International Conference on Business and Economics - Hellenic Open University

Vol 4, No 1 (2024)

Proceedings of the ICBE-HOU 2024

An empirical analysis of the recent inflation in Greece

Prodromos Prodromidis

An empirical analysis of the recent inflation in Greece*

Prodromos Prodromidis†

Abstract

The paper empirically estimates the impact of the 2002 currency changeover, of seasonal sales, of a VAT increase, of the 2020-21 pandemic lockdowns and post-pandemic spending, of the war in Ukraine and of energy gas supplies, of the minimum wage, of the ECB interest rate, and of the prices of agricultural inputs on Greece's consumer price index, and provides policy suggestions based on the findings.

JEL Classifications: C22, E31.

Keywords: Price inflation, trend-seasonal-cyclical effects, minimum wage, ECB interest rates, agricultural inputs

* The paper has benefited from preliminary analyses and a timeline of events prepared by Ioannis Tsamis (KEPE intern), and comments made by an anonymous referee and participants at the KEPE Research Seminar, and at the International Conference on Business & Economics of the Hellenic Open University held in Athens in September 2024. The usual disclaimer applies.

† Corresponding author. Centre for Planning & Economic Research, Hellenic Open University and Open University of Cyprus. KEPE, Athens, Greece. Email: pjprodr@kepe.gr

1 Introduction

The sharp increase in price inflation from 2021 onwards in many advanced economies is attributed primarily to the pandemic lockdowns and to the Russian invasion of Ukraine. The first development adversely affected production and supply chains around the globe, causing shortages and the contraction of the aggregate supply. It also triggered fiscal and monetary expansion to support households and businesses affected by the lockdowns, causing the expansion of the aggregate demand. *Ceteris paribus*, a contraction of the aggregate supply or an expansion of the aggregate demand pushes prices up. The second development adversely affected the production capacity of Russia and Ukraine and, hence, the overall supply; while the international sanctions on Russia, especially against Russia's energy products, intensified the demand for critical energy commodities produced elsewhere around the world for several months. Together they pushed international prices up too. Climate-related disasters, business practices aiming to raise profits in certain industries, even a tool employed by the EU Commission to ensure duty revenues from imports, may have aggravated the situation, and one suspects that the resurgence of tensions in the Middle East and the Red Sea may also adversely affect global supply chains and the prices of energy commodities (OECD, 2022; Andersen, 2023; the European Commission, 2023; Hahn, 2023; Hansen et al., 2023; Matthews, 2023; Arce et al., 2024; Prodromidis and Lappas, 2024).

Inflationary developments in the small open Eurozone economy of Greece fit into the above narrative. It also seems that Greek society, putting behind the sovereign debt crisis of 2009-10, the austerity measures, and the long recession that followed, the imposition of capital controls in mid-2015, the deadly coronavirus pandemic of 2020-23, natural disasters, and a state of alert along the land-sea-and-air border with Turkey that lasted several months in 2022-23, has to considerable extent turned its attention to inflation matters (e.g., Deutsche Welle, 2023; Euronews, 2023; Kathimerini, 2024).

The paper empirically studies the changes in Greece's monthly Consumer Price Index (CPI) from January 2000 to May 2024, and is organized as follows: Chapter 2 provides a brief literature review, Chapter 2 presents the analytical approach employed and discusses the explanatory factors used, Chapter 3 describes the econometric results, and Chapter 4 provides the conclusion.

2 Research method, data considerations and choices

Economic theory and empirical analyses suggest that prices are affected by: (a) Changes in the aggregate supply, such as changes along the inputs-production-sales-and-after sales service support value chain (e.g., changes in input prices, in competition, in markups, in minimum wages). (b) Changes in the aggregate demand, such as changes in monetary or fiscal policy (e.g., in the interest rates, the tax rates, public spending). (c) Unexpected anomalies in the above (e.g., in the case of a war, in the case of an epidemic) as already mentioned in the Introduction. (d) Seasonal and cyclical features. See Lemos, 2008; Coibion et al., 2015; Petralias and Prodromídis, 2015; Bodnár et al., 2018; Harasztosi and Lindner, 2019; Ferrara et al., 2021; Kouvaras et al., 2021; Caldara et al.,

2022; Bernardini and Lin, 2023; Di Giovanni et al., 2023; and the sources cited therein.

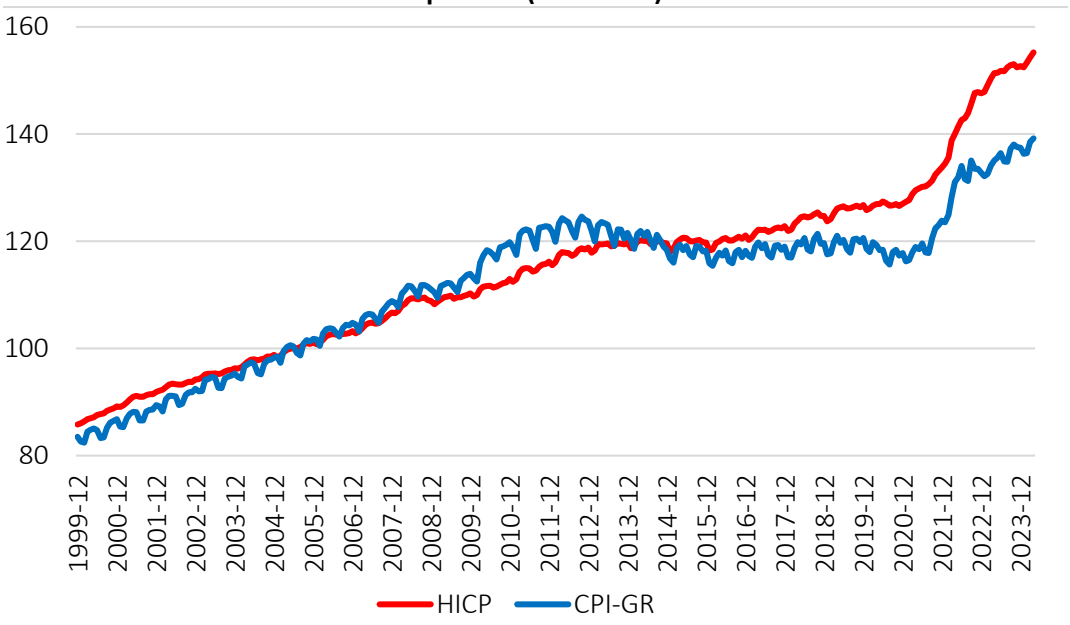
Here the quantitative approach employed is inferential: An OLS regression aimed to estimate via (i) available numerical data regarding prices and a good number of the aforesaid likely explanatory factors, and (ii) the statistical software STATA the impact of the said factors on prices.

In particular, the analysis that follows takes into account via binary categorical variables a number of events: (a) The euro-changeover in early 2002. (b) Seasonal discounts (mid-season winter and summer sales periods) in January-February and July-August. (c) The introduction of additional short (intermediate) autumn and spring sales (in November and May, respectively) at a time real income fell in an attempt to offset consumer losses, and the cancelation of these short sales periods at the request of sellers. These short run sales did run from the autumn of 2013 to the spring of 2022. (d) A value added tax (VAT) rate hike on catering services in the autumn of 2011. (e) The arrival in Greece of the coronavirus pandemic in the spring of 2020. (f) The Russian invasion of Ukraine in late winter of 2022. It coincided with considerable post-pandemic spending through the EU's new Recovery and Resilience Fund (RRF) and other programs. (g) The EU-27's achievement of filling up 90% of its natural gas storage capacity in the autumn of 2022 (European Council, 2024).Of these: The VAT and public spending increase ought to push prices up, while the drop in consumption due to the pandemic lockdown ought to drive the aggregate demand and (hence) prices down (e.g., Begg, 2008: 169, 807, 817, and 782 in conjunction with and 796). (Let us call these outcomes: *points A*, *B* and *C*, respectively). Increased (reduced) demand for energy commodities ought to push prices up (bring prices down) as per the *Introduction.* (*Point D,* hereinafter.) To the extent that seasonal price discounts are routinely reported for the calculation of the CPI, they ought to be captured or reflected in it. (*Point E*, hereinafter.) The currency changeover could have affected prices either way depending on the policies adopted before and after by the monetary authorities.

In the empirical analysis these factors are supplemented by three continuous variables (time-series). The first of these is employed as a primary monetary policy instrument by the European Central Bank (ECB). It takes the form of the interest rate associated with overnight credit to banks, runs from January 1999 onwards, and is made available by the ECB. The ECB has been in charge of the EU's monetary policy from 1998 onwards. One of its tasks was to put into circulation the euro banknotes and coins in January 2002.

Another task was and still is to maintain 2% inflation across the Eurozone over the medium term (European Parliament, 2024). To achieve the latter the ECB manipulates the interest rate with the understanding that, *ceteris paribus*, the rate's rise (fall) makes borrowing more expensive (cheaper), resulting in less (more) money circulating in the market, thus reducing (raising) the demand for goods and services and bringing about lower (higher) prices (*Point F*, hereinafter.) The price inflation measure considered by the

Figure 1: The evolution of the EU-27 HICP and of the Greek CPI (CPI-GR), Dec.1999-Apr.2024 (2005=100)



Sources:
Eurostat (HICP, dated 31.05.2024), ELSTAT (CPI-GR, dated 10.06.2024), own calculations.

Table 1: Granger causality tests of the null hypothesis that Greek CPI changes do not systematically predict ECB interest rate changes, Jan.1999-May 2024

Lag	P-value	Lags	P-value	Lags	P-value	Lags	P-value	Lags	P-value
1	0.162	9	0.402	17	0.581	25	0.562	33	0.606
2	0.311	10	0.269	18	0.528	26	0.567	34	0.657
3	0.148	11	0.396	19	0.532	27	0.504	35	0.741
4	0.190	12	0.357	20	0.308	28	0.519	36	0.750
5	0.140	13	0.375	21	0.309	29	0.454	37	0.814
6	0.191	14	0.392	22	0.427	30	0.527	38	0.841
7	0.223	15	0.461	23	0.486	31	0.530	39	0.889
8	0.356	16	0.545	24	0.546	32	0.501	40	0.898

The p-value relates the probability that the null hypothesis holds. To the extent it is never small, there is little evidence against the null hypothesis.

Sources: ELSTAT (CPI data dated 10.06.2024), ECB (interest rate data accessed on 10.6.2024), own calculations.

ECB is the Harmonized Index of Consumer Prices (HICP) estimated by Eurostat, the statistical service of the EU. The HICP is based on a basket of goods and services, representing the consumption of all private people in the EU member states, and its broad EU-27-wide version frequently moves as the Greek CPI (see Figure 1; the Greek CPI is supplied by Greece's statistical authority, ELSTAT). However, the inflation target is not based on the Greek CPI, so changes in the Greek CPI do not systematically precede changes in the interest rate. See Table 1. In the empirical analysis that follows the change in the Greek CPI is regressed on slightly earlier changes in the ECB interest rate, as it may take some time (three months) for the latter's impact to pass through.

The second continuous explanatory variable employed also functions as a policy instrument. It is the minimum wage. Unlike the equilibrium wage, which is shaped by labor market forces, the minimum wage is set by the government. It takes the form of a price floor below which employees may not sell their labor. When this floor is set (or reset higher) above the equilibrium wage, then, *ceteris paribus*, employment decreases; accordingly, output and the aggregate supply fall (e.g., by Begg et al., 2008: 204-206),so prices increase.(*Point G*, hereinafter.) While Greece does not have an automatic wage indexation system for all (abolished in 1990), the minimum monthly wage went from € 505.1 in May 1999 to € 968.3 in April 2024 via 22 increments and one reduction (from € 876.6 to € 683.8 in December 2012). At the EU-level an attempt is made to establish a framework for adequate minimum wages across the member-states (European Union, 2022), but from the monthly Greek CPI and minimum wage time-series,[1] it appears that changes in the CPI systematically precede changes in the minimum wage (not simultaneously or in a short period of time, but) perhaps by 25 or 36-37 months, probably by 38-39 months. See Table 2.

Table 2: Granger causality tests of the null hypothesis that CPI changes do not systematically predict minimum wage changes in Greece, Jan.1999-May 2024

Lag	P-value	Lags	P-value	Lags	P-value	Lags	P-value	Lags	P-value
1	0.340	9	0.312	17	0.540	25	0.015	33	0.034
2	0.312	10	0.159	18	0.613	26	0.038	34	0.043
3	0.389	11	0.172	19	0.672	27	0.044	35	0.040
4	0.035	12	0.297	20	0.575	28	0.040	36	0.014
5	0.035	13	0.290	21	0.285	29	0.050	37	0.017
6	0.303	14	0.383	22	0.333	30	0.054	38	0.004
7	0.457	15	0.421	23	0.102	31	0.065	39	0.008
8	0.624	16	0.485	24	0.115	32	0.032	40	0.013

The p-value is small (1-2%) at the 25th and 36-37th lags, and very small (less than 1%) only in the last entries of the last column. It is in these that we have the strongest evidence against the null hypothesis.

Sources:
ELSTAT (CPI data dated 10.06.2024), ESSE *and* Country Economy (minimum wages accessed on 28.06.2024), own calculations.

[1] The minimum wage time series is constructed here from relevant tables of the ESSE (2024) and of the Country Economy (2024).

Table 3: Granger causality tests of the null hypothesis that CPI changes do not systematically predict minimum changes in the input price index in agriculture in Greece, Jan.2000-May 2024

Lag	1	2	3	4	5	6	7	8	9	10
P-value	0.834	0.354	0.456	0.042	0.018	0.010	0.021	0.027	0.043	0.063

The probability of error is large at the 1st-3rd lag, and very small (0.0095%) at the 6th lag. So it is in the latter that we have the strongest evidence against the null hypothesis.

Source:
ELSTAT (CPI data dated 10.06.2024; input price index data dated 15.07.2024), own calculations.

The third continuous explanatory variable employed is the input price index in agriculture, made available by ELSTAT. Its monthly figures run from January 2000 onwards,[2] and are based on the intermediate consumption of goods and services (fertilizers, pesticides, feed, seed, energy and lubricants, maintenance and repairs, etc.) and purchase of fixed capital (machinery and equipment, farms, buildings, etc.) used is the production of crops, poultry and livestock commodities for food and fiber. Typically, when input prices (i.e., average costs) increase, marginal costs and prices increase too (e.g., Begg, 2008: 270-285) so one expects the former to affect the latter in the same direction (*Point H*, hereinafter). Interestingly, changes in the particular index seem to follow changes in the CPI (same direction) with a six- & month lags (see Table 3), even as no such temporal precedence appears in the semi-annual data.

To the extent changes in the CPI affect changes in the aforesaid continuous variables some or several periods later or not at all, and the correlation coefficients regarding the latter three continuous variables are quite low (ρ< 3%), the specification is appropriate. Also, the dependent variable is modestly correlated with the residual ($\rho_{\Delta CPI,u}$=49%); its immediate lags, the independent variables and their immediate lags are less correlated with the residual ($\rho_{\Delta CPIt-1,ut}$ =46%, $\rho_{\#10t,ut}$ =14%, $\rho_{\#11t,ut}$ =4%, $\rho_{\#12t-1,ut}$ =1%);the Ramsey Regression Equation Specification Error Tests (RESET) suggest that the model is not missing any non-linear combinations of the explanatory variables (p-value = 95%); and the overall explanatory power of the model turns out to be high (R^2 = 76%, adj.R^2=75%).

[2] As a result, a small number of observations is dropped.

Table 4: Econometric analysis of the monthly change in the CPI in Greece, Jan.200-May 2024 (2020=100)

1	Autonomous component	0.20
2	Introduction of new currency (binary variable for Jan. 2002)	0.38
	Seasonal effects (binary variables)	
3	Winter and summer sales: January-February & July-August	-1.10
4	Intermediate sales: November & May (in effect from Nov.2013-May 202:	-0.95
5	March, April, September	1.25
	The most intense cycle-phases (binary variables)	
6	Sept. 2011 (1 month of the VAT rate hike in catering services)	1.70
7	Apr.2020 (1 month after the pandemic's arrival & first lockdowns)	-1.69
8	Apr. 2022 (1 month & a few days after the Russian invasion of Ukraine which triggered the energy crisis; also a commencement of considerable public spending)	2.09
9	Oct. 2022 (the EU-27 reaches the goal of filling up 90% of its gas storage capacity)	-2.71
	Other factors (continuous variables)	
10	Minimum wage (first differences)	0.01
11	ECB marginal lending rate to banks (first differences, 3 lags)	-0.04
12	Input price index in agriculture (first differences)	0.29

N = 292. R^2 = 76.0%. adj. R^2 = 75.1%. Ramsey RESET p-value = 95.1%.

The analysis is carried out with robust standard errors. The p-values associated with coefficients #2, 10, 11 are equal to 0.001, 0.001, 0.836, respectively; while the rest are all equal zero.
NB: In a regression analysis p-values help determine whether the relationships observed in the sample also exist in the population. However, in this case the regression is carried out (not in a sample, but) in the population. As a result, the p-values are not particularly useful, and are supplied here as readers are used to them and frequently ask to see them.

Sources:
ELSTAT (CPI data dated 10.06.2024, input price index data dated 15.07.2024), ECB (lending rates from 1999 on, accessed on 10.6.2024), ESSE *and* Country Economy (minimum wages accessed on 28.06.2024), own calculations.

3 Econometric findings

The econometric analysis of monthly CPI changes (first differences) from January 2000 to May 2024 (in Table 4) suggests that the monthly CPI changes:

- Increased over time, especially after the currency-changeover. This is in line with the ECB target of a small positive inflation rate over the medium term.
- Fell below the long-run trend: (a) during the mid-season sales and short sales periods (rows 3-4), (b) in the wake of the first pandemic lockdowns (row 7), and (c) when the demand for (and drive to secure) energy resources eased (row 9), in line with *points E*, *C*, and *D*, respectively.
- Rose above the trend: (i) in March-April and September (row 5) after the mid-season sales, (ii) after the tax increase (row 6, in line with *point A*), and (iii) the Russian invasion of Ukraine (in line with *point D*). The latter coincided with the flow of considerable post-pandemic public spending (row 8), so it is in line with *point B* as well.
- Evolved in the same way the minimum wage and the prices of agricultural inputs changed (rows 10 and 12) and in the opposite way the ECB interest rate changed (row 11), in line with *points G*, *H*, and *F*, respectively.

4 Conclusion

The ECB, through its monetary policy tools, will bring the inflation of the Eurozone to the desired level (around 2%). Understandably, individual countries may deviate more or less from the average. So, if policy makers in Greece wish to reduce inflationary pressures further in order to, say, help exports (competitiveness) and improve consumers' purchasing power, they have a number of options: (a) Shift the aggregate supply (that is, try to affect the opposite of what set off the international inflation in 2021-22) by stimulating healthy competition in as many domestic sectors of economic activity as possible. (To be safe, some analysis ought to be carried out to identify the small number of natural monopolies that may exist, and to put to good use their low-cost advantage.) (b) Following the findings listed above, re-establish the short autumn and spring sales, refrain from consumption tax and minimum wage increases, reduce government spending, affect the reduction of agricultural input prices, pursue energy autonomy and raise the country's energy storage capacity. Future research may look into the input price situation and price effects in other sectors or into the likely impact of setting up short sales periods (e.g., variants of the so-called *black Fridays*) in additional markets or into other issues. The findings may lead to additional policy recommendations. In the meanwhile, the policy suggestions made above are good places to start.

References

Andersen, F.N.G. (2023). The problem of stagflation: How should the European Central Bank respond to the increase in inflation? *European View, 22*(1): 39-47.

Arce, Ó., Ciccarelli, M., Kornprobst, A., & Montes-Galdón C. (2024). What caused the euro area post-pandemic inflation? *ECB Occasional Paper, 2024/343*.

Begg, D., Fisher, S., &Dornbusch, R. (2008). *Economics*. 9th edition. London: McGraw-Hill.

Benzarti Y., Carloni D., Harju J., Kosonen T. (2020). What Goes Up May Not Come Down: Asymmetric Incidence of Value-Added Taxes. *Journal of Political Economy, 128*(12): 4438-4474.

Bernardini, M., & Lin, A. (2023). Out of the ELB: expected ECB policy rates and the Taylor rule. *Bank of Italy Occasional Paper, 815*.

Bodnár, K., Fadejeva, L., Iordache, S., Malk, L., Paskaleva, D., Pesliakaitė, J., Jemec, N.T., Tóth, P., & Wyszyński, R. (2018). How do firms adjust to rises in the minimum wage? Survey evidence from Central and Eastern Europe. *IZA Journal of Labor Policy, 7*(11):1-30.

Caldara, D., Conlisk, S., Iacoviello, M.,& Penn, M. (2022). The effect of the war in Ukraine on global activity and inflation. *FEDS Notes* # May 27, 2022. Washington: Board of Governors of the Federal Reserve System.

Cloyne, J., Martinez, J., Mumtaz, H., & Surico, P. (2023). Do Tax Increases Tame Inflation? *AEA Papers and Proceedings, 113*: 377–81.

Coibion, O., Gorodnichenko, Y., & Hong, G.H. (2015). The cyclicality of sales, regular and effective prices: Business cycle and policy implications. *American Economic Review, 105*(3): 993-1029.

Country Economy (2024). *Greece National Minimum Wage*. Accessed on 28.6.2024 via https://countryeconomy.com/national-minimum-wage/greece.

Deutsche Welle (2023). Greece: Cost of living crisis hits ordinary households hard. Report

of K. Bali dated 05.11.2023. Accessed via https://www.dw.com/en/greece-cost-of-living-growing-prohibitively-expensive/a-67300533#:~:text=It%20comes%20as%20no%20surprise,the%20high%20cost%20of%20groceries.

Di Giovanni, J., Kalemli-Özcan, Ş., Silva, A., &Yildirim, M.A. (2023). Pandemic-era inflation drivers and global spillovers. *National Bureau of Economic Research Working Paper series, w31887.*

ESSE (2024). The evolution of minimum wage and unemployment in Greece, 2000-2016. (In Greek). Athens: Hellenic Confederation of Commerce & Entrepreneurship. Accessed viahttps://esee.gr/wp-content/uploads/2016/09/%CE%95%CE%BE%CE%AD%CE%BB%CE%B9%CE%BE%CE%B7-%CE%BA%CE%B1%CF%84%CF%8E%CF%84%CE%B1%CF%84%CE%BF%CF%85-%CE%BC%CE%B9%CF%83%CE%B8%CE%BF%CF%8D-%CE%BA%CE%B1%CE%B9-A%CE%BD%CE%B5%CF%81%CE%B3%CE%AF%CE%B1%CF%82-%CF%83%CF%84%CE%B7%CE%BD-%CE%B5%CE%BB%CE%BB%CE%B7%CE%BD%CE%B9%CE%BA%CE%AE-%CE%9F%CE%B9%CE%BA%CE%BF%CE%BD%CE%BF%CE%BC%CE%AF%CE%B1-2000-2016-2.pdf.

Euronews (2023). Cost of living soars in Greece despite economic recovery. Report of S. Touchtidou and R.E. Armstrong dated 15.05.2023. Available via https://www.euronews.com/2023/05/15/cost-of-living-crisis-in-greece-despite-economic-recovery.

European Commission (2023). European Economic Forecast Spring 2023. Luxembourg: Publications Office of the European Union. Accessed via https://economy-finance.ec.europa.eu/document/download/52e0cd19-59c1-4d5c-8876-b498aafc6d45_en?filename=ip200_en_1.pdf.

European Council (2024). How much gas have the EU countries stored? Brussels: General Secretariat of the Council. Revised on March 21, 2024. Accessed via https://www.consilium.europa.eu/en/infographics/gas-storage-capacity/.

European Parliament (2024). European Monetary Policy. Fact Sheet of the EU revised last in April 2024. Accessed via https://www.europarl.europa.eu/erpl-app-public/factsheets/pdf/en/FTU_2.6.3.pdf.

Ferrara, L., Metelli, L., Natoli, F., & Siena, D. (2021). Questioning the puzzle: fiscal policy, real exchange rate and inflation. *Journal of International Economics, 133*: 103524.

Hahn E. (2023). How have unit profits contributed to the recent strengthening of euro area domestic price pressures? *Economic* Bulletin, 4/2023: 62-70.

Hansen, N.J., Toscani, F., & Zhou, J. (2023). Euro Area Inflation after the Pandemic and Energy Shock: Import Prices, Profits and Wages. *International Monetary Fund Working Paper, 2023/131*.

Harasztosi, P., & Lindner, A. (2019). Who pays for the minimum wage? *American Economic Review, 109*(8): 2693-2727.

Kathimerini (2024). Fighting cost-of-living crisis is government's top priority, PM says. Report dated 24.05.2024. Available via https://www.ekathimerini.com/economy/1239588/fighting-cost-of-living-crisis-is-governments-top-priority-pm-says/.

Kontolaimou, A., Prodromídis, P.I, & Konstantakopoulou, I. (2019). The issue of fixed book pricing: Evidence based on the Greek experience. *Cyprus Economic Policy Review, 13*(2): 102-120.

Kouvavas, O., Osbat, C., Reinelt, T., & Vansteenkiste, I. Markups and inflation cyclicality in the euro area. *European Central Bank Working Paper Series #2617*.

Lemos, S. (2008). (2008). A survey of the effects of the minimum wages on prices. *Journal*

of Economic Surveys, 22(1): 187–212.
Matthews, A. (2023).Food price situation in Europe. *Studies in Agricultural Economics, 125*(2): 60-68.
OECD (2022). Competition and Inflation, OECD Competition Policy Roundtable Background. Paris: Organisation for Economic Co-operation and Development. Accessed via https://www.oecd.org/daf/competition/competition-and-inflation-2022.pdf.
Petralias, A., &Prodromídis, P. (2015). Price discovery under crisis: uncovering the determinant factors of prices using efficient Bayesian model selection methods. *Empirical Economics 41*(3), 859–879.
Prodromidis, P. (2020). Who benefited from the 2014 fixed book price amendment in Greece? *Hellenic Open Business Administration Journal, 6*(2): 67- 92.
Prodromidis, P.K. & Lappas, P.Z. (2024). The statistical tool used in the EU to estimate fair import prices, under scrutiny: The case of underpriced textile and footwear imports from China. Athens: KEPE.