

Year	Agricul.	Livestock	Forestry	Mining etc	Tot. Primary	Second.	Tertiary	Year	Agricul.	Livestock	Forestry	Mining etc	Tot. Primary	Second.	Tertiary
	1	2	3	4	5	6	7		1	2	3	4	5	6	7
1879	50,14%	16,83%	1,27%	3,37%	71,62%	6,88%	21,51%	1934	32,50%	22,84%	1,10%	0,99%	57,43%	8,97%	33,59%
1880	50,90%	16,07%	1,18%	3,28%	71,43%	6,68%	21,89%	1935	33,18%	22,71%	1,17%	0,93%	57,99%	9,07%	32,94%
1881	47,29%	16,41%	0,96%	2,81%	67,46%	5,76%	26,78%	1936	31,22%	22,43%	1,08%	1,03%	55,76%	9,24%	35,00%
1882	43,91%	24,79%	1,09%	3,30%	73,10%	6,45%	20,46%	1937	38,91%	19,02%	1,27%	1,27%	60,46%	8,78%	30,76%
1883	42,11%	26,78%	0,99%	3,10%	72,98%	5,99%	21,03%	1938	36,06%	19,09%	1,24%	1,19%	57,57%	9,23%	33,19%
1884	37,94%	31,30%	0,96%	2,97%	73,17%	5,93%	20,90%	1939	35,92%	17,62%	1,49%	1,09%	56,11%	8,22%	35,66%

Still, in spite of this, one has to admit that, on the basis of the above, it appears that, overall, very few things changed in regard to the Greek productive structure during the pre-WWI period, and especially in the 19th century. Unfortunately available information regarding other key variables, such as the capital/labor (K/L) ratio for instance that could be used to strengthen or discredit this argument does not exist. What qualitative information does exist would appear, indirectly at least, to support the argument.

One question that remains open is whether growth would have been larger had it not been for the slowdown experienced in all three cases of major territorial expansions. In both cases included in the period examined, i.e. 1864 and 1881 this factor appears to have been significant, although in the earlier case the effect might have been a positive one. This too is a subject that calls for further examination.

In concluding, one must refrain from pronouncing final judgement regarding such an important subject such as long run development in Greece during the pre-WWI years, on the basis of the present tentative exploration. This is merely a first attempt on studying the question and it is hoped that it will stimulate more work on the subject. Obviously much more work remains to be done for the subject to be tackled conclusively.

Notes

1. This has been noted, among others, by Dertiles (1993) and Van Arc (1995). See also Kostelenos (2003).

2. Dertiles (1993).

3. Thomadakis (1981).

4. Pizanias and Mitrofanis (1991).

5. Sakellaropoulos (1993).

6. Petrakis and Panorios (1992).

7. Kostelenos (1995) and Kostelenos et al. (forthcoming).

8. Greek financial authorities commenced operating officially in the Ionian Islands in accordance to the Decree of the 19th of December 1864 *"About the establishment of financial authorities in the Ionian Islands"* (Διάταγμα *"Περί εγκαταστάσεως οικονομικών αρχών εν Επτανήσω"*) Φλ. Παρ. β, σελ. 959, π. 355, v. 111.

9. The magnitude, 25,89 drs/head, is the lowest since 1856.

10. Mansolas (1867), pp. 10-11.

11. The Latin Monetary Union was formed as a result of the Monetary convention of 1865, in which France, Italy, Switzerland and Belgium participated. The basic goal of the participant-countries was to achieve the *"... mutual regulation of the coinage on some basis ..."*. Although it introduced a bimetallic regime, in essence it retained the gold standard as it stipulated a fixed ratio between silver and gold. See Willis (1901).

12. Greece became an official member of the Latin Monetary Union in 1867. However, it implemented the use of the new currency, the Latin Monetary Union drachma, in 1881, i.e. after an extended period of transition. Based on silver content, the Latin Monetary Union drachma was worth 0,895 old drachmae. See, among others Pratsikas (1946) and Kostelenos (1995).

13. The notation average estimate appearing in all cases in which GDP estimates are cited refers to the fact that originally two sets of estimates have been determined: a minimum and a maximum one. In the analysis the average of these two has been used. See Kostelenos et al. (Forthcoming).

14. Hereafter referred to as GDP (1914).

15. In fact, it is so powerful that it conceals the big population influx in 1922-1923.

16. One wonders what the picture might have been were it not for the war years. Could one argue that the increase would have continued up to the early 1930s ?

17. It must be pointed out that the nominal public expenditure values have been deflated with the GDP deflator. This is an obvious shortcoming but cannot be avoided as no relevant deflator exists. Still, for our present purposes it does not lead us to wrong directions.

18. The data from which the diagram is produced appear in table 3.

19. It must always be kept in mind that the GDP deflator has been used to deflate both the expenditure figures.

20. See Enders, (2004), Chapter 4, pp 157 - 215, especially p. 212.

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MARKET EFFICIENCY IN THE GREEK STOCK EXCHANGE: THE HALLOWEEN EFFECT

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Abstract

This paper examines the robustness of the Greek Halloween puzzle to alternative model specifications and time periods. The Halloween effect disappears after adjustments for the impact of outliers, and other model specifications. This paper argues against the existence of Sell in May effect in the ASE and its sectors. JEL G10, G24.

1. Introduction

According to the Efficient Market Hypothesis (EMH) rational investors gather relevant information fully and correctly, and if immediately incorporate it in stock prices, only new information should cause change in prices. This would imply that stock returns are unpredictable. However, there is growing evidence in the international literature that stock returns are predictable to some degree from historical prices and returns, lagged economic and financial variables, and seasonal (or calendar) dummies.

The concept of EMH predicts that once calendar effects become widely known, then excess risk-adjusted returns are arbitraged away. For instance, the January effect became statistically insignificant since 1982 due to the received publicity in the financial press (Fama 1991). In general, there are particular periods that the investors' behavior changes significantly. To give some examples, we can have a change in the mean, the variance, the skewness, or the kurtosis of the returns' distribution, only for the periods the effect is observed (Aggrawal and Schatzberg 1997 and Mills et al., 2000). There are no universally accepted explanations for calendar anomalies, and a number of factors have been found as potential contributors: measurement errors, differences in

settlement time of transactions, taxes, capitalization, riskness of the stock, company-type etc. (Mills et al., 2000).

A particular calendar anomaly is known as Halloween effect. According to Halloween Indicator (HI) the month of May signals the start of a bear market, so that investors are better off their stocks. The Halloween effect is frequently cited in the popular financial press, but attired little attention by the academic literature.

This study provides additional empirical evidence and extends the international literature to the Halloween effect. A data set from a small European capital market, namely the Greek stock market, and more recent sample are considered to circumvent the data snooping problem. Emerging markets provide an interesting "out of sample" test of the existence of calendar anomalies, since many well-known calendar anomalies do not exist in the emerging stock markets (Claessens et al., 1995).

The sample refers to the General Index (GI) and the sectors indices of the Athens Stock Exchange (ASE). In addition, although several calendar effects are examined for the ASE, no previous study refers to the Halloween effect (Mills et al., 2000). The only evidence refers to Bouman and Jacobsen's (2002) data set that contains 128 monthly returns for the Greek stock market with the most recent month being August 1998. Their sample period does not contain the financial crisis of August 1998, the huge price appreciation in 1999 and the fall since 2000. Thus, the lack of these periods increases the probability of rejecting the null hypothesis.

Additionally, the economic significance of this particular calendar anomaly is considerable. Calendar effects affect the decisions made by professional asset managers and investors as well. Following such an anomaly, if it holds and is statistically significant, with low costs transactions an investor may obtain large returns. Especially the Halloween calendar anomaly results in a very simple trading strategy, and of minimum cost. For example, following the Halloween strategy the last 20 years in the ASE one could have return 18.7% with standard deviation 29.73%. The buy and hold strategy gives returns 13% with standard deviation 74.8%. Thus, it is interesting to study the significance of the Halloween effect in the Greek market under different model specifications.

The rest of the paper is organized as follows. Section 2 presents an overview of the financial literature as concerns as the calendar anomalies of the stock markets. Section 3 gives the data set used as well as the preliminary statistics

and diagnostics. Section 4 deals with model specification and presents the empirical results, while section 5 concludes the paper along with a route for future research.

2. Previous literature

Empirical studies on financial time series have revealed the so-called calendar effects in the behavior of stock returns. Thaler (1987a, 1987b) provides an early and partial survey, while Mills and Coutts (1995), and Mills et.al. (2000), provide more recent references and additional evidence. Calendar studies questioned whether regularities exist in the rates of return during the calendar year. This fact would allow investors to predict returns on stocks. According to the Efficient Market Hypothesis (EMH) such seasonal patterns should not persist since their existence implies the possibility of obtaining abnormal returns by market timing research strategies.

Vast number of studies provides evidence for calendar anomalies in international stock markets. Among the most important calendar effects are the monthly or January effect (relatively higher January returns), the weekend effect, the day-of-the week effect, the trading month effect, and the holiday effect. Day-of-the week effect is first documented by Osborne (1962), and subsequently analysed by Cross (1973) and French (1980). The January effect is one of the most famous calendar effects. January effect is first reported in Wachtel (1942). Rozeff and Kinney (1976) conducted the first rigorous study, which confirmed the January effect, followed by many other researchers. The weekend effect (significantly lower returns over the period between Friday's close and Monday's close) is first documented by French (1980) and Gibbons and Hess (1980). Ariel (1987) studies the month effect, and Lakonishok and Smidt (1988) and Ariel (1990) examine the holiday effect.

Jaffe and Westerfield (1985a,b) test for the weekend effect and find out significant negative mean returns on Mondays in the US, Canada and the UK stock markets, and significant negative Tuesday returns in the Japanese and Australian stock markets. Aggrawal and Rivoli (1989) observe lower mean returns on Mondays and Tuesdays in stock returns of Hong Kong, Singapore, Malaysia and the Philippines from September 1976 to June 1988. Both in Jaffe and Westerfield (1985a, b), and Aggrawal and Rivoli (1989), the strong Tuesday effect is attributable to the +13 hour time difference between New York and these four markets.

Aggrawal and Tandom (1994) provide international evidence for several calendar anomalies in stock markets of eighteen countries (Australia, Belgium, Brazil, Canada, Denmark, France, Germany, Hong Kong, Italy, Japan, Luxembourg, Mexico, the Netherlands, New Zealand, Singapore, Sweden, Switzerland, and the UK) other than the USA. They find large, positive mean returns on Fridays and Wednesdays in most of the countries. They observe lower or negative mean returns on Mondays and Tuesdays, and higher and positive returns from Wednesday to Friday in almost all the countries. Balaban (1995, 1996) reports that in the Turkish stock market for the period January 1988 to August 1994 the highest returns and the lowest standard deviations on Fridays followed by Wednesdays. He observes the lowest and negative mean returns on Tuesdays, and the highest standard deviations on Mondays. In addition, he notes that the day of the week effects change in direction and magnitude across years. The author claims that observed anomalies could be partly attributed to the settlements rules in the Turkish stock market. Dubois and Louvet (1996), find negative returns on Mondays and Tuesdays and positive returns on Wednesdays for eleven indices in nine countries from 1969 to 1992.

Mills et.al. (2000), analyze calendar effects for each of the constituent stocks of the Athens Stock Exchange, rather than examining only basket indices. They demonstrate that the calendar regularities vary significantly across the constituent shares and that aggregation introduces a considerable bias in unraveling these regularities. Their study refers to the period 1986-1997, and they find substantial evidence of the day-of-the week, monthly and holiday effects. They also report that there is an intensity of these effects for various stocks on the basis of capitalization, beta coefficient and company-type factors. In particular, for the capitalization they report a weakly significant inverse relationship, a statistically significant relationship with aggressive, high-beta stocks, and that company-type is an important factor in the seasonality of returns.

Bayara and Kan (2002) provide further international evidence for the presence of the day of the week effects in local currency terms from a majority of stock markets in nineteen countries. They provide evidence for the presence of the day of the week effects in the mean returns denominated in dollars from most of stock markets of eighteen countries, excluding the USA.

Hansen and Lunde (2003) examine calendar anomalies in ten stock exchanges. They analyze 27 stock indices from 10 countries and find calendar effects to be significant in most return series, and it is particularly end-of-the-year effects that produce the largest anomalies. The most solid evidence in

favor of calendar effects is found in small-cap indices. In these series, they find significant calendar effects and their findings are found to be robust in sub-sample analyses.

Aly et. al.'s (2004) result suggest no evidence of day of the week effect in the Egyptian stock market. Their findings indicate that while Monday stock returns are significantly positive, they are not significantly different from returns during the rest of the week. Since they found that the returns on Monday are significantly more volatile than the returns from Tuesday to Thursday, they conclude that the significantly positive returns on Monday are associated with returns that are more risky.

Tang (1997) studies the day-of the-week effect on exchange rate risks. He finds that different days of the week have great impact on the diversification of exchange rate risks, particularly on skewness and kurtosis. Aggrawal and Schatzberg (1997) also indicate differences on each weekday's distribution of equity returns. Mills et.al. (2000), try to explain seasonalities of the Greek stock market on the basis that certain calendar periods show a combination of high returns, kurtosis and skewness. They provide evidence that investors prefer to invest on days with higher kurtosis and positive skewness coefficients, which is consistent with Aggrawal and Schatzberg (1997) result.

For the studies about the holiday effect it is worth to mention Mills and Coutts (1995) about the London Stock Exchange, Hiraki and Maberly (1995) about the Tokyo stock exchange, Mookerjee and Yu (1999) for the two stock exchanges of China, and Mills et. al (2000) for the emerging stock market of Greece. They all conclude that there are anomalies on the time series before the days of holidays, so that the holidays have a certain influence on the time series of returns.

Leontitsis and Siriopoulos (2007) present a forecasting method based on chaos theory taking into account the specific calendar characteristics, and they give empirical results for NASDAQ Composite Index and TSE 300 Composite Index. Their study shows that there is a great deal of improvement on out-of-sample forecasting results, for calendar-corrected time series. On the other hand, if the time series does not show any calendar affection at all, the forecasting is not improved a lot. This fact was clearly shown on the results regarding the TSE 300 Cmp results. In a second paper Leontitsis and Siriopoulos (2006) present a way to incorporate some of the most significant calendar effects on forecasting by neural networks. The main advantage of their method is that it gives no correction to time series that do not show calendar

effects. Finally, they indicate that calendar effects may be hidden in indices, which represent low-risk stocks. This result is not consistent with the findings of Aly et.al. (2004) for the emerging market of Egypt.

In a recent issue of the American Economic Review, Bouman and Jacobsen (2002) document yet another calendar time anomaly in stock prices, which they claim many Americans tend to be unfamiliar with. They label this anomaly the Halloween effect, as October 31 marks the end of the "scary period" for investors. In particular, Bouman and Jacobsen conclude that stock returns are significantly lower during the May–October periods versus the November–April periods, and they propose a trading strategy to exploit this anomaly. The Halloween effect amounts to a "Sell in May and go away" strategy. The strategy is described as investing in a value-weighted index like the S&P 500 index during the November-April periods and in a risk-free investment like U.S. Treasury bills during the May-October periods.

Bouman and Jacobsen (2002), report evidence of the Halloween effect in 36 of the 37 studied developed and emerging markets. The effect tends to be particularly strong and highly significant in European countries. Sample evidence shows that in a number of countries it has been noticeable for a very long time, and in the U.K. stock market, for instance, they find evidence of a Sell in May effect as far back as 1694. However, they find no evidence that the effect can be explained by factors like risk, cross correlation between markets, or the January effect.

Marquering (2002) indicates that the Sell in May effect is presented in US, UK, Belgium, Germany and the Netherlands. Maberly and Pierce (2004) do not find evidence of the effect for the US stock and futures markets. However, in a second paper in 2005 they observe significant Halloween effect for the Japanese market, prior to the mid-1980s.

Bouman and Jacobsen (2002) examine the Halloween effect in the Greek stock exchange using 128 monthly returns for the general index, with the most recent month being August 1998. Their sample period does not contain major financial events of the recent period, namely the financial crisis of August 1998, the huge price appreciation in 1999 and the fall since 2000. It might be the lack of these periods that increases the probability of rejecting the null hypothesis.

3. Data and preliminary statistics

Table 1 represents the data set used along with the period covered and the number of total observations, while table 2 reports summary statistics.

TABLE 1
Indices consider in the study

Index	Period	# of Observations
General Index (GI)	10/1986-12/2004	219
Banks	10/1986-12/2004	219
Industrial	5/1987-12/2004	213
Construction	10/1994-12/2004	124
Holdings	10/1994-12/2004	124
Parallel Market	8/1995-12/2004	114
Insurance	1/1993-12/2004	124
Investments	1/1993-12/2004	124

Monthly returns for each index are calculated as follows

$$R_t = \ln\left(\frac{IDX_t}{IDX_{t-1}}\right) \tag{1}$$

where IDX_t is the value of the index in month t.

TABLE 2
Descriptive statistics

	GI	BANKS	INDSTR	CONSTR	HOLD	PARALEL	INSUR	INVEST
MEAN	0.01551	0.01822	0.01102	-0.0007	0.00603	0.0024426	-0.0034	0.00162
VARIANCE	0.10925	0.01492	0.00932	0.01848	0.01245	0.0203835	0.01464	0.01039
STDEV	0.10452	0.12214	0.09652	0.13595	0.11159	0.1427706	0.12099	0.10194
MAX	0.40967	0.51175	0.3704	0.55495	0.26862	0.5371819	0.34765	0.33909
MIN	-0.2865	-0.3113	-0.349	-0.3525	-0.3487	-0.350304	-0.3207	-0.2806
KURTOSIS	2.5536	3.0369	1.87313	1.99014	0.68511	1.7354935	0.6908	0.92492
SKEWNESS	0.00177	1.0926	0.4697	0.59671	0.07985	0.4785982	0.06732	0.22929
JARQUE-BERA	1.81848	43.5851	19.1018	12.6276	27.8184	11.947207	27.6444	23.334

General Index, Banks Index and Industrial Index perform better, while Construction Index and Insurance Index report negative returns. We also

observe that indices' returns do not follow the normal distribution, because the Jarque-Bera test was found significant for all indices.

4. Model specifications and empirical results

To test for the existence of a Halloween effect the usual dummy variable method is applied. According to Bouman and Jacobsen (2002) this is represented as

$$R_t = a + \beta_1 D_{1t} + u_t \tag{2}$$

R_t represents continuously compounded monthly returns of the Index and D_{1t} is the dummy variable taking the value 1 if month t falls within the November-April periods and 0 if it falls within the May-October periods. The intercept a represents the monthly mean return over the May-October periods and $a + \beta_1$ represents the monthly mean return over the November-April periods. β_1 denotes the average monthly returns in the period November-April in excess of the average monthly returns during the other six months of the year. Evidence of a Halloween effect is considered if the regression parameter β_1 is positive and significant.

Because of the high sensitivity of the OLS to outliers Bouman and Jacobson (2002) and Meberly and Pierce (2004) examine their impact on the estimation of equation (2) coefficients including an outlier dummy. The outliers are defined as unusual large returns. The January effect is best-documented calendar anomaly in stock returns, and the Sell in May-effect may be simply the January-effect in disguise. Thus high positive January returns are the driving force behind a significant β_1 coefficient in equation (2). To test this possibility, equation (3) is considered

$$R_t = a + \beta_1 D_{1t}^{adj} + \beta_2 JANUARY + u_t \tag{3}$$

where JANUARY is a January dummy that takes the value 1 whenever month t is January and 0 otherwise. In January we now assigned the dummy $D_{1t}{}^{adj}$ the value zero.

Maberly and Pierce (2004) identify two months that potentially drive the findings of a statistically significant Halloween effect over the period January 1970-August 1998: the Crash of October 1987 and the August 1998, where the Russian government unexpectedly announced a moratorium on debt repayments, and financial markets were into a tailspin. These are verified by a within sample z-score of 1.8893 and 2.6 and corresponding p-values of 0.0021 and 0.0047, respectively.

However, unusual large returns may be observed in other month as well, especially in a small equity market. Therefore, a month is identified as an outlier whenever the absolute value of the within sample z-score is greater than 2.5. Using this criterion, eight outliers are observed over the period October 1986 through December 2004 (six negative and two positive). Including a dummy variable for outliers, equation (3) becomes

$$R_t = a + \beta_1 D_{1t}^{adj} + \beta_2 JANUARY + \beta_3 OUTLIERS + u_t \qquad (4)$$

The outlier dummy variable *OUTLIERS* is set equal to 1 for the ten identified outliers, and 0 otherwise.

Table 3 represents the estimations of equations (2)-(4) for the General Index (GI). The value of the parameter β_1 provides evidence of the Halloween effect since it is positive at 0.0185 and significant at 10% (t-value of 1.282). This result confirms the Bouman and Jacobsen's results (2002) for the case of the Greek stock market (t-statistic 1.77, their table 1) for the period January 1970-August 1998.

Adjusting for the January effect the estimation of equation (4) shows that the Sell in May effect does not survive. Thus, we could not accept the hypothesis that is the January effect in disguise. The same conclusion could be drawn from the Bouman and Jacobsen's results for Greece (t-statistic for β_2 equals 1.53, their table 1). In the next two columns the results of equation (4) are provided, where the dummy variable includes all the outliers (column three) or the outliers for October 1987 and August 1998 only (column four). The Halloween effect is not statistically significant in both cases. The impact of the outliers is represented by β_3 , which is highly significant. Thus, it appears that the Halloween effect in the ASE is being driven by the large negative returns observed during the months of October 1987 and August 1998.

TABLE 3
Halloween effect in the Athens Stock Exchange

	Equation (2)	Equation (3)	Equation (4)	Equation (4)*
Coefficient				
a	0.006138	0.006138	-0.00133	-0.007557
t-statistic	(0.61)	(0.6097)	(-0.14)	(0.7588)
p-value	[0.5425]	[0.542676]	[0.8883]	[0.4487]
β1 (HALLOWEEN)	0.018577	0.014436	0.013137	0.01468
t-statistic	(1.32)	(0.9726)	(0.95)	(1.0016)
p-value	[0.1911]	[0.3318]	[0.3441]	[0.3176]
β2 (JANUARY)		0.039738	0.034074	0.032147
t-statistic	N/A	(1.492)	(1.35)	(1.2010)
p-value		[0.1371]	[0.1778]	[0.2310]
β3 (OUTLIERS)			0.20175	-0.1532
t-statistic	N/A	N/A	(5.72)	(-2.5353)
p-value			[3.47E-08]	[0.01194]

* Only the outliers for October 1987 and August 1998 are considered.

An important finding in the study of Bouman and Jacobsen (2002) is that all sector indices in a country presenting the Halloween effect also exhibit the Sell in May effect. Equation (2) is estimated in all sectors indices to test if the Halloween effect is a sector-specific anomaly. Table 4 represents the results.

TABLE 4
Halloween effect in the Greek Sectors

	Banks*	Industries	Holdings	Parallel Market	Insurance	Investments	Construction
Intercept	0.0043	0.009898	7.4128	0.006398	-0.0065	-0.0084	-0.00231
t-statistic	(0.3655)	(1.05587)	(79.26)	(0.3324)	(-0.4128)	(-0.6361)	(-0.1324)
p-value	[0.7151]	[0.2922]	[0.00]	[0.7402]	[0.6804]	[0.5259]	[0.8947]
Coefficient	0.0277	0.002278	-0.08298	-0.00798	0.006141	0.19876	0.0147
t-statistic	(1.6761)	(0.1702)	(-0.623)	(-0.292)	(0.227)	(1.06855)	(0.5934)
p-value	[0.0951]	[0.8650]	[0.53]	[0.7701]	[0.7823]	[0.2874]	[0.5537]

* For the Banking sector several alternative model specification were tested, as before, and inserting the January dummy reduced the Halloween effect further.

Finally, the predictability of the Halloween Index (HI) is examined. For the bull periods the Halloween strategy predicts correctly 14 markets out of 18, and in the bear periods it predicts correctly 10 markets out of 18. It follows from

table 5 that the Halloween strategy appears to have better skills in forecasting bull markets than bear markets.

TABLE 5
The noise-to-signal ratio of the HI in the ASE

	Bull Market: November-April (Correct signal)	**Bear Market: May-October (False signal)**
HI issues a BUY "signal"	14 (cell A)	4 (cell B)
HI does not issue a BUY "signal"	8 (cell C)	10 (cell D)

However, if the HI were a perfect predictor of the market we would only have entries in cells A and D. Consequently, an extremely noisy HI would have many entries in cells B and C. The noise-to-signal ratio (NSR) is given by the ratio of false signals to all possible bad signals divided by the ratio of good signals to all possible good signals (Kaminsky and Reinhart 1999)

$$NSR_{HI} = \frac{B/(B+D)}{A/(A+C)} \tag{5}$$

The NSR of the HI for a Buy signal is 0.572 and for a Sell signal is 3.2, which are considered high (>0.50). Therefore, the HI could not be considered as a good predictor for the period under study on the ASE. Thus, our results differ considerably from those obtained by Bouman and Jacobsen (2002) as concern as the Greek stock market.

5. Conclusion

This study examines the robustness of the Halloween effect to alternative model specifications on the ASE. The paper could not accept the existence of exploitable Sell in May-effect in the Greek stock market during the period October 1986-December 2004. The results of the paper differ from the results present in the study of Bouman and Jacobsen (2002) for he Athens stock exchange. Our results are robust under different model specifications. Robustness is needed because the financial time series show non-normal distributions. Their distribution presents skewnes and leptokurtosis, therefore the robust methods should be preferred.

Every year, in the period of May the financial press refers to that market strategy. Recent years, however, many investors do not sell stocks in May (R. Byrne, 2004). Schwert (2003) observes, that in many cases, following scholarly documentation of apparent predictability in stock return based on some observable patterns, the predictive power of the pattern diminishes. This means, that all market anomalies receiving publicity become insignificant soon or later, as finance theory and the efficient market hypothesis predict.

This paper is inconclusive about the usefulness of the Halloween effect to the traders. One of the fundamental questions with which many financial economists and practitioners are concerned is how can the information about the presence or absence of a calendar market anomaly be translated in improved portfolio performance and financial forecasting. Jensen (1978) highlights the importance of trading profitability when assessing market efficiency: "if a trading rule is not strong enough to outperform a buy and hold strategy on a risk-adjusted basis then it is not economically significant". In a *Wall Street Journal* commentary, Professor Richard Roll says "if calendar time anomalies represent evidence of market inefficiencies, then they ought to represent an exploitable opportunity" (Makiel 2000).

In this line of research it will be interesting and useful both for the practitioners and the financial economists to examine the performance of different forecasting methods and techniques that take into consideration calendar effects (Leontitsis and Siriopoulos 2006, 2007).

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