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AN EMPIRICAL INVESTIGATION OF THE RELATIONSHIP BETWEEN UNIT LABOUR COST AND PRICE DEVELOPMENTS: THE CASE OF GREECE

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I INTRODUCTION

The changes taking place in employees' wages and labour productivity are considered to be factors that shape inflation expectations, and largely impact on inflation's current and future paths. The main assumption is that wage dynamics plays a central role in determining price developments. In particular, if nominal wages grow faster than labour productivity, price stability is undermined, since firms face higher production costs, which they will finally have to pass through to the end prices charged. Although energy and raw material costs represent considerable fractions of total costs as well, labour costs form a large part of a firm's production costs, especially in labour-intensive economies. Consequently, indices measuring labour cost developments, such as unit labour costs, are treated and used as forward-looking indicators of future inflation.

In the Greek economy, the rate of change in prices seems to respond with a lag and disproportionately to the large reductions of labour costs[1] recently brought about in the country in the context of fiscal consolidation and internal devaluation[2] adopted with a view to regaining losses in competitiveness and balancing the current account. The Greek economy continues to be expensive in basic consumption goods, despite recession, declining incomes and a high unemployment rate. Based on recent surveys, the prices of several goods in the domestic market deviate considerably from those in other countries – even EU countries under fiscal consolidation regimes (see e.g. European Commission 2013, and Petroulas and Kosma 2014). According to the EC report, an examination of indicative prices for 20 basic consumption goods in supermarkets in Greece, Portugal, the Netherlands and Luxembourg leads to the conclusion that in essence Greece has the most expensive basket of goods. Compared with consumers in the other three countries, Greek consumers need a larger share of their wages to buy the same quantity of goods. The fact that prices in the country do not adjust proportionately to the decline in unit labour costs has limited any benefits gained in terms of competitiveness and has reduced consumers' purchasing power, further weakening total demand across the Greek economy.

Nevertheless, it should be noted that such disconnection between unit labour costs and consumer price developments is a phenomenon typical not only in Greece but in several euro area countries as well (Wolff 2012).

The present paper attempts an empirical investigation of the relationship between unit labour costs (i.e. nominal wages per employee adjusted for labour productivity) and price developments. More specifically, it empirically explores the existence of cointegration between price and wage levels in the economy as a whole, as well as in its major sectors. If a

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1 According to Hellenic Statistical Authority (ELSTAT) national accounts (ESA 95) data, GDP at constant prices (base year 2005=100) fell by 16.92% in the period 2010-2013, while the total wages of dependent employees dropped by 28.7%. Also, according to European Commission and European Central Bank (ECB) data, compensation per employee for the total economy fell by 13.2% in the period 2010-2013, while nominal unit labour costs correspondingly declined by 13.3%. By contrast, in the same period, inflation as measured by the Consumer Price Index rose by 3.3%, whereas inflation as measured using the GDP deflator fell only by 2.1%. Section 4 of this paper describes in more detail this disconnection between inflation and changes in unit labour costs.

2 In its report on Greece (IMF Country Report No. 13/20, January 2013), the International Monetary Fund characteristically states: "Large external liabilities ultimately require large trade surpluses in order to service them, and achieving these surpluses requires a more depreciated level of the real exchange rate. In a currency union the depreciation has to be achieved largely through deflation, which necessitates a larger negative output gap (though measures to increase flexibility of wages and prices can lessen this effect). For Greece, the reduction in the cost of debt servicing (through lower interest rates) and increasing the maturity of the debt will partly alleviate the short-term problem of resource transfers, but it is still there".

cointegration relationship exists, the paper estimates the rate of adjustment of prices to changes in wages, and vice versa, as well as the speed at which the system adjusts to its long-run equilibrium. In addition, it examines the direction of causality based on tests for weak, short-term and strong exogeneity between prices and wages. To the best of the author's knowledge, at least with respect to the Greek economy, no other empirical study has so far undertaken such a detailed and definition-consistent investigation of the interaction between prices and unit labour costs at the sectoral level.

The findings of both the descriptive analysis and the econometric investigation support the conclusion that, for the total economy, price developments not only affect unit labour cost developments, but also unit labour costs affect price developments practically across the entire economy.

The rest of this paper is structured as follows: Section 2 discusses the theoretical background of the connection between unit labour costs and price developments and briefly reviews the relevant literature; Section 3 presents the data; Section 4 provides a descriptive analysis of the data and draws some initial conclusions regarding the existence of the disconnect between prices and unit labour costs; Section 5 discusses a number of methodological issues and describes the econometric methodology; Section 6 presents the empirical results; and finally, Section 7 concludes.

2 THE INTERCONNECTION BETWEEN UNIT LABOUR COSTS AND PRICES

2.1 THEORETICAL SETTING OF THE RELATIONSHIP BETWEEN UNIT LABOUR COSTS AND PRICES

It is often argued that labour cost developments drive price developments. This view stems from the well-known "cost-push theory of inflation", according to which any increase in labour costs (employees' wages and employers' social security contributions) — which form a considerable part of a firm's variable production costs — will eventually pass through to intermediate (wholesale) prices and retail prices (the CPI or the respective sectoral deflators).

In more detail, if nominal wages per employee grow faster than labour productivity, firms are forced to pass through the higher costs to retail prices, which leads to an upward price adjustment. In the real economy, however, this pass-through is neither automatic nor full. The literature on nominal rigidities shows that in many cases firms tend to avoid changing their prices frequently. Firms' tendency to avoid repeated price changes depends mainly on the sector's degree of oligopoly (firms' market power) and the potential reactions of customers.

The more oligopolistic the structure of the economic sector in which the firm operates, the higher the firm's degree of monopoly power, and the larger the room for frequent price changes with a correspondingly lower risk of market share losses. In addition, an oligopolistic structure encourages market-pricing collusion, a phenomenon manifested via a nominal downward rigidity of prices in cases where a unit labour cost reduction would justify a lowering of prices. By contrast, frequent price changes foster a climate of uncertainty that increases the customer reaction effect, particularly for products with a high elasticity of demand. The rate of pass-through and the speed of adjustment depend on several factors, such as the magnitude and persistence of price increases, the size of profit margins, the elasticity of demand for the sector's products, and competitors' expected behaviour. In the short run, firms may be willing to accept a narrowing of their profit margins and partly absorb the rise in labour costs, but over the medium term, persistent increases in nominal wages render an upward price adjustment inevitable. According to the cost-push theory of inflation, wage dynamics is exogenous and the price adjustment entailed is strongly

affected by wage fluctuations. Nevertheless, this view cannot sufficiently explain how an acceleration of labour costs can be seen as the driver of price developments and not the other way around.

The majority of explanations regarding inflation originate in demand-side theories (demand-pull inflation), according to which the exogenous determinant of inflationary pressures is an excessively expansionary fiscal policy (higher public expenditure or lower taxes), or an excessively expansionary monetary policy (stronger money supply growth or lower policy rates), or a combination of both. This approach does not rule out bidirectional causality, but argues that a change in demand is what primarily triggers the spiral relationship between price and wage developments.

As firms compete to hire employees so as to meet increasing demand, wages will tend to rise, unless the labour supply elasticity is sufficient to satisfy the initial increase in demand. In other words, when higher demand reduces unemployment and the economy performs close to its potential output, firms are willing to raise nominal wages in order to attract employees. Moreover, in such cases employees are in a relatively better position to negotiate higher wages. Higher wages raise production costs, thereby increasing the prices of goods and services.

However, the direction of this causal relationship could very well be reversed, meaning that in cases where excess total demand coincides with inadequate production capacity, the overall market supply shortage may allow firms to raise their prices, which leads to higher profit margins. This in turn pushes employees to ask for wage increases in order to maintain their purchasing power. This view implies that wage developments follow developments in demand. From this point of view, wages as a forward-looking indicator of future inflation risks being underestimated, and our focus would turn to developments in fiscal and monetary aggregates that affect total demand.

In fact, the various interaction mechanisms described above may possibly operate simultaneously in an economy, allowing for a bi-directional feedback between wages and prices. In general, economic theory provides no clear view on the direction of the effect that links unit labour costs and prices. The following subsection presents a brief review of the literature, which investigates this issue empirically.

2.2 LITERATURE REVIEW

According to existing reports in the literature, attempts to investigate the interaction between nominal wages and prices empirically have produced contradictory results. The majority of relevant studies seem to provide limited empirical support for the hypothesis that higher nominal wages or unit labour costs affect price dynamics.

Table 1 summarises the empirical findings of part of the international literature on the feedback relationship between labour costs and price dynamics. Even briefly inspected, it reveals a lack of consensus regarding the direction of the causality. In general, the results of the empirical studies are quite sensitive to the selected sample, the econometric method applied, and the policy measures that followed.

2.3 THE THEORETICAL MODEL OF AN EXPECTATIONS-AUGMENTED PHILLIPS CURVE

There are two alternative theoretical approaches generally used to describe the interaction between wages and prices: the Phillips curve and the wage curve (see Layard et al. 1991; Blanchard and Katz 1999; Bardsen et al. 2005). While the Phillips curve approach relies on a negative relationship between the rate of change in nominal wages and the unemployment rate or some broader indicator of fluctuations in economic activity (e.g. the output gap), the wage curve implies a negative relationship between the level of real wages and the unemployment rate.

Table 1 Summary of findings in the international literature

Year	Researchers	Country	Findings
1977	Mehra	USA	The findings support the existence of a bidirectional causal relationship between average nominal wages and CPI, irrespective of the industry market structure.
1988	Gordon	USA	Changes in nominal wages are not relevant in explaining price inflation when the latter is measured using the GDP deflator.
1991	Mehra	USA	Changes in nominal wages are not important in explaining price inflation when the latter is measured using the GDP deflator.
1992	Gaillard	Switzerland	Unit labour cost plays a highly significant role for the short-run dynamics of prices in all the sectors examined. In addition, lagged price changes are a key determinant of short-run wage developments.
1993	Mehra	USA	Unit labour cost growth affects prices when they are measured by the Consumer Price Index (CPI). In contrast, there is no impact on inflation when the latter is measured based on the rate of change in the GDP deflator.
1995	Rissman	USA	The direction of causality runs from prices to unit labour costs, except in manufacturing and retail trade where wages Granger-cause inflation, i.e. it has some predictive power for future inflation developments.
1996	Arora and Blackley	USA	In all sectors except non-durable manufacturing, estimates indicate there is bidirectional causality between ULC and prices.
1996	Emery and Chang	USA	Unit labour cost included as an explanatory variable in the inflation equations provides no significant improvement in the models' out-of-sample predictive power. In contrast, strong evidence suggests that inflation helps predict (Granger-causes) wage increases across all sample periods.
1997	Brauer	USA	While compensation per employee in the industrial sector seems to have little predictive power for goods prices, compensation per employee in the private services sector can help to predict prices for a specific group of services; therefore it helps predict changes in the CPI.
1999	Chan-Lau and Tokarick	USA	The small rise in unit labour costs is necessary to explain the low inflation puzzle in the second half of the 1990s, since the widened output gap and the continuous fall in unemployment can explain this phenomenon only partly.
1999	Ghali	USA	Causality is found to run from wages to prices, which supports the case for systematically monitoring labour costs for controlling inflation.
2000	Mehra	USA	Wage growth helps to predict inflation, only during periods when wage growth is high. By contrast, inflation always helps to predict wage growth over a much longer time horizon, covering various inflation regimes.
2000	Hess and Schweitzer	USA	There is more evidence that inflation helps to predict unit labour cost growth rather than vice versa.
2001	Aaronson	USA	There is evidence that the impact of minimum wage hikes affects food and restaurant prices.
2007	Zanetti	Switzerland	Prices (as measured by the CPI) systematically influence wages, whereas the impact of wages on prices is more sensitive to the choice of the sample period.
2012	Wolff	Euro area	Unit labour cost adjustment has been largely disconnected from CPI developments. The absence of a strong transmission mechanism between ULC, wage adjustments and inflation significantly hampers policy making in the euro area.

This paper follows Gordon (1982, 1985, 1988), Stockton and Glassman (1987), Ghali (1999), and Mehra (1993, 2000), and specifies the relationship between the rate of change in prices (inflation) and the average cost of labour per unit of output (unit labour costs) using the methodological framework of an augmented Phillips curve. The structure of the model implies a systematic, long-term relationship between prices and unit labour costs.

According to this model, prices are set based on a profit margin (mark-up) applied over wages, as specified in equation (1). In turn, wages depend on expected inflation, as described in equation (2). In addition, both

equations include variables that reflect possible shocks attributable to total demand and/or supply.

The two reduced-form equations described above are specified as follows:

Price equation:

$$\Delta p_t = a_p + \beta_{1p}\Delta(wun - lprod)_t + \beta_{2p} ds_t + \beta_{3p} ss_{pt} \quad (1)$$

Wage equation:

$$\Delta(wun - lprod)_t = a_w + \beta_{1w}\Delta p_t^e + \beta_{2w} ds_t + \beta_{3w} ss_{wt} \quad (2)$$

given that

$$\Delta p_t^e = \sum_{i=1}^{n} \lambda_i \Delta p_{t-i} \quad (3)$$

(adaptive inflation expectations)

where p_t stands for the level of prices, wun_t for the level of nominal wages per employee, and $lprod_t$ for labour productivity. Δ denotes the first difference operator. The variable $\Delta(wun - lprod)_t$ expresses changes in the productivity-adjusted wages per employee, i.e. changes in unit labour costs $\Delta(ulc)_t$, where $\Delta(ulc)_t = \Delta(wun - lprod)_t$. Δp_t^e denotes the inflation expectations, assuming an adaptive relationship of inflation expectations based on past inflation (backward-looking adjustment) as described by equation (3). The rate of change in unit labour costs $\Delta(ulc)_t$ is therefore affected by the time lags of inflation. The specification of equations (1), (2) and (3) indicates that unit labour costs and prices systematically interact, i.e. that a long-term relationship connects them.[3] The variable ds_t denotes a measure of the cyclical phase of total demand (subdued or excess), which can be proxied by output gap. A positive output gap means that the economy is overheated and operates above its long-term trend (potential output), thereby suggesting that excess demand will create inflationary pressures. A negative output gap means that the economy is in recession and operates below its potential output, thereby suggesting that subdued demand will generate deflationary trends. ss_{pt} denotes any supply-side shocks to prices (e.g. an increase in marginal cost due to rising oil prices, or higher prices of imported intermediate goods in industry), while ss_{wt} denotes any supply-side shocks to wages.

3 THE DATA

The empirical analysis is based on quarterly data extending over the period 2000-2013. The study examines the interaction between unit labour costs and prices both at an aggregate level and in individual sectors of the economy.

According to the national accounts compiled and published by the Hellenic Statistical Authority (ELSTAT) in accordance with the European System of Accounts (ESA 1995), Gross Domestic Product (GDP) at basic prices,[4] based on the production method, is broken down into ten major sectors, presented in detail in Table 2.

Dividing output value at current prices by output value at constant prices (taking as base year 2005=100), we calculate the sectoral deflators for each of these ten sectors, in addition to the GDP deflator calculated for the whole economy. These deflators along with the Harmonised Index of Consumer Prices (HICP), also compiled and published by ELSTAT, constitute the group of prices p_t.

3 The price equation (1) and the wage equation (2) used in this study should be seen as reduced-form equations. More specifically, the price equation (1) relies on a pricing model based on the firm's profit margin (mark-up). Nordhaus (1972) shows that the specification of equation (1) is derived from an optimisation process of a Cobb-Douglas production function. On the assumption of constant returns to scale and a constant relative price of capital, the production function results in a long-term coefficient equal to unity, $\beta_{1p}=1$ in the price equation (1). Coefficient $\beta_{1p}=1$ indicates that prices and wages increase at similar rates in the long run. Following the same line of reasoning, in the wage equation (2), if the sum of the coefficients of lagged prices is equal to unity, $\beta_{1w}\sum_{i=1}^{n}\lambda_i = 1$, this also indicates that wages and prices grow at similar rates in the long run. According to Gordon (1985), the wage equation (2) is derived from a labour demand and supply model in which the rate of change in wages is each time adjusted to correct for labour market imbalances.

4 GDP at basic prices (total gross value added) equals GDP at market prices, minus taxes on production plus subsidies.

Table 2 Definitions of labour cost and price variables by production sector and for the total economy

	Labour cost variables			Price variables		
Sectors	Unit labour cost (ulc_t)	Compensation per employee (wun_t)	Labour productivity ($lprod_t$)	Deflators (p_t)	Harmonised CPI (p_t)	Profit margin (pm_t)
GDP-total economy (gross value added at basic prices)	TT_ULC	TT_WUN	TT_LPROD	YFD	HICP	TT_PM
Agriculture, forestry and fishing	AGR_ULC	AGR_WUN	AGR_LPROD	AGRD		AGR_PM
Mining and quarrying, manufacturing, energy, water supply, sewerage, waste management and remediation	IND_ULC	IND_WUN	IND_LPROD	INDD		IND_PM
Construction	CON_ULC	CON_WUN	CON_LPROD	COND		CON_PM
Wholesale and retail trade, repair of motor vehicles and motorcycles, transportation and accommodation and food services	TR_ULC	TR_WUN	TR_LPROD	TRD		TR_PM
Information and communication	COM_ULC	COM_WUN	COM_LPROD	COMD		COM_PM
Financial and insurance activities	FI_ULC	FI_WUN	FI_LPROD	FID		FI_PM
Real estate activities	RE_ULC	RE_WUN	RE_LPROD	RED		RE_PM
Professional, scientific and technical activities, administrative and support service activities	SC_ULC	SC_WUN	SC_LPROD	SCED		SC_PM
Public administration and defence, compulsory social security, education, human health and social assistance activities	PA_ULC	PA_WUN	PA_LPROD	PAD		PA_PM
Arts, entertainment and recreation, repair of household appliances and other services	ART_ULC	ART_WUN	ART_LPROD	ARTD		ART_PM

Sources: Calculations based on ELSTAT data.

Table 2 presents the abbreviations of the variables used for the couples of labour costs (ulc_t, wun_t, $lprod_t$) and prices p_t (deflators, HICP and profit margin) for the total economy and the individual sectors.

It should be noted that HICP was added to the group of prices although there is no exact methodological correspondence (as to the composition of goods and services) with the various measures of total labour costs, as derived in total gross value added terms. The reason for the inclusion of HICP in the analysis is that price stability, as defined by the European Central Bank (ECB) (inflation below, but close to, 2% over the medium term), is calculated based on the rate of change in HICP prices.[5]

For the total economy and the ten individual sectors labour costs are measured using the respective indexes. The data on nominal unit labour costs ulc_t (index using as base year 2005=100) for the total economy and the ten individual sectors are taken from the Statistical Data Warehouse (SDW) of the ECB. According to the standard definition provided by Eurostat,[6] nominal unit labour costs are defined as follows:

5 The primary objective of the European System of Central Banks (ESCB) is to maintain price stability (Article 127 of the Treaty on the functioning of the European Union). The ECB Governing Council aims to keep inflation rates below, but close to, 2% over the medium term. In order to achieve its primary objective, the Governing Council bases its decisions on a two-pillar monetary policy strategy and implements them using its operational framework.

6 Source: Eurostat, http://epp.eurostat.ec.europa.eu.

$$ulc_t = \frac{wun_t}{lprod_t} = \frac{\frac{wind_t}{led_t}}{\frac{yer_t}{let_t}}$$

where $wind_t$ represents the total compensation of employees, led_t the total number of employees, and $wun_t = wind_t/led_t$ the average compensation per employee, while yer_t denotes GDP at constant prices (base year 2005=100), let_t total employment in the economy, and finally $lprod_t = yer_t/let_t$ average total productivity. The data on average compensation per employee and average total productivity, the two main components of nominal unit labour cost, are also published in the SDW database of the ECB broken down by sector.

The unit profit margin indicator for a specific sector is defined as follows: $pm_t = p_t/ulc_t$, i.e. as the ratio of the level of prices (deflator at basic prices) in the sector to the respective unit labour costs in the same sector.

Total demand shocks are proxied by the output gap[7] variable $Ogap_t$, which reflects the cyclical phase of demand in relation to the real economy's long-term trend (potential output). In addition, the rate of change in money supply to the economy *M3*[8] is taken into account as a proxy of the cyclical phase of demand.

Shocks attributable to total supply are proxied by the relative prices variable $RP_t = IM\_PPI_t / TT\_PPID_t$, wherein relative prices RP_t are defined as the ratio of the import price index in industry IM_PPI_t to the industrial producer price index for the domestic market TT_PPID_t. All series are seasonally adjusted (X_SA) using the X-12 method, and all variables examined in the empirical analysis are logarithmised.[9]

4 DESCRIPTIVE ANALYSIS. IS THERE EVIDENCE OF A DISCONNECTION BETWEEN PRICE DEVELOPMENTS AND UNIT LABOUR COST?

4.1 SECTORAL PRODUCTION SHARES AS PERCENTAGES OF GDP

As can be seen in Table 3, in the period covered by the present study (2000-2013), four production sectors account for comparatively

7 The output gap is the ratio of GDP (gross value added at basic prices, 2005=100) to the economy's potential output. Potential output is calculated by applying the Hodrick-Prescott (HP) filter to GDP.

8 M3=time deposits with an agreed maturity of up to 2 years + deposits redeemable at a period of notice of up to 3 months + repurchase agreements (repos) + money market fund shares/units + debt securities with a maturity of up to 2 years.

9 On the one hand, the logarithmic transformation of series eliminates any quadratic trends and on the other hand, the coefficients in the equations of the models estimated in the paper's empirical part express elasticities.

Table 3 Sectoral production shares as percentages of GDP

(% of GDP at basic prices, period average)

Sector	2000-2013	2000-2007	2008-2013
Agriculture	4.70	5.00	4.30
Industry	12.30	12.80	11.80
Construction	6.10	7.70	4.10
Trade	24.50	25.00	23.90
Information and communication	4.40	3.80	5.10
Financial sector	5.40	5.10	5.70
Real estate activities	12.90	12.00	14.20
Professional and other activities	6.30	6.90	5.40
Public administration and defence	19.60	18.60	20.90
Arts, entertainment and recreation	4.30	4.30	4.40

Sources: Calculations based on ELSTAT, ECB and European Commission data.

larger average shares in GDP: industry (12.3%); trade (24.5%); real estate (12.9%); and public administration and defence (19.6%). The combined share of these four sectors stands at 69.3% of GDP.

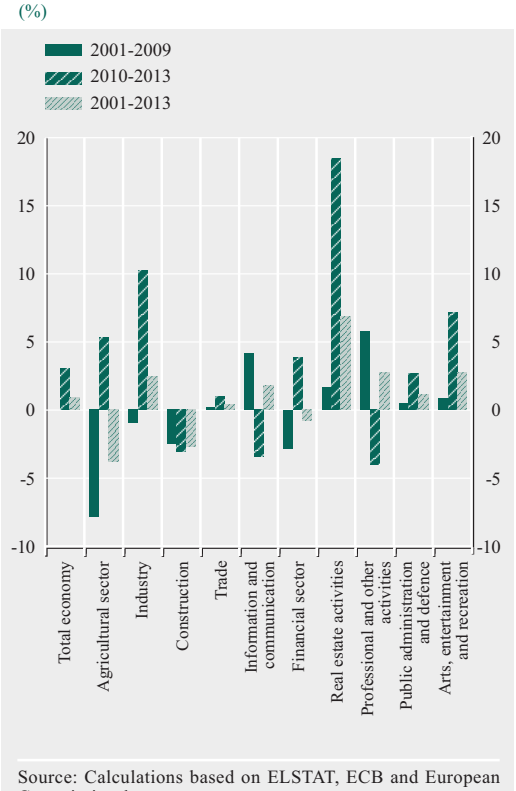
At the same time, no significant changes can be observed in sectoral shares during the two subperiods: 2000-2007 (pre-crisis period) and 2008-2013 (recession period). It should be noted that in the whole period examined (2000-2013), services —including trade; information and communication; financial services; real estate services; professional, scientific and technical services; public administration and defence; and arts, entertainment and recreation— is the most important sector of the economy, with a share of 77%, while the remaining sectors, i.e. agriculture (4.7%), industry (12.3%) and construction (6.1%), account for a combined share of approximately 23%.

In light of the above clarifications regarding the importance of each sector in terms of share in GDP, the following subsection, as well as the econometric investigation in Section 5, focuses only on the analysis for the total economy and its four major sectors: industry, trade, real estate, and public administration and defence.

4.2 DEVELOPMENTS IN PRICES, UNIT LABOUR COSTS AND UNIT PROFIT MARGIN INDICATORS OVER TIME

Examining the economy in two subperiods, before and after 2010, Table 4 along with Charts 1, 2.A and 2.B provide an extensive range of information as regards price, unit labour cost and profit margin developments over time, for the total economy and for its major sectors.[10] Year 2010 was selected as a structural breakpoint that splits the sample into two subperiods (2000-2009: first subperiod; and 2010-2013: second subperiod), based on the fact that since mid-2010 (with the signing of the first Memorandum[11]) Greece has seen a gradual implementation of fiscal consolidation measures.

Chart 1 Developments in the unit profit margin indicator in all sectors of the economy



Source: Calculations based on ELSTAT, ECB and European Commission data.

The profit margin indicator per unit is calculated as $pm_t=p_t/ulc_t$, i.e. as the ratio of the basic price in the respective sector (excluding taxes on production) to the respective unit labour costs. Compared with other definitions used for calculating a sector's profit margins, the above definition, albeit seemingly simplistic, offers the following advantages: data collection availability, computational ease, and relative consistency in terms of comparability, allowing for the study of different sectors and economies. On the other hand, this approach ignores the cost of other inputs in the pro-

10 Table 12 in the Annex presents the same information for all sectors of the economy.

11 Memorandum of Understanding on financial assistance to the Hellenic Republic – along with its integral parts, namely: (i) Memorandum of Economic and Financial Policies; (ii) Memorandum of Understanding on Specific Economic Policy conditionality; and (iii) Technical Memorandum of Understanding – signed on 3 May 2010 on the one hand by the IMF, the ECB and the European Commission acting on behalf of the euro area countries, and on the other hand by the Greek Government.

Table 4 Developments in prices, unit labour costs and profit margins in the major sectors of the economy

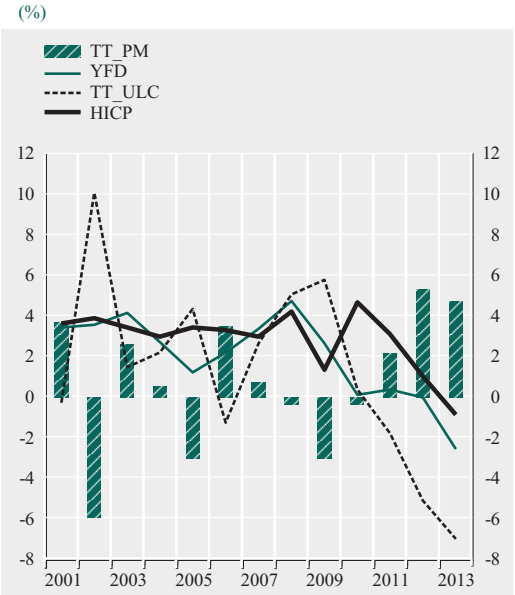
(annual percentage changes %)

	Total economy				Industry		
	HICP (HICP)	Deflator (YFD)	Unit labour cost (TT_ULC)	Profit margin (TT_PM)	Deflator (INDD)	Unit labour cost (IND_ULC)	Profit margin (IND_PM)
2001	3.6	3.5	-0.2	3.7	2.5	1.8	0.6
2002	3.9	3.6	10.1	-5.9	4.5	14.9	-9.1
2003	3.5	4.2	1.5	2.6	0.8	-1.7	2.6
2004	3.0	2.7	2.2	0.5	7.1	3.3	3.7
2005	3.5	1.3	4.4	-3.0	-1.9	13.2	-13.4
2006	3.3	2.2	-1.2	3.5	8.9	5.3	3.4
2007	3.0	3.4	2.7	0.7	2.4	4.6	-2.2
2008	4.2	4.8	5.1	-0.3	13.0	10.1	2.7
2009	1.3	2.7	5.8	-3.0	-3.1	-5.7	2.8
2010	4.7	0.1	0.4	-0.3	4.1	-3.2	7.6
2011	3.1	0.4	-1.7	2.2	-0.1	-5.7	5.9
2012	1.0	0.0	-5.0	5.3	4.6	-12.6	19.6
2013	-0.9	-2.5	-7.0	4.8	0.8	-6.3	7.6
Period average	**HICP**	**YFD**	**TT_ULC**	**TT_PM**	**INDD**	**IND_ULC**	**IND_PM**
2001-2013	2.9	2.0	1.3	0.8	3.3	1.4	2.4
2001-2009	3.3	3.1	3.4	-0.1	3.8	5.1	-1.0
2010-2013	2.0	-0.5	-3.3	3.0	2.3	-6.9	10.2

	Trade			Real esate activities			Public administration and defence		
	Deflator (TRD)	Unit labour cost (TR_ULC)	Profit margin (TR_PM)	Deflator (RED)	Unit labour cost (RE_ULC)	Profit margin (RE_PM)	Deflator (PAD)	Unit labour cost (PA_ULC)	Profit margin (PA_PM)
2001	2.7	-10.2	14.4	4.1	145.2	-57.5	6.2	3.5	2.6
2002	-0.7	-0.7	0.0	4.3	61.8	-35.5	9.9	12.2	-2.0
2003	3.4	-4.6	8.4	5.1	-32.1	54.8	5.1	0.5	4.5
2004	0.7	-2.4	3.2	5.5	56.8	-32.7	7.4	13.0	-5.0
2005	-12.8	4.8	-16.7	8.1	-32.1	59.1	1.5	1.6	0.0
2006	2.4	1.3	1.1	3.5	10.5	-6.3	-0.9	-1.1	0.2
2007	4.0	2.5	1.4	4.8	-10.3	16.8	4.5	4.7	-0.2
2008	5.0	6.0	-1.0	4.8	1.2	3.6	8.4	5.3	2.9
2009	2.1	12.6	-9.3	4.7	-6.6	12.1	8.0	6.9	1.1
2010	1.5	5.0	-3.4	3.3	-0.9	4.2	-5.5	-7.1	1.7
2011	2.9	0.8	2.1	3.2	-18.8	27.0	-4.7	-4.8	0.0
2012	0.4	0.5	-0.1	-2.1	-10.3	9.2	-0.3	-5.5	5.5
2013	-1.3	-6.3	5.3	-6.7	-29.9	33.0	-4.0	-7.2	3.4
Period average	**TRD**	**TR_ULC**	**TR_PM**	**RED**	**RE_ULC**	**RE_PM**	**PAD**	**PA_ULC**	**PA_PM**
2001-2013	0.8	0.7	0.4	3.3	10.3	6.8	2.7	1.7	1.1
2001-2009	0.8	1.0	0.2	5.0	21.6	1.6	5.6	5.2	0.5
2010-2013	0.9	0.0	1.0	-0.6	-15.0	18.4	-3.6	-6.1	2.7

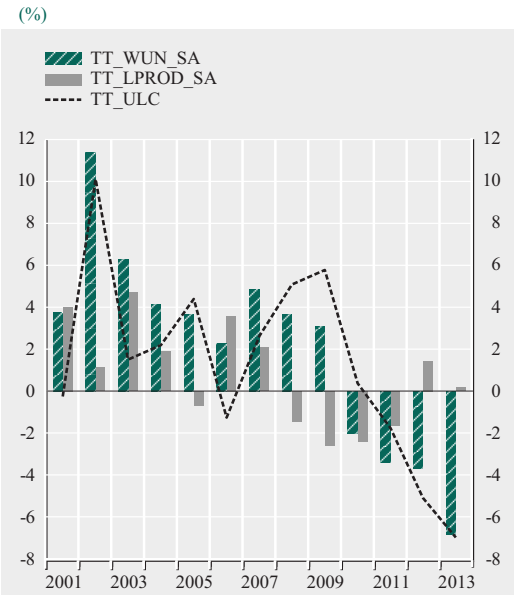
Sources: Calculations based on ELSTAT, ECB and European Commission data.

Chart 2.A Rates of change in GDP deflator (YFD), HICP, unit labour costs (TT_ULC) and profit margin indicator (TT_PM) in total economy



Source: Calculations based on ELSTAT, ECB and European Commission data.

Chart 2.B Rates of change in unit labour costs (TT_ULC), total compensation per employee (TT_WUN_SA) and labour productivity (TT_LPROD_SA) in total economy



Source: Calculations based on ELSTAT, ECB and European Commission data.

duction process (raw materials, intermediate goods and energy), firms' tax burden, as well as financial costs.

Data in Table 4 in combination with Chart 1 show that for the total economy the profit margin per unit rose on average by 3.0% in the subperiod 2010-2013, against an average of only 0.8% in the whole period 2001-2013.

This implies a disconnection between the rate of change in unit labour costs and inflation. In other words, in the subperiod 2010-2013, whereas unit labour costs fell on average by 3.3%, prices fell by only 0.5% when measured using the GDP deflator, and rose by 2.0% when measured based on the HICP. This disconnection is more visible in the years 2012 and 2013, when profit margins widened by 5.3% and 4.8% respectively (see Table 4).

As for the total economy, in Chart 2.A it can be seen that the rates of change in the GDP deflator, the HICP and the unit labour cost indicator follow a relatively common path in the subperiod 2000-2009.

From mid-2010 onwards, with the gradual implementation of fiscal consolidation measures (after the signing of the first Memorandum), the series examined changed significantly, trending downwards. Nevertheless, they strongly deviate from each other, with unit labour costs recording a much steeper fall compared with the two inflation measures in the subperiod 2010-2013. This is attributable to the large cumulative reduction (14.9%) of total compensation per employee in the subperiod 2010-2013, while labour productivity also fell by 2.3% (see Chart 2.B). Evidently therefore, two different patterns can be observed: a first pattern (2001-2009) in which the series co-fluctuate, and a second pattern (2010-2013) characterised by a common but disproportionate downward trend. Industry (10.2%) and real estate (18.4%) show the widest average profit margins in the subperiod 2010-2013 (see Chart 1).

Table 5 Pearson correlation coefficient between deflators and unit labour costs

	Total economy	Industry	Trade	Real estate activities	Public administration
2000-2013	***YFD_SA***	***INDD_SA***	***TRD_SA***	***RED_SA***	***PAD_SA***
TT_ULC_SA	*0.92*	0.81	0.37	0.91	0.96
IND_ULC_SA	0.70	*0.58*	-0.05	0.69	0.81
TR_ULC_SA	0.68	0.74	*0.66*	0.71	0.51
RE_ULC_SA	-0.10	-0.24	-0.25	*-0.15*	0.10
PA_ULC_SA	0.80	0.66	0.12	0.77	*0.93*
2000-2009	***YFD_SA***	***INDD_SA***	***TRD_SA***	***RED_SA***	***PAD_SA***
TT_ULC_SA	*0.97*	0.91	0.07	0.95	0.98
IND_ULC_SA	0.95	*0.95*	-0.08	0.95	0.90
TR_ULC_SA	0.32	0.40	*0.22*	0.34	0.29
RE_ULC_SA	0.28	0.21	0.16	*0.22*	0.33
PA_ULC_SA	0.97	0.91	0.05	0.95	*0.98*
2010-2013	***YFD_SA***	***INDD_SA***	***TRD_SA***	***RED_SA***	***PAD_SA***
TT_ULC_SA	*0.65*	-0.86	-0.33	0.75	0.81
IND_ULC_SA	0.41	*-0.88*	-0.56	0.54	0.76
TR_ULC_SA	0.73	-0.28	*0.37*	0.68	0.35
RE_ULC_SA	0.60	-0.73	-0.47	*0.62*	0.90
PA_ULC_SA	0.55	-0.80	-0.52	0.61	*0.88*

Source: Author's own calculations.

Table 5 presents the Pearson linear correlation coefficient between prices and unit labour costs in the total economy and the individual sectors. It should be noted that the coefficient is calculated using the levels of the two series,[12] and for all three periods selected.

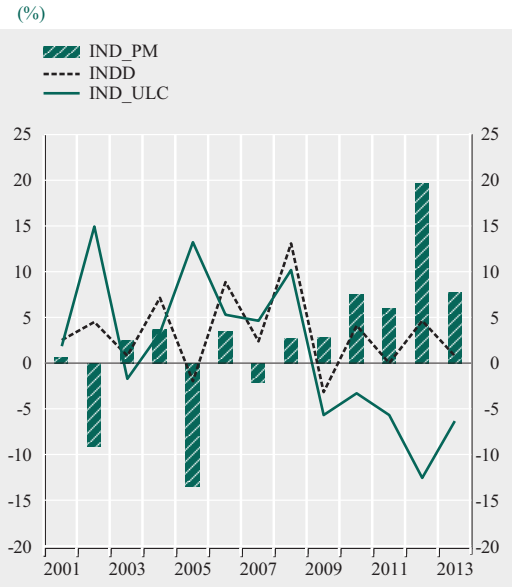
In the subperiod before the signing of the Memorandum (2000-2009), the Pearson correlation coefficient (see Table 5) between prices and unit labour costs in the total economy is high, $p_{yfd,tt\_ulc} = 0.97$. In the subperiod after the signing of the Memorandum (2010-2013), the correlation coefficient in the total economy declines, $p_{yfd,tt\_ulc} = 0.65$, providing support for the observation that there is, in general, a partial disconnection of the series after 2010.

In particular, the disconnection between inflation (2.3%) and the rate of change in unit labour costs (-6.9%) in the subperiod 2010-2013 becomes more evident in industry (see Chart 3), which produces the bulk of the economy's tradable (exportable) goods. This disconnection is more apparent in 2012 and 2013, when the profit margin rose by 19.6% and 7.6% respectively. This was due to the rapid fall in unit labour costs (down by 12.6% and 6.3%) in 2012 and 2013, with the rates of change in prices standing at 4.6% and 0.8%, respectively.

The decline in unit labour costs in 2012 and 2013 is attributable to a 5.5% and 4.2% reduction of total compensation per employee, respectively, and to an 8.2% and 2.1% pick-up in labour productivity at the same time. This disconnection hindered the country's efforts to regain competitiveness based on the policy of

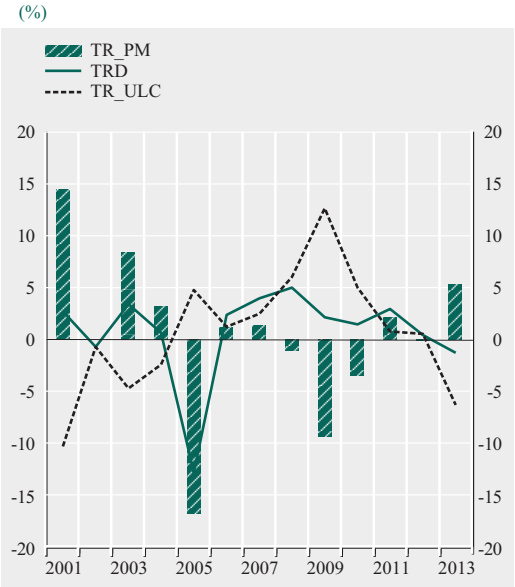
12 The Pearson linear correlation coefficient was calculated at the levels of the two series so as to provide a forward-looking indication of the existence or otherwise of a constant long-term relationship between prices and unit labour costs.

Chart 3 Rates of change in industry deflator (INDD), unit labour costs (IND_ULC) and profit margin indicator (IND_PM)



Source: Calculations based on ELSTAT, ECB and European Commission data.

Chart 4 Rates of change in trade deflator (TRD), unit labour costs (TR_ULC) and profit margin indicator (TR_PM)



Source: Calculations based on ELSTAT, ECB and European Commission data.

internal devaluation pursued from 2010 onwards, since prices in the industrial sector seem not to have sufficiently responded to adjustments in labour costs.

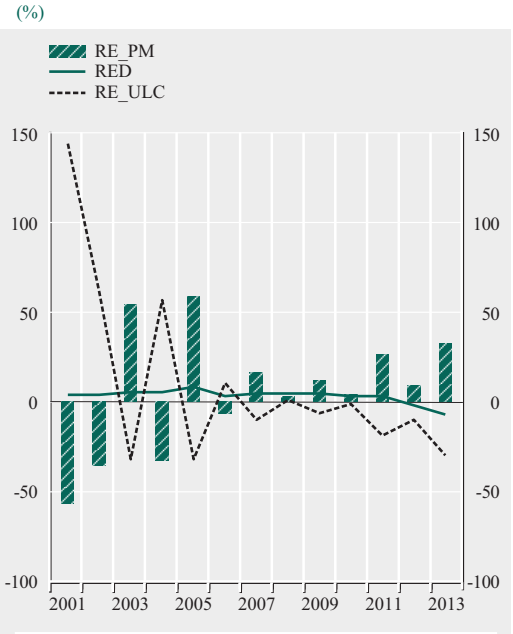
In industry, whereas the Pearson correlation coefficient (see Table 5) is high $p_{ind,indd\_ulc}$=0.95 in the subperiod 2000-2009, it becomes quite negative $p_{ind,indd\_ulc}$=-0.81 in the subperiod 2010-2013, thus suggesting a strong disconnection between prices and unit labour costs. Over the whole period 2000-2013, this coefficient is relatively high $p_{ind,indd\_ulc}$=0.58, implying that there is considerable interconnection between prices and labour costs in the sector. This finding indicates that a constant long-term relationship might be detected.

With respect to the trade sector, as can be observed in Chart 4, mainly after 2010 the rate of changes in the deflator and unit labour costs follow a relatively common trend.

The average profit margin per unit in the subperiod 2000-2009 was 0.2%, while it rose by 1.0% in the subperiod 2010-2013. Unit labour costs in the subperiod 2010-2013 remained unchanged. The average compensation per employee fell by 4.3%, while average labour productivity also declined by 4.1%. It can be argued that this sector shows no strong disconnection between prices and wages in the subperiod 2010-2013, with the exception of 2013 during which the profit margin widened by 5.3% due to a 6.3% decline in unit labour cost amidst negative inflation (-1.3%). It should however be noted that the Pearson correlation coefficient (see Table 5) in the subperiod 2000-2009 is much lower for the trade sector (p_{trd,tr_ulc}= 0.22) than for the industrial sector ($p_{ind,indd\_ulc}$=0.95) or the total economy (p_{yfd,tt_ulc}=0.97). This means that the trade sector exhibits a weaker interconnection between prices and labour costs, implying that the existence of a constant long-term relationship cannot be detected. In the subperiod 2010-2013, the linear correlation coefficient increases (p_{trd,tr_ulc}=0.37).

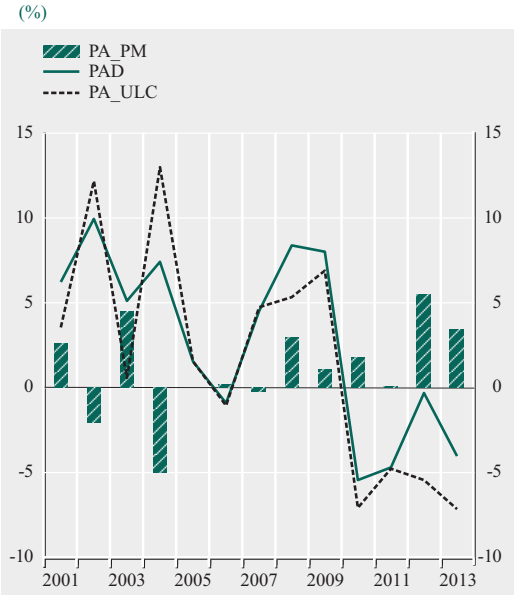
In real estate (see Chart 5), labour costs fluctuate strongly up to 2006 (perhaps due to sta-

Chart 5 Rates of change in real estate deflator (RED), unit labour costs (RE_ULC) and profit margin indicator (RE_PM)



Source: Calculations based on ELSTAT, ECB and European Commission data.

Chart 6 Rates of change in the public administration and defence deflator (PAD), unit labour costs (PA_ULC) and profit margin indicator (PA_PM)



Source: Calculations based on ELSTAT, ECB and European Commission data.

tistical reasons as well), while the deflator changes more smoothly, by 5.0% on average in the subperiod 2001-2009.

For this reason, and given also that prices in the real estate activities sector may possibly be largely implied, we should be cautious about drawing conclusions with respect to the profit margin in this sector. In the subperiod 2010-2013 the average profit margin seems to have widened to 18.4%, on account of a 15.0% drop in unit labour costs, while inflation was on average negative (-0.6%). This large reduction of unit labour costs is attributable to an apparent pick-up in labour productivity, which rose on average to 14.6% in the subperiod 2010-2013, while wages per employee fell to 4.9%. It is possible that, with the collapse in building activity and the large recession in the real estate market, the very steep decrease in employment in this sector leads to overestimated labour productivity. In addition, it should also be noted that the Pearson correlation coefficient is relatively low (p_{red,re_ulc}= 0.22) in the subperiod 2000-2009, and rises considerably (p_{red,re_ulc}=0.62) in the subperiod 2010-2013, as strong volatility levels out after 2006. This means that there is no constant interconnection between prices and labour costs in this sector, thus indicating that the existence of a long-term relationship is not likely to be detected in the empirical part of the study.

Turning now to public administration and defence, it can be seen in Chart 6 that up to 2011 the rates of change in the deflator and the unit labour cost index follow a common path. From mid-2009 onwards, a change of course is recorded for both rates. They exhibit a strong downward trend, but also appear disconnected from each other after 2011. This is attributable to the rapid fall (-6.1% on average) in unit labour costs in the subperiod 2010-2013 on account of lower wages per employee by 4.9% on average, while labour productivity in the sector picked up by 1.4% mainly due to a large decline in employment in the context of public sector consolidation measures. Profit mar-

Table 6 Degree of disconnection between prices and unit labour costs in 2010-2013 compared with 2000-2009

Sectors	Couples of prices and unit labour costs by production sector	Pearson correlation coefficient			Degree of disconnection in 2010-2013 compared with 2000-2009
		2000-2013	2000-2009	2010-2013	
Total economy	(YFD, TT_ULC)	0.92	0.97	0.65	Partial disconnection
Industry	(INDD, IND_ULC)	0.58	0.95	-0.88	Strong disconnection
Trade	(TRD, TR_ULC)	0.66	0.22	0.37	Partial reconnection
Real estate activities	(RED, RE_ULC)	-0.15	0.22	0.62	Partial reconnection
Public administration and defence	(PAD, PA_ULC)	0.93	0.98	0.88	Partial disconnection

Source: Author's own calculations.

gin in the subperiod 2010-2013 widened by 2.7% as a result of a larger decrease in unit labour costs (down by 6.1%) compared to the decline in the rate of change in prices (by 3.6%). The Pearson correlation coefficient (see Table 5) fell from p_{pad,pa_ulc}=0.98 in the subperiod 2000-2009 to p_{pad,pa_ulc}=0.88 in the subperiod 2010-2013, providing support for the observation regarding a partial disconnection between inflation and labour costs mainly after 2011. On the other hand, the value p_{pad,pa_ulc}=0.88 remains still high, thereby indicating that in general, despite the disconnection observed in recent years, prices and labour costs in this sector follow a common long-term path.

Table 6 summarises the above conclusions and intends to characterise the degree of disconnection between prices and unit labour costs observed in the total economy and the individual sectors.

In light of all the above, we arrive at the conclusion that for the total economy in the subperiod 2010-2013, unit labour cost adjustments are largely disconnected from price measures, at both the levels of the series and their rates of change. The considerable fall in unit labour costs is mainly attributable to the reduction of nominal wages per employee rather than the pick-up in average labour productivity. Strengthening productivity is the crucial factor that will help improve the economy's competitiveness, since any further downward adjustment of wages is rather unlikely to benefit the economy while it risks undermining social cohesion. The disconnection between prices and labour costs hinders the monetary policy transmission channel (Wolff 2012) from acting as a catalyst that would speed up the intended adjustments in terms of competitiveness and consumer purchasing power so as to faster cure any distortions in the economy's smooth operation, growth and stability.

5 METHODOLOGICAL ISSUES AND ECONOMETRIC METHODOLOGY

5.1 METHODOLOGICAL ISSUES

The econometric method used distinguishes between a long-term and a short-term price adjustment mechanism. This enables the exploration of two different questions: the pass-through rate and the speed of adjustment to long-run equilibrium level.

The pass-through rate is the part of the increase or decrease in unit labour costs that moves on to prices, or vice versa, i.e. the part of the increase or decrease in prices passed through to unit labour costs. For instance, if an increase in unit labour costs leads to an equal increase in prices, then it is considered that the adjustment rate is 100%, i.e. full pass-through

is achieved and long-term elasticity takes a value equal to unity. Long-term elasticity depends on the pattern of demand firms have to meet and the strength of competition in the sector. In a perfectly competitive environment, this value equals marginal cost. Given that unit labour cost represents a key component of the marginal cost a firm needs to cover, we would expect a long-term elasticity value close to unity, or in other words a pass-through rate of almost 100%.

The speed of adjustment of prices and wages to the long-run equilibrium is affected by many factors. Market structure reflects a firm's degree of power and offers a good explanation of the phenomenon. The existence of only a small number of firms engaged in a given market generates incentives for cartel-forming collusion deals,[13] with a view to ensuring an excessive (non-normal) profit margin. In such a case, a price reduction by one firm when unit labour cost is shrinking may be seen by the other firms as an aggressive move that breaches their agreement. As a consequence, in periods of declining labour costs firms tend to keep their prices unchanged (rigid), or delay any changes, so as to achieve the continuation of a higher profit margin. In contrast, when labour costs are rising there is no misinterpretation about any cartel-breaking move, and firms tend to raise their prices immediately and proportionately.

Employees, on the other hand, when they see that prices go up tend to ask in advance for "precautionary" larger wage increases than their labour productivity would justify, in fear of a further price increase in the future and with a view to offsetting possible losses of their purchasing power. But when prices go down, nominal wages are not adjusted as quickly (wage rigidity), causing a lag in the speed of adjustment of wages.

5.2 ECONOMETRIC METHODOLOGY

The study applies an econometric methodology that comprises the following steps:

The first step is to test the series' integration order, determining whether it possesses a unit root, by carrying out the DF-GLS (Elliott et al. 1996) tests and the PP (Phillips and Perron 1988) tests.[14]

The second is to investigate the existence of possible long-run equilibrium relationships among the variables, using the JJ (FIML) maximum likelihood cointegration method proposed by Johansen and Juselius (Johansen 1998 and 1992; and Johansen and Juselius 1990). The JJ test for cointegration is based on an autoregressive vector error correction model (VECM) and is methodologically preferable to the test proposed by Engle and Granger (1987).[15] For the purposes of the present study we estimate a bivariate VAR (2), in which unit labour costs and prices are seen as endogenous variables of the system. The results of the JJ method are known to be sensitive to the number of lags (Banerjee et al. 1993) included in the VAR model. The appropriate number of lags in the vector autoregressive VAR system is determined using the AIC, SBC, HQ and LR information criteria.[16] Whether the model specification should include deterministic components (trends and constant terms) or not is determined following the Pantula (1989) principle.

Third, assuming the existence of a long-run equilibrium or a cointegration relationship

13 A typical example would be the oligopolistic structure of the wholesale trade market, with the poultry market cartel detected by the Competition Commission in 2012.

14 The DF-GLS (Elliott et al. 1996) and PP (Phillips and Perron 1988) tests for unit root are generally considered statistically more reliable than the DF-ADF (Dickey and Fuller 1979, 1981) tests.

15 The Engle and Granger (1987) test for cointegration examines regression between series of the same integration order I(n), and then, if the residuals from this regression are stationary – i.e. I(0) – the series are considered to be cointegrated. But this test has some weaknesses: First, the results are sensitive to the specific series selected as the dependent variable. Second, it disallows testing the number of cointegration relationships, i.e. if there are one or more. Third, the classical statistical tests of hypotheses regarding the cointegration vectors cannot be run, since the estimated coefficients follow an unknown non-standardised distribution. In contrast, the JJ test proposed by Johansen and Juselius (1990) is free of all these problems: it allows for a direct investigation of the number of cointegration vectors and enables the application of classical statistical tests of hypotheses on the estimated cointegration vectors.

16 LR: sequential modified LR test statistic (Sims' Test); AIC: Akaike information criterion (1973); SC: Schwarz information criterion (1978); HQ: Hannan-Quinn information criterion (1979).

between prices and unit labour costs using the JJ method, the cointegration relationship to be estimated has the following specification:

$$p_t = \delta\ (wun - lprod)_t + U_{1t} \qquad (4)$$

with $\delta > 0$ and $ulc_{t-1} = (wun - lprod)_{t-1}$

where U_{1t} is the random disturbance term. Granger (1988, 1995) has shown that if two series are cointegrated, then Granger-causality[17] must be present, running at least in one direction.

Consequently, the existence of a cointegration relationship such as (4) suggests that there is an error correction model between prices and wages, which can be written as follows:

$$\Delta p_t = \alpha_0 + \sum_{s=1}^{k1} \alpha_{1s} \Delta p_{t-s} + \sum_{s=1}^{k2} \alpha_{2s} \Delta (wun - lprod)_{t-s} + \lambda_1 (p - \delta (wun - lprod)_{t-1} + \varepsilon_{1t} \qquad (5.1)$$

and

$$\Delta (wun - lprod)_t = \beta_0 + \sum_{s=1}^{k1} \beta_{1s} \Delta (wun - lprod)_{t-s} + \sum_{s=1}^{k2} \beta_{2s} \Delta p_{t-s} + \lambda_2 (p - \delta (wun - lprod)_{t-1} + \varepsilon_{2t} \qquad (5.2)$$

where λ_1 and $\lambda_2 \neq 0$. The model of equations (5.1) and (5.2) implies that anytime the level of prices p_{t-1} deviates from the long-run equilibrium level of $\delta(wun - lprod)_{t-1}$, either prices or unit labour costs adjust so that the series move together in the long run. The time lag at the levels of the series is introduced in the VAR (2) via the error correction term $p_{t-1} - \delta(wun - lprod)_{t-1} = U_{t-1}$.

The test for the hypothesis that unit labour costs show no causal relationship with prices (cannot help predict prices) is that all $\alpha_{2s} = 0$ and/or $\lambda_1 = 0$. Respectively, the test for the hypothesis regarding a causal relationship between prices and unit labour costs is that all $\beta_{2s} = 0$ and/or $\lambda_2 = 0$. Therefore, the existence of causality (or absence of weak exogeneity) is examined by testing whether λ_1 and $\lambda_2 \neq 0$, or whether at least one of them is statistically significant (not equal to zero).

In case the JJ test reveals the existence of a long-run equilibrium or cointegration relationship between prices and unit labour costs, we use the dynamic ordinary least squares (DOLS) method proposed by Stock and Watson (1993) to estimate the long-term elasticities. The JJ method also provides maximum likelihood estimates for the cointegration relationships of the price equations and the wage equations. However, even though the JJ method asymptotically is superior, it does not perform well with small samples. The sample of 56 observations (Q1 2000-Q4 2013) is considered to be rather small in order to test for (long-term) cointegration relationships. In contrast, DOLS method proposed by Stock and Watson (1993) to test for cointegration is effective and well-fitted to small samples.

The specifications of the long-term equations are respectively written as follows:

Price equation:

$$p_t = a_0 + a_1 (wun - lprod)_t + \sum_{s=-k}^{k} \alpha_{2s} \Delta (wun - lprod)_{t-s} + U_{1t} \qquad (6.1)$$

Wage equation:

$$(wun - lprod)_t = \beta_0 + \beta_1 p_t + \sum_{s=-k}^{k} \beta_{2s} \Delta p_{t-s} + U_{2t} \qquad (6.2)$$

where $ulc_t = (wun - lprod)_t$.

Given that the random disturbance terms U_{1t} and U_{2t} may be linearly autocorrelated, equations (6.1) and (6.2) are typically submitted to the standard tests for autocorrelation and appropriately corrected. The correlation between unit labour cost and the level of prices

17 A variable X_{1t} Granger-causes variable Y_{2t}, if prediction regarding Y_{2t} improves including X_{1t} information and time lags of X_{1t}.

is not statistically significant in the long run if $\alpha_1 = 0$ and is statistically significant if $\beta_1 = 0$.

Fourth, the existence and nature of short-term interactions between unit labour costs and prices are Granger-tested in the context of an expectations-augmented Phillips curve. In the tests for weak, strict (short-term) and strong exogeneity we use an autoregressive vector error correction model VECM (2) with prices and unit labour costs as endogenous variables, and the output gap, money supply and relative prices as exogenous variables. In their augmented version, the equations of the bivariate system VECM (2) have the following specifications:

Dynamic price equation:

$$\Delta p_t = \alpha_0 + \sum_{s=1}^{k1} \alpha_{1s} \Delta p_{t-s} + \sum_{s=1}^{k2} \alpha_{2s} \Delta ulc_{t-s} + \sum_{s=1}^{k3} \beta_{3s} Ogap_{t-s} + \sum_{s=1}^{k4} \alpha_{4s} \Delta M3_{t-s} + \sum_{s=1}^{k5} \alpha_{5s} \Delta RP_{t-s} + \lambda_1 \hat{U}p_{t-1} + \varepsilon_{1t} \quad (7.1)$$

and

Dynamic wage equation:

$$\Delta ulc_t = \beta_0 + \sum_{s=1}^{k1} \beta_{1s} \Delta ulc_{t-s} + \sum_{s=1}^{k2} \beta_{2s} \Delta p_{t-s} + \sum_{s=1}^{k4} \beta_{4s} \Delta M3_{t-s} + \sum_{s=1}^{k5} \beta_{5s} \Delta RP_{t-s} + \lambda_2 \hat{U}w_{t-1} + \varepsilon_{2t} \quad (7.2)$$

where $\hat{U}p$ is the residual from the cointegration relationship of the long-term price equation and $\hat{U}w$, respectively, the residual from the cointegration relationship of the long-term wage equation. Lag lengths k_1, k_2, k_3, k_4 and k_5 denote the time lags of the explanatory variables needed for the disturbance terms (ε_1, ε_2) to become linearly uncorrelated. Unit labour costs do not Granger-cause prices if all $\alpha_{2s}=0$ and/or $\lambda_1 = 0$, whereas prices do not Granger-cause unit labour costs if all $\beta_{2s}=0$ and/or $\lambda_2=0$.

6 THE EMPIRICAL RESULTS

6.1 TEST FOR LONG-RUN EQUILIBRIUM

The results of the DF-GLS and PP tests for the existence of unit roots[18] lead to the conclusion that the unit root hypothesis cannot be rejected at the levels of the series, while, by contrast, in their first differences it is rejected in all cases, in favour of the alternative hypothesis of stationarity. The results show that all the series examined are I(1) integration order, which means that they are stationary in their first differences.

The results of the JJ test support the existence of cointegration between the levels of prices and unit labour costs in the total economy and in the industrial and public administration and defence sectors. In contrast, no cointegration was found in the sectors of trade and real estate activities. Table 8 presents the cointegration vectors based on the DOLS method. Briefly inspected, it shows that long-term elasticities seem to stand very close to unity for the total economy and the public administration and defence sector, whereas they are not as close for the industrial sector. However, testing for the hypothesis of long-term unit elasticity using the Wald test statistic, we find that this hypothesis cannot be accepted in all cases (see Table 9).

Table 7 presents the results of the test for cointegration of the series and more specifically between the level of the unit labour cost indicator and the level of prices in the respective sector and in the total economy. The test is run using the JJ maximum likelihood method.

As regards price equations, the hypothesis of long-term unit elasticity can only be accepted in the cases of the total economy when prices are measured based on the GDP deflator, in the public administration and defence sector. This means that the adjustment rate is 100%, i.e. an increase in unit labour costs leads to an equal increase in prices in these sectors. By contrast, in the cases of the total economy when prices are measured based on the HICP, and of the industrial sector, the hypothesis of long-term unit elasticity cannot be accepted.

18 Unit root test results are not presented here for brevity reasons, but are available on request.

Table 7 JJ cointegration test

Sectors	System	Lags	Test hypothe-sis	Trace test (λ)	p-value	Max-eigenvalue test (λ max)	p-value	Result
Total economy	(YFD, TT_ULC)	1	H_0:r=0	30.08**	0.00	27.29**	0.00	Cointegration
Total economy	(HICP, TT_ULC)	1	H_0:r=0	74.96**	0.00	70.94**	0.00	Cointegration
Industry	(INDD, IND_ULC)	5	H_0:r=0	22.60**	0.02	16.92**	0.03	Cointegration
Trade	(TRD, TR_ULC)	5	H_0:r=0	9.27	0.71	8.55	0.48	No cointegration
Real estate activities	(RED, RE_ULC)	1	H_0:r=0	25.51**	0.00	13.99	0.06	No cointegration
Public administration and defence	(PAD, PA_ULC)	8	H_0:r=0	28.42**	0.00	22.13**	0.00	Cointegration

* Statistical significance at the 10% level.
** Statistical significance at the 5% level.
Note: Time lags for no autocorrelation of the residuals in the system were selected using the SIC (Schwarz 1978), AIC (Akaike 1973) and HQ (Hannan and Quinn 1979) information criteria.

More specifically, the long-term elasticity of prices based on the HICP is α_1=1.18, implying[19] that an increase of 1% in unit labour costs raises prices by 1.18%.

On the other hand, in industry the long-term elasticity of prices is α_1 = 0.62, implying that an increase of 1% in unit labour costs raises prices by 0.6%. A value of 0.62 for α_1 leads us to the conclusion that the industrial sector is possibly characterised by an oligopolistic market structure and the adjustment rate depends predominantly on the shape of the demand curve firms in the sector have to meet and the strategy they follow with respect to profit margins. It should be recalled that in the subperiod 2010-2013, mainly due to the large fall in unit labour costs, the unit profit margin in industry rose on average by 10.2%, while in the total economy only by 3.0%. Partial price adjustment is expected in oligopolistic structured sectors, wherein firms have already chosen the price that maximises their profits.

19 Nevertheless, this result should be treated with caution, given that, as already noted, HICP was included in the group of prices examined, despite the lack of an exact methodological correspondence (as to the composition of goods and services) with the variables of total labour costs, since price stability (inflation close to 2% over the medium term) according to the ECB definition is measured based on the rate of change in HICP prices.

Table 8 Cointegration vectors using the DOLS method

Sectors	Price equations	Wage equations
Total economy	YFD = 0.10 + 0.98 TT_ULC (0.46) (20.16)	TT_ULC = -0.12 + 1.01 YFD (-0.39) (15.21)
Total economy HICP	HICP= -0.76 + 1.18 TT_ULC (-3.43) (24.60)	TT_ULC = 1.24 + 0.70 HICP (4.53) (11.95)
Industry	INDD= 1.86 + 0.62 IND_ULC (3.93) (6.12)	IND_ULC = 1.50 + 0.64 INDD (1.37) (2.74)
Public administration and defence	PAD= 0.21 + 0.96 PA_ULC (0.93) (19.23)	PA_ULC = 0.29 + 0.92 PAD (2.01) (28.43)

Note: t-statistic values in brackets; long-term equations have been estimated using the DOLS method (Stock and Watson 1993); time lags and leads are based on the SIC information criterion; variance-covariance matrix estimators have been corrected for heteroscedasticity and autocorrelation using the HAC method.

Table 9 Test for long-term unit elasticity

	Price equations	Wage equations
Wald t-statistic test	$H_0: \alpha_1=1$	$H_0: \beta_1=1$
Production sectors	p-value	p-value
Total economy	0.77	0.77
Total economy	0.00	0.00
Industry	0.00	0.14
Public administration and defence	0.45	0.02

Note: The null hypothesis (H_0)) is accepted for p-value>0.05.

As regards the wage equations, the hypothesis of a long-term unit elasticity can only be accepted in the cases of the total economy, when prices are measured based on the GDP deflator, and the industrial sector. In the latter, the elasticity of wages was estimated at α_1=0.64, but is statistically insignificantly different than 1, which would imply that a 1.0% increase in prices could raise unit labour costs by 1.0% in the long run. This full adjustment rate of unit labour costs to changes in the level of prices, as much in the total economy as in industry, could reflect the extensive bargaining power of employees' representatives (i.e. trade unions and confederations) in collective wage negotiations. In other words, there is evidence that in the Greek economy employees' institutional representatives manage to adjust wages in proportion to changes in the level of prices. On the other hand, in the public administration sector, the long-term elasticity of unit labour costs is α_1=0.92, possibly reflecting difficulties in determining prices in the specific sector.

6.2 CAUSALITY TESTS

The results of the cointegration tests provide empirical evidence that prices and unit labour costs exhibit a long-run equilibrium relationship. But this finding cannot help us discern which of the two series adjusts to changes in the other, or if this adjustment is bidirectional. Granger-tests for weak, strict and strong exogeneity provide evidence of a causal relationship between the two variables.

In the specification of the price equation (5.1), the existence of weak (long-term) exogeneity is tested with the hypothesis H_0:λ_1=0. The existence of strict (short-term) exogeneity is Granger-tested with the hypothesis H_0:$\sum_{s=1}^{k2}\alpha_{2s}=0$. The existence of strong exogeneity is Granger-tested with the test of the combined hypotheses that H_0:λ_1=0 and H_0:$\sum_{s=1}^{k2}\alpha_{2s}=0$.

Respectively, in the specification of the wage equation (5.2), the existence of weak (long-term) exogeneity is tested with the hypothesis H_0:λ_2=0. The existence of strict (short-term) exogeneity is Granger-tested with the hypothesis $H_0: \sum_{s=1}^{k2}\beta_{2s}=0$. The existence of strong exogeneity is Granger-tested with the combined hypotheses that $H_0: \lambda_2 = 0$ and $\sum_{s=1}^{k2}\beta_{2s}=0$.

Table 10 summarises the tests for Granger-causality (running from unit labour costs to prices) for the augmented dynamic price equation based on (7.1). The VECM (2) system includes as exogenous variables the output gap (Ogap), money supply (M3) and relative prices (RP). According to the results, the existence of weak exogeneity is rejected in all cases (since the error correction term is statistically significant) with the exception of the industrial

Table 10 Augmented dynamic price equations: Results of Granger-causality test running from unit labour costs to prices

(whole period: 2000Q1-2013Q4)

	System					Granger-causality tests				
	VECM(2)	Lags		Lags	Long-run equilibrium adjustment coefficients	Weak exogeneity	Strict exogeneity		Strong exogeneity	
					λ_1	$\lambda_1=0$	$\sum\alpha_{x1}=\sum\alpha_{x2}=\sum\alpha_{x3}=\sum\alpha_{x4}=0$		$\lambda_1 \wedge \sum\alpha_{x1}=\sum\alpha_{x2}=\sum\alpha_{x3}=\sum\alpha_{x4}=0$	
Sectors		Endogenous variables	Exogenous variables	k_3,k_4,k_5	Error correction term	t-stat	χ^2-stat	p-value	χ^2-stat	p-value
Total economy	(YFD, TT_ULC)	(2,2)	Ogap, M3, RP	(1,1,1)	-0.12	-2.32**	11.19	0.08*	13.43	0.06*
Total economy	(HICP, TT_ULC)	(4,4)	Ogap, M3, RP	(1,1,1)	-0.10	-3.42**	16.87	0.03**	28.00	0.00**
Industry	(INDD, IND_ULC)	(1,1)	Ogap, M3, RP	(1,1,1)	-0.02	-0.64	9.96	0.08*	10.67	0.09*
Public administration and defence	(PAD, PA_ULC)	(1,1)	Ogap, M3, RP	(3,3,3)	-0.16	-3.00**	12.48	0.33	22.05	0.03**

Note: ** and * denote rejection of the null hypothesis (for the existence of weak, strict and strong exogeneity in each case) at 5% and 10% level of significance, respectively.

sector. This means that unit labour costs affect the dynamic behaviour of prices, thereby indicating the existence of a long-term causal relationship running in the direction from unit labour costs to prices. The highest speed of adjustment of prices to the long-run equilibrium is observed in the sector of public administration and defence, since the error correction coefficient is λ_1=-0.16, which means that any deviations from the equilibrium level are corrected in approximately 6 quarters. In industry, the error correction coefficient is statistically insignificant, which means that prices evolve in the long run irrespective of unit labour cost developments. Perhaps in this sector there are other factors —such as cost of capital, energy costs, oligopolistic structure, etc.— that affect price developments to a larger extent, creating adjustment rigidities.

The existence of short-term causality, i.e. absence of strict (short-term) exogeneity, is found in all sectors except the public sector, and implies that the rates of change in lagged unit labour costs can be used to help predict inflation in the short run. Moreover, no strong exogeneity is observed in any sector, therefore unit labour cost affects (Granger-causes) jointly developments in price levels and inflation across all sectors of the economy.

Table 11 summarises the tests for Granger-causality (running in the direction from prices to unit labour costs) for the augmented dynamic wage equation based on equation (7.2). The VECM (2) system also includes the output gap (Ogap), money supply (M3) and relative prices (RP) as exogenous variables.

According to the results presented in Table 11, the existence of weak exogeneity is accepted in all cases, except the industrial sector (in which the error correction coefficient is statistically significant). The error correction coefficient is λ_2=-0.07, which means that any deviations from equilibrium are corrected in roughly 14 quarters (3.5 years). This entails that developments in the level of basic prices in industry affect long-term developments in unit labour costs in this sector, thereby implying the existence of a long-term causal relationship running in the direction from prices to unit labour

Table 11 Augmented dynamic wage equations: Results of Granger-causality test running from prices to unit labour costs

(whole period: 2000Q1-2013Q4)

	System					Granger-causality tests				
	VECM(2)	Lags	Lags		Long-run equilibrium adjustment coefficients	Weak exogeneity	Strict exogeneity		Strong exogeneity	
					λ_1	$\lambda_1=0$	$\sum\beta_{2i}=\sum\beta_{3i}=\sum\beta_{4i}=\sum\beta_{5i}=0$		λ_2^ $\sum\beta_{2i}=\sum\beta_{3i}=\sum\beta_{4i}=\sum\beta_{5i}=0$	
Sectors		Endoge-nous variables	Exogenous variables	k_3,k_4,k_5	Error correction term	t-stat	χ^2-stat	p-value	χ^2-stat	p-value
Total economy	(YFD, TT_ULC)	(2,2)	Ogap, M3,RP	(1,1,1)	-0.02	-0.17	12.75	0.04**	12.80	0.07*
Total economy	(HICP, TT_ULC)	(4,4)	Ogap, M3,RP	(1,1,1)	-0.14	-1.05	15.50	0.05**	17.70	0.03**
Industry	(INDD, IND_ULC)	(1,1)	Ogap, M3,RP	(1,1,1)	-0.07	-2.20**	7.58	0.18*	17.12	0.00**
Public administration and defence	(PAD, PA_ULC)	(1,1)	Ogap, M3,RP	(3,3,3)	-0.12	-1.637	7.58	0.66	11.88	0.37

Note: ** and * denote rejection of the null hypothesis (for the existence of weak, strict and strong exogeneity in each case) at 5% and 10% level of significance, respectively.

costs. This last finding supports the view that institutional representatives in this sector manage to adjust employees' wages in proportion to changes in the level of prices. The statistically significant adjustment rate of wages to changes in prices observed in the industrial sector may reflect trade unions' extensive bargaining power that allows them to negotiate wage increases proportional to price dynamics, as well as their ability to predict price developments correctly.

The evidence shows no strict (short-term) exogeneity in all cases, with the exception of public administration and defence (possibly reflecting correct price-setting difficulties in this sector). The existence of short-term causality, i.e. rejection of strict exogeneity, means that the rates of change in lagged prices can be used to predict changes in unit labour costs in the short run. Moreover, no strong exogeneity is observed in any sector but that of public administration and defence, therefore price dynamics affect (Granger-cause) jointly developments in unit labour cost practically across all activity sectors of the economy.

7 CONCLUSIONS

The main argument of the expectations-augmented Phillips curve model regarding the inflation mechanism is that prices are set on the basis of a profit margin (mark-up) applied over unit labour costs. If this argument is correct, then long-term developments in the levels of prices and unit labour costs should be correlated.

Nevertheless, in the Greek economy the rate of change in prices seems to respond with a lag and disproportionately to the large reductions of labour costs recently observed in the context of fiscal consolidation and internal depreciation. In the subperiod 2010-2013, unit labour cost adjustments are largely disconnected from price indices, at both the levels of the series and their rates of change.

The large decline in unit labour costs is mainly attributable to the reduction in nominal wages per employee rather than the pick-up in average labour productivity. Strengthening productivity is the crucial factor that will help to

improve the economy's competitiveness, since any further downward adjustment of wages is unlikely to benefit the economy, while social cohesion is undermined.

For the total economy in the subperiod 2010-2013, the disconnection between inflation (up by 2.0% on average) and the rate of change in unit labour costs (down by 3.3% on average) is obvious, resulting in a 3.0% increase in the unit profit margin indicator.

Particularly in industry, which produces the bulk of the economy's tradable (exportable) goods, the disconnection between inflation (up by 2.3%) and the rate of change in unit labour costs (down by 6.9%) becomes more evident in the subperiod 2010-2013, resulting in a 10.2% increase in the unit profit margin indicator. This disconnection is more evident in 2012 and 2013, when the unit profit margin indicator rose by 19.6% and 7.6%, respectively. This was attributable to the rapid fall in unit labour costs (down by 12.6% and 6.3%) in 2012 and 2013, with inflation standing at 4.6% and 0.8%, respectively.

The partial price adjustment compared with the considerable decline in unit labour costs may largely be attributable to the oligopolistic structure of the economy, which still remains strong in several sectors related to the production or trade of goods, such as for instance the fuel market (Bragoudakis and Sideris 2012; Polemis 2012) or the food sector (OECD 2013; European Commission 2013; and Competition Commission 2011). This phenomenon of a disconnect between prices and labour costs impedes the monetary policy transmission channel from acting as a catalyst that would speed up the intended adjustments in terms of competitiveness and consumer purchasing power so as to faster remedy any distortions in the economy's smooth operation, growth and stability. Targeted structural reforms are crucial to lifting price rigidity. Therefore, reforms in product markets aimed at breaking these oligopolies should be highly prioritised within the economic policy implemented.

The econometric investigation of the relationship between unit labour costs and prices produced the following findings.

As regards the price equations, the hypothesis of long-term unit elasticity can only be accepted in the cases of the total economy when prices are measured based on the GDP deflator, and in public administration and defence. By constrast, the long-term elasticity of prices in industry is statistically lower than unity, suggesting that this sector shows traces of an oligopolistic structure. It should be noted that the unit profit margin indicator over 2010-2013 rose by 10.2% in industry, compared with 3.0% in the total economy, only 1% in the trade sector, and 2.7% in public administration and defence.

As regards the wage equations, the hypothesis of a long-term unit elasticity can only be accepted in the cases of the total economy, when prices are measured based on the GDP deflator, and the industrial sector. In industry, the elasticity of wages was estimated at a level lower than unity, but the hypothesis that it may be equal to unity cannot be statistically rejected, thereby suggesting that a 1.0% increase in prices could raise unit labour costs by 1.0% in the long run. The full adjustment of unit labour costs to changes in the level of prices, as much in the total economy as in the industrial sector, possibly reflects the extensive bargaining power of employees' institutional representatives (i.e. trade unions and confederations) in collective wage negotiations. In other words, there is evidence that in the Greek economy over a long-term horizon workers' representatives managed to adjust employees' wages close to changes in the level of prices. In addition, the Granger-tests for strong exogeneity provide evidence of a strict causal relationship between the two variables. In the total economy, prices affect unit labour cost developments, but unit labour costs also affect price developments.

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Price, unit labour cost and profit margin developments in all the sectors of the economy

(annual rates of change %)

Share (%) in GDP (at basic prices)	Total economy			Agriculture			Industry		
2000-2013	100%			4.7%			12.3%		
2000-2007	100%			5.0%			12.8%		
2008-2013	100%			4.3%			11.8%		
	Deflator (YFD)	**Unit labour cost (TT_ULC)**	**Profit margin (TT_PM)**	**Deflator (AGRD)**	**Unit labour cost (AGR_ULC)**	**Profit margin (AGR_PM)**	**Deflator (INDD)**	**Unit labour cost (IND_ULC)**	**Profit margin (IND_PM)**
2001	3.5	-0.2	3.7	4.7	12.7	-7.1	2.5	1.8	0.6
2002	3.6	10.1	-5.9	2.8	22.1	-15.9	4.5	14.9	-9.1
2003	4.2	1.5	2.6	13.1	36.6	-17.2	0.8	-1.7	2.6
2004	2.7	2.2	0.5	-12.3	-11.4	-1.0	7.1	3.3	3.7
2005	1.3	4.4	-3.0	1.5	1.4	0.1	-1.9	13.2	-13.4
2006	2.2	-1.2	3.5	-6.5	21.2	-22.8	8.9	5.3	3.4
2007	3.4	2.7	0.7	11.6	12.0	-0.4	2.4	4.6	-2.2
2008	4.8	5.1	-0.3	-8.2	-1.2	-7.0	13.0	10.1	2.7
2009	2.7	5.8	-3.0	-5.3	-5.3	0.0	-3.1	-5.7	2.8
2010	0.1	0.4	-0.3	-5.0	-9.1	4.5	4.1	-3.2	7.6
2011	0.4	-1.7	2.2	3.1	-1.2	4.3	-0.1	-5.7	5.9
2012	0.0	-5.0	5.3	-6.0	-4.3	-1.7	4.6	-12.6	19.6
2013	-2.5	-7.0	4.8	2.4	-10.1	13.8	0.8	-6.3	7.6
Period average									
2001-2013	2.0	1.3	0.8	-0.3	4.9	-3.9	3.3	1.4	2.4
2001-2009	3.1	3.4	-0.1	0.2	9.8	-7.9	3.8	5.1	-1.0
2010-2013	-0.5	-3.3	3.0	-1.4	-6.2	5.2	2.3	-6.9	10.2

Sources: Calculations based on ELSTAT, ECB and European Commission data.

Price, unit labour cost and profit margin developments in all the sectors of the economy *(continued)*

(annual rates of change %)

	Construction			Trade			Information and communication			Financial sector		
Share (%) in GDP (at basic prices)												
2000-2013	6.1%			24.5%			4.4%			5.4%		
2000-2007	7.7%			25.0%			3.8%			5.1%		
2008-2013	4.1%			23.9%			5.1%			5.7%		
	Deflator (COND)	**Unit labour cost (CON_ULC)**	**Profit margin (CON_PM)**	**Deflator (TRD)**	**Unit labour cost (TR_ULC)**	**Profit margin (TR_PM)**	**Deflator (COMD)**	**Unit labour cost (COM_ULC)**	**Profit margin (COM_PM)**	**Deflator (FID)**	**Unit labour cost (FI_ULC)**	**Profit margin (FI_PM)**
2001	0.3	-3.6	4.1	2.7	-10.2	14.4	-0.4	6.9	-6.8	3.3	10.9	-6.9
2002	2.6	45.6	-29.5	-0.7	-0.7	0.0	-1.2	-5.1	4.1	18.9	23.4	-3.7
2003	2.9	-3.4	6.5	3.4	-4.6	8.4	-0.5	3.4	-3.8	10.4	9.5	0.8
2004	0.5	-4.0	4.7	0.7	-2.4	3.2	0.4	1.0	-0.6	1.4	-13.1	16.6
2005	15.1	-1.6	17.0	-12.8	4.8	-16.7	-7.0	-2.4	-4.7	4.6	24.3	-15.8
2006	0.5	-13.5	16.2	2.4	1.3	1.1	-1.3	-12.9	13.4	3.8	8.1	-4.0
2007	1.8	16.8	-12.8	4.0	2.5	1.4	1.7	-3.2	5.0	-5.9	2.2	-7.9
2008	2.4	9.6	-6.6	5.0	6.0	-1.0	0.6	-13.4	16.2	-7.6	-3.2	-4.5
2009	0.6	30.1	-22.6	2.1	12.6	-9.3	1.5	-11.2	14.3	0.8	1.1	-0.3
2010	-5.3	11.8	-15.3	1.5	5.0	-3.4	3.5	9.0	-5.1	1.1	-2.8	4.0
2011	-5.9	3.9	-9.4	2.9	0.8	2.1	2.3	3.7	-1.4	5.3	-0.3	5.6
2012	-0.6	-7.9	7.9	0.4	0.5	-0.1	-1.1	-2.9	1.8	1.3	-0.1	1.4
2013	-1.1	-5.1	4.3	-1.3	-6.3	5.3	-2.5	7.3	-9.1	-2.4	-6.2	4.1
Period average												
2001-2013	1.1	6.0	-2.7	0.8	0.7	0.4	-0.3	-1.5	1.8	2.7	4.1	-0.8
2001-2009	3.0	8.4	-2.6	0.8	1.0	0.2	-0.7	-4.1	4.1	3.3	7.0	-2.9
2010-2013	-3.2	0.7	-3.1	0.9	0.0	1.0	0.5	4.3	-3.4	1.3	-2.4	3.8

Sources: Calculations based on ELSTAT, ECB and European Commission data.

Price, unit labour cost and profit margin developments in all the sectors of the economy *(continued)*

(annual rates of change %)

	Real estate activities			Professional and other activities			Public administration and defence			Arts, entertainment and recreation		
Share (%) in GDP (at basic prices)												
2000-2013	12.9%			6.3%			19.6%			4.3%		
2000-2007	12.0%			6.9%			18.6%			4.3%		
2008-2013	14.2%			5.4%			20.9%			4.4%		
	Deflator (RED)	**Unit labour cost (RE_ULC)**	**Profit margin (RE_PM)**	**Deflator (SCED)**	**Unit labour cost (SC_ULC)**	**Profit margin (SC_PM)**	**Deflator (PAD)**	**Unit labour cost (PA_ULC)**	**Profit margin (PA_PM)**	**Deflator (ARTD)**	**Unit labour cost (ART_ULC)**	**Profit margin (ART_PM)**
2001	4.1	145.2	-57.5	5.4	22.5	-14.0	6.2	3.5	2.6	3.7	5.0	-1.2
2002	4.3	61.8	-35.5	-0.6	11.1	-10.5	9.9	12.2	-2.0	4.1	6.1	-1.9
2003	5.1	-32.1	54.8	5.5	42.2	-25.8	5.1	0.5	4.5	3.9	5.5	-1.5
2004	5.5	56.8	-32.7	3.6	9.9	-5.8	7.4	13.0	-5.0	4.7	6.6	-1.8
2005	8.1	-32.1	59.1	82.0	-2.9	87.4	1.5	1.6	0.0	16.5	-3.2	20.4
2006	3.5	10.5	-6.3	3.1	-3.2	6.5	-0.9	-1.1	0.2	4.5	5.3	-0.7
2007	4.8	-10.3	16.8	3.4	-5.9	9.9	4.5	4.7	-0.2	4.6	18.4	-11.6
2008	4.8	1.2	3.6	2.0	10.9	-8.0	8.4	5.3	2.9	4.3	8.7	-4.0
2009	4.7	-6.6	12.1	3.7	-7.0	11.5	8.0	6.9	1.1	2.6	-6.2	9.4
2010	3.3	-0.9	4.2	1.1	16.3	-13.1	-5.5	-7.1	1.7	1.1	1.0	0.1
2011	3.2	-18.8	27.0	-2.4	11.7	-12.6	-4.7	-4.8	0.0	1.9	-1.3	3.1
2012	-2.1	-10.3	9.2	-0.7	0.2	-0.8	-0.3	-5.5	5.5	-0.9	-8.8	8.7
2013	-6.7	-29.9	33.0	-0.5	-10.0	10.6	-4.0	-7.2	3.4	-2.7	-16.5	16.5
Period average												
2001-2013	3.3	10.3	6.8	8.1	7.4	2.7	2.7	1.7	1.1	3.7	1.6	2.7
2001-2009	5.0	21.6	1.6	12.0	8.6	5.7	5.6	5.2	0.5	5.4	5.1	0.8
2010-2013	-0.6	-15.0	18.4	-0.6	4.5	-4.0	-3.6	-6.1	2.7	-0.2	-6.4	7.1

Sources: Calculations based on ELSTAT, ECB and European Commission data.