Lisbon School of Economics & Management
Universidade de Lisboa

MASTER

MASTER'S IN ECONOMICS

MASTER´S FINAL WORK

DISSERTATION

MARKET POWER AND BUSINESS CYCLES IN PORTUGAL IN THE 21ST CENTURY

FERNANDO TIAGO LOPO REIS

Lisbon School of Economics & Management
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OCTOBER - 2024

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SUPERVISION:

LUÍS F. COSTA

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GLOSSARY

GDP – Gross Domestic Product.

OLS – Ordinary Least Squares.

INE – Statistics Portugal

GFCF – Gross Fixed Capital Formation

HH – Herfindahl-Hirschman

NACE – Statistical classification of economic activities in the European Community

ABSTRACT

This dissertation investigates the cyclical behaviour of the branches and aggregate markups in the Portuguese economy from 1995 to 2021, with a focus on decomposing changes in aggregate markups into their primary components: markup changes, branches weight changes, and their interaction. Additionally, the study gives an insight on the impact of major economic events such as the 2008-2009 financial crisis and the 2011-2014 European sovereign debt crisis on markups in Portugal.

The decomposition reveals that both labour- and materials-based markups exhibited an unconditional counter-cyclical behaviour, with notable fluctuations during periods of economic crises and recovery. Markup changes were primarily driven by structural change, i.e. due to sectorial weight shifts. The interaction effect between markups and weights became significant during periods of economic turbulence, especially during the Troika intervention and austerity measures, reflecting the complex dynamics of sectorial adjustments. The results suggest that sectorial shifts and the relative importance of key industries were critical in shaping the evolution of aggregate markups. The recovery phase post-2014 saw a gradual stabilization, with positive contributions from weight changes as key industries regained prominence.

This study's contribution lies in its detailed decomposition of markup behaviour and its application to the Portuguese economy, providing insights into how external shocks and sectorial adjustments influence aggregate trends. Future research could further explore the implications of sectorial dynamics on broader economic policy and international comparisons.

KEYWORDS: Mark-ups; Sectorial Analysis; Business Cycles; Production Function; Macroeconomics.

JEL CODES: L11; E32; D22; C22; O52; E25.

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STATEMENT

For this dissertation I used generative AI tools such as ChatGPT and Claude for various tasks, namely organizing ideas and proofreading. This was done to ensure that my ideas were being conveyed to the reader in the clearest way possible, and to ensure an effective presentation of my findings. It is important to note that I used this technology as a tool, and I followed the best practice and ethical standards while using it. Any mistakes, errors or inaccuracies in this dissertation are entirely my responsibility.

ACKNOWLEDGMENTS

Before anything, I would like to express my deepest gratitude to my parents, whose support, encouragement, and love have been the foundation of everything I have accomplished and without them this dissertation would not be possible. Your blind belief in me has been my constant motivation, and I am forever grateful for all the sacrifices you have made to ensure I could chase my dreams.

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MARKET POWER AND BUSINESS CYCLES IN PORTUGAL IN THE 21ST CENTURY

By Fernando Reis

This dissertation explores the behaviour of aggregate markups in Portugal between 1995 and 2021. Markup changes were decomposed into three components: changes in markups, sectorial weights, and their interactions. Findings reveal that structural change and external shocks played a critical role in shaping aggregate markups, with weight contributions becoming more prominent during recovery phases.

1. INTRODUCTION

In this dissertation, I aim to tackle a main question: how have Portugal's aggregate markups changed between 1995 and 2021? Furthermore, I intend to analyse the impact of major economic events on their trajectory.

Understanding aggregate markups is crucial because they serve as indicators of market power and efficiency within an economy. Considering the significant economic events the world has gone through in the past three decades, I have chosen to focus on Portugal to investigate how major events, such as the adoption of the euro, the global financial crisis, and the European sovereign debt crisis have influenced the way these markups have evolved. By analysing these markups, we can understand better how these events have affected different branches, market power, and the overall stability of the economy.

The relevance of this dissertation comes from the importance of markups as a measure of competition and structural economic change. Previous studies have explored the evolution of markups in other advanced economies. However, few have focused specifically on the Portuguese case, where significant economic transformations, policy interventions, and austerity measures may have had a unique impact on the behaviour of sectorial markups. For example, the global financial crisis and the subsequent intervention by the Troika significantly affected both labour- and materials-based markups in Portugal, leading to shifts in sectorial importance and monopoly power.

Most of the existing literature focuses on the relationship between market power, economic shocks, and aggregate outcomes. Notable contributions, such as Bergman et al. (2024) and Laeven and Valencia (2011) include studies on the impact of crises on sectorial shifts and the role of policy interventions in shaping markups. Some studies, for example De Loecker and Warzynski (2012), have employed firm-level data to examine markups, while others, like Griffith et al. (2010) have concentrated on industry-wide dynamics. This dissertation builds on this body of research by focusing on sectorial data, thus offering a more comprehensive view of how the Portuguese economy responded to both internal and external economic shocks.

To address the research question, this dissertation approaches the issue by decomposing aggregate markups into three components: changes in markups at the branch level, structural change, and the interaction between these two factors. Using sectorial data sourced from different databases, I use a Cobb-Douglas production function to estimate markups for each branch. This allows for a detailed analysis of how sectorial shifts, pricing behaviour, and labour-market dynamics have influenced aggregate markups. Additionally, the decomposition methodology sheds light on the relative importance of different forces in shaping the cyclical behaviour of markups over time.

The contribution of this dissertation lies in its comprehensive decomposition of aggregate markups in the Portuguese economy over a relatively extensive period. While much of the existing literature focuses either on firm-level markups or on aggregate data, this dissertation provides a sectorial-level analysis, which is crucial for understanding broader macroeconomic trends and helps understand an economy in a different way. Moreover, the application of decomposition techniques to both labour- and materials-based markups is relatively rare, and this research offers new insights into the drivers of cyclical markup behaviour. By analysing the impact of key historical events, this dissertation provides a detailed overview of how different economic shocks have shaped branches across the economy and aggregate pricing power in Portugal.

The structure of the dissertation is as follows. Chapter 2 reviews the relevant literature in the area. Chapter 3 introduces the theoretical framework underlying markup analysis and the key economic theories relevant to understanding the dynamics of market power. Chapter 4 describes the data sources, and the methodology used for estimating sectorial and aggregate markups. Chapter 5 presents the results for the markups at a sectorial level, while chapter 6 presents the same results for the aggregate markups. Finally, chapter 7 analyses the cyclical behaviour of these aggregated markups and its decomposition, and chapter 8 concludes.

2. Literature Review

The study of markups in imperfect markets is not something that is a novel in economic literature. Markups serve a crucial part as an indicator of market power and pricing behaviour. In imperfect markets, markups give us information on how branches react to supply shocks, changes in demand and other economic conditions. When analysing markups over time, it is possible to understand changes in the market structure, and firm competition. The analysis of these markups can provide valuable insights to researchers on how branches adapt to economic changes, and structural fluctuations.

Chamberlin's (1933) seminal "Theory of Monopolistic Competition." focuses on markets where firms sell differentiated products, and this product differentiation gives firms some pricing power, unlike perfect competition markets. This price setting ability is limited due to the availability of substitute products and firms compete on non-price factors like marketing and innovation so that they can attract and retain their customer base. With every new firm that enters the market, the competition increases and prices get pushed closer to their marginal cost over time. This theory demonstrates the balance between differentiation-driven pricing power and competitive pressures.

Bain (1956) further advanced this field by developing a comprehensive framework linking market structures to the behaviours exhibited in different branches. This paper emphasizes that the level of competition within a market directly influences how firms approach pricing. In less competitive environments, like markets with significant entry barriers, companies have greater opportunities to increase their markups. For example, in industries with few competitors, firms can have prices above margin costs leading to higher markups, reducing the pressure to have competitive prices. This contributes to less competitive environments that supress innovation and that can distort market efficiency.

Hall (1988) offers the cornerstone for markup studies and as such for this dissertation as well. It helped establish the concept that markups are not static and tend to fluctuate with the business cycle, in imperfect markets. It also introduced the concept that markups tend to have countercyclical behaviours, rising during recessions when firms reduce output but maintain their prices.

Roeger (1995) expanded the work done by Hall, addressing the bias present in Hall's approach introducing a dual approach using price- and cost-based measures of productivity, which allow more accurate and robust estimates. Roeger also confirmed the countercyclical behaviour of markups, and that this behaviour is consistent across the different estimation methods.

The interaction between aggregate markups and business cycles is a critical aspect of modern macroeconomic analysis. Theoretical perspectives on the cyclical behaviour of markups diverge into two main camps, countercyclical markup theories, and procyclical markup theories.

Countercyclical markup theories, such as those proposed by Rotemberg & Saloner (1986), suggest that markups tend to increase during economic downturns. In recessions, firms often reduce output and capacity utilization, which increases unit costs that are not fully passed on to consumers through price reductions. This behaviour aligns with the notion that firms possess greater monopoly power during downturns, as reduced competitive pressures allow them to maintain or even raise markups despite falling demand.

Procyclical markup theories, like the one proposed by Green & Porter (1984), suggest that markups increase during booms when demand is strong. Firms can charge higher prices relative to marginal costs because consumers are less price-sensitive during economic expansions.

Customer market models, like Phelps & Winter (1970), where firms set prices based on long-term relationships with customers. Firms may smooth prices over the business cycle to maintain customer loyalty, leading to counter cyclical markup behaviours.

The methodological framework introduced by De Loecker & Warzynski (2012) represents a pivotal advancement in estimating firm-level markups. By applying a Cobb-Douglas production function within an OLS framework, they emphasize the role of variable inputs like labour and materials in determining markups.

Christopoulou & Vermeulen (2012) compare markups across different branches in the Euro Area and the US, offering insights that different industries react to economic shocks differently depending on their market power. They also suggest that branches where firms have more market power also have higher markups while more competitive branches exhibit lower markups.

The relationship between markups and the labour share is another critical theme in literature. Elsby et al. (2013) explore these trends in the US identifying a significant decline in the labour share linking this to macroeconomic shifts and globalization, since this allows firms to reduce labour costs without lowering their prices, which increases markups. Karabarbounis & Neiman (2014) also expand on this subject addressing it in a

global point of view attributing it to the large technological advancements made which allow to replace labour with capital, this substation allows firms to maintain or even increase productivity while reducing their labour costs.

Expanding the scope to the macroeconomic landscape, the comprehensive studies by Reis (2013) alongside Blanchard & Portugal (2017) delve into Portugal's economic resurgence post the Eurozone crisis. Reis (2013) analyses the country's slumps during the Eurozone crisis, focusing on the structural weakness of its economy, such as low investment and high debt. It's shown that the constraints imposed by the Eurozone and by the austerity measure led to a deeper and prolonged recession.

Blanchard & Portugal (2017) complement this idea, by studying the economic boom and slumps Portugal experienced. Their study emphasizes the fragility of the recovery due to the high debt levels and low productivity growth seen in the country. As a final note it also advises against aggressive fiscal consolidation or an exit from the euro.

A key study specific to Portugal is Amador & Soares (2013), which estimates price-cost margins across various branches of the Portuguese economy using firm-level data. This paper provides an in-depth look at competition in Portugal and the methodologies used to estimate markups. They found that Portuguese firms have significant market power, while this market power significantly changes between different branches. Due to this to reduce this market power, all policies that aim to reduce this market power will need to be branch specific, otherwise their effectiveness will be reduced.

Bils et al. (2018) offers a foundational understanding of the cyclical behaviour of markups, showing that they tend to increase during economic downturns, moving countercyclically relative to marginal costs. This countercyclical behaviour is explained by the ability that firms must maintain or increase their prices during downturns, while decreasing their costs and output. The authors also state that this is mainly due to changes in marginal costs rather than shifts in demand, which plays a pivotal role in driving this behaviour.

Santos et al. (2022), estimate how markups responded to demand and supply shocks at the firm-product level, using data from the Portuguese economy. Their analysis reveals that markups in Portugal generally a conditional countercyclical pattern when firms are hit by demand shocks and a procyclical pattern when they are hit by supply shocks.

Figueira & Alves (2023) examined the effects of the reforms implemented from 2011 to 2014 on markups, especially within non-manufacturing branches, and discovered that labour-market changes led to markups reductions.

3. THEORETICAL FRAMEWORK

Unlike what happens in the perfectly competitive environment, where prices equalise marginal costs and firms have no ability to extract pure profits, imperfectly competitive markets, as seen in real economies, grant firms the possibility of setting prices above marginal costs, so generating abnormal profits. This distinction enables the exploration of how pricing strategies change under varying economic conditions. Most industries do not show the characteristics of perfect competition, since companies are

allowed to establish prices that exceed marginal costs, due to their market power, resulting in positive markups.

Estimating markups empirically presents a challenge, therefore various approaches have been developed to infer markups using observable data.

The demand estimation approach, exemplified by Berry et al. (1995), focuses on estimating demand elasticities faced by firms at the product level and establishing a connection to how firms choose to set their prices. By analysing how consumer demand reacts to price changes, this method helps us understand how firms adjust prices and establish markups in response to what the market demands.

The approach used in this dissertation draws from the production function approach, as proposed by Hall (1986, 1988) or De Loecker & Warzynski (2012), which uses (aggregate or firm-level) data on inputs such as labour, capital, and materials, along with revenues (sales), to estimate the implicit ratio between prices and marginal costs.

Now, a markup is the difference between a firm's price for a product and the marginal cost of said product, it measures the extent to which firms set their prices above their marginal cost, so it acts as a measure of market power, since the higher the difference between the price and the marginal cost, the more market power you have. In competitive markets, prices are close to marginal costs, but in imperfect markets this does not apply, since firms have more market power in those situations. Marginal costs are calculated with the following formula:

$$\mu_{ijt} = \frac{p_{ijt}}{MC_{ijt}}$$

where $\mu_{ijt} \geq 1$ is the monopoly-power indicator for firm *i* in the market of product *j* in period *t*, *p* represents the price, and *MC* the marginal cost. The problem with calculating markups like this is determining the marginal costs, since they are not directly observable. If firms maximise their profits the marginal cost is given by

$$MC_{ijt} = \frac{\varpi_{ijt}^{x}}{MP_{ijt}^{x}},$$

where ϖ^x stands for the price of flexible input *x* and MP^x denotes its marginal product. The problem with this approach is that the issue was now pushed to the production function

$$q_{ijt} = F(\mathbf{X}_{ijt}),$$

where q represents the physical output, **X** is the vector of inputs (which includes x) used in the production of product j, and $MP_{ijt}^{x} = \frac{\partial F}{\partial x_{ijt}}(\mathbf{X}_{ijt})$.

Going back to the markup definition and replacing with this

$$\mu_{ijt} = \frac{MP^x_{ijt}}{\frac{\varpi^x_{ijt}}{p_{ijt}}}.$$

Dividing and multiplying by the ratio of prices in the denominator x/q

$$\mu_{ijt} = \frac{\frac{MP^x_{ijt}.x_{ijt}}{q_{ijt}}}{\frac{\varpi^x_{ijt}.x_{ijt}}{p_{ijt}.q_{ijt}}}.$$

From this equation, we get the share of the cost of input *x* on the total sales of product since $p_{ijt}.q_{ijt} = Y_{ijt}$,

$$Sh^x_{ijt} = \frac{\varpi^x_{ijt}.x_{ijt}}{Y_{ijt}}$$

Now in the numerator we obtain the elasticity of input *x* in the production of good *j:*

$$\varepsilon^x_{ijt} = \frac{MP^x_{ijt}.x_{ijt}}{q_{ijt}} = \frac{\partial F}{\partial x_{ijt}}(\mathbf{X}_{ijt}).\frac{x_{ijt}}{F(\mathbf{X}_{ijt})}.$$

Assuming the production function F (•) is Cobb-Douglas then the elasticities ε^x are constant, but they must be estimated. For this dissertation we are going to use a three-input model $\mathbf{X} = (K, L, IC^*)$, with their respective prices, R being the return of capital, w being the wage rate and P^{IC} being the price of intermediate consumption. Labour and the intermediate consumption are going to be used to calculate the markups, while capital isn't going to be used since to adjust this variable you need significant time and investment which is not feasible in the short run. Usually, capital is a long-term variable, coupled with its depreciation over time, since it is planned this way by firms.

The reason why the Cobb-Douglas production function is the one being used is because it is shown in Santos et al. (2022) that this production function is a good approximation since it provides good approximations across different branches, and it produces results that are quite like the translog function with constant elasticities, which simplifies the model without putting at risk its accuracy. With this production function and only having access to branch level data, the production function looks like this:

$$q_{ijt} = A_{ijt}K^{\alpha j}_{ijt}L^{\beta j}_{ijt}IC^{\gamma j}_{ijt}$$

With αj, βj, and γj being the elasticities for capital, labour and intermediate consumption of the branch *j*, respectively.

Going back to Santos et al. (2022), constant returns to scale are assumed in their analysis using a Cobb-Douglas production function, where the sum of the input elasticities equals to one. This assumption allows me to focus on the input elasticities when analysing sectorial pricing behaviour in Portugal.

4. DATA

4.1. Introduction to the Data

This dissertation relies on data from various sources, including from Statistics Portugal (INE), AMECO, and the Bank of Portugal. From INE (2024) all the data obtained is annual, the data extracted is sectorial data for output, both in current (Y_{jt}) and previous year prices (Y_{jt}(PYP)), intermediate consumption by industry, both in current (IC_{jt}) and previous year prices (IC_{jt}(PYP)), total hours worked by industry (H_{jt}), compensation of employees(W_{jt}), gross fixed capital formation (GFCF), and capital stock (K_{jt}) data, available for 2000 and 2016. From AMECO (2024) all data is for the whole economy and annual, the data obtained is net capital stock (K_t), capital consumption (δK_t), and the GFCF price deflator ($DEFL_t^{GFCF}$). Finally, quarterly real GDP (Y_t) was sourced from the Bank of Portugal (2023).

I used disaggregate at the two-digit (A10) level (branches) from the Statistical Classification of Economic Activities in the European Community (NACE) revision 2. Therefore, I used a breakdown in ten branches: (1) agriculture, forestry, and fishing; (2) industry, energy, water supply, and sewerage; (3) construction; (4) wholesale and retail trade, repair of motor vehicles and motorcycles, transportation and storage, accommodation and food service activities; (5) information and communication; (6) financial and insurance activities; (7) real estate activities; (8) professional, scientific, and technical activities, administrative and support service activities; (9) public administration and defence, compulsory social security, education, human health and social work activities; and (10) arts, entertainment, repair of household goods, and other services.

4.2. Variables and Data Transformation

From INE (2024), the data that was used directly as extracted was the compensation of employees and total hours worked by industry. Capital consumption and the net capital stock from AMECO (2024) were used as extracted, the same is true for the data sourced from the Bank of Portugal (2023).

To compute the elasticities β_j and γ_j, some transformations to the data were needed mainly to IC_{jt} and Y_{jt}, since both variables need to be at constant prices, IC_{jt} to act as a proxy for all "materials" and Y_{jt} to act as a proxy q_{ijt}, since I do not have firm-product data, thankfully with the data mentioned these transformations were direct and all the data used the year of 2016 as a base.

The trickier part was to obtain the K_{jt}^*, which required more transformations. First, I obtained the depreciation rate by

$$\delta_t = \frac{\delta K_t}{K_t}$$

The next step was rebasing $DEFL_t^{GFCF}$ to 2000, here I did not go directly to 2016 since this was giving me results that were impossible to be real, so I started from 2000 as my base. Using this new deflator I obtained my $GFCF_t^{*}$. Then using the PIM I calculated K_{jt} for the years after 2000 using the following formula

$$K_{jt} = K_{Jt-1}(1 - \delta_{t-1}) + GFCF^*_{t-1}$$

And for the years prior using

$$K_{jt} = \frac{K_{Jt+1} - GFCF^*_t}{(1 - \delta_t)}$$

The last thing I have to do, is to calculate the shares of materials, for which I used the following formula

$$sh^m_{jt} = \frac{IC^*_{jt}}{Y^*_{jt}}$$

And for the share of labour the formulas used was

$$sh^L_{jt} = \frac{w_{jt}H_{jt}}{Y^*_{jt}}$$

A final note before estimating the elasticities, all the data to this point is annual and cubic spline was used on the material and labour shares so that I can use quarterly data. Cubic spline works by creating a smooth curve that connects the annual data points, filling in the gaps between them. This method helps me generate quarterly data while keeping the overall trend of the original data. It's useful when more frequent data is needed but it isn't available.

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5. Estimating the Production Elasticities

In order to estimate the elasticities β_j and γ_j in the Cobb-Douglas production function, I estimated the following specification using the OLS estimator for the available annual time series

$$\Delta \ln Y^*_{jt} = \Delta \ln A_{jt} + \alpha_j . \Delta \ln K_{jt} + \beta_j . \Delta \ln L_{jt} + \gamma_j . \Delta \ln IC^*_{jt} + u_{jt}.$$

I used first differences to avoid potential non-stationarity of the series involved.

Table I

Elasticities of the different branches[1]

Branch	1	2	3	4	5	6	7	8	9	10
L	-0.058	0.196	0.137	0.342	0.272	-0.398	0.262	0.253	0.588	0.41
	(0.222)	(0.045)	(0.058)	(0.125)	(0.122)	(0.383)	(0.078)	(0.157)	(0.402)	(0.157)
IC	0.707	0.815	0.789	0.663	0.759	1.103	0.035	0.752	0.762	0.626
	(0.078)	(0.013)	(0.035)	(0.082)	(0.049)	(0.160)	(0.028)	(0.083)	(0.112)	(0.072)

Source: Own calculations.

NOTES: Standard errors in brackets

In addition to the estimation with free parameters, I have also estimated a constrained version of this production function, but imposing constant returns to scale, i.e. assuming that $\alpha_j + \beta_j + \gamma_j = 1$.

Table II

Elasticities of the different branches assuming constant returns to scale

Branch	1	2	3	4	5	6	7	8	9	10
L	-0.058	0.196	0.137	0.342	0.272	-0.398	0.262	0.253	0.588	0.41
	(0.212)	(0.039)	(0.030)	(0.072)	(0.106)	(0.370)	(0.069)	(0.084)	(0.339)	(0.109)
IC	1.592	0.729	0.838	0.426	0.602	1.991	-1.367	0.685	0.286	0.187
	(0.284)	(0.063)	(0.028)	(0.212)	(0.132)	(0.405)	(0.438)	(0.086)	(0.381)	(0.123)

Source: Own calculations.

NOTES: Standard errors in brackets

For both cases the estimation was done with and without the intercept to see the differences in the elasticities.

Table III

Elasticities of the different branches without intercept

Branch	1	2	3	4	5	6	7	8	9	10
L	-0.117	0.169	0.021	0.218	0.217	-0.327	0.21	0.363	0.598	0.34
	(0.137)	(0.049)	(0.053)	(0.115)	(0.074)	(0.388)	(0.238)	(0.151)	(0.397)	(0.142)
IC	0.719	0.824	0.854	0.767	0.768	0.988	0.134	0.714	0.802	0.65
	(0.069)	(0.014)	(0.034)	(0.068)	(0.045)	(0.140)	(0.082)	(0.084)	(0.092)	(0.069)

Source: Own calculations.

NOTES: Standard errors in brackets

1 For the replication package related to this dissertation please check:

https://github.com/Przon/Market-Power-and-Business-Cycles-in-Portugal-in-the-21st-Century

Table IV

Elasticities of the different branches assuming constant returns to scale without intercept

Branch	1	2	3	4	5	6	7	8	9	10
L	-0.058	0.196	0.137	0.342	0.272	-0.398	0.262	0.253	0.588	0.41
	(0.131)	(0.043)	(0.036)	(0.080)	(0.068)	(0.373)	(0.215)	(0.082)	(0.301)	(0.105)
IC	1.592	0.729	0.838	0.426	0.602	1.991	-1.367	0.685	0.286	0.187
	(0.264)	(0.060)	(0.034)	(0.193)	(0.061)	(0.419)	(0.920)	(0.070)	(0.325)	(0.103)

Source: Own calculations.

NOTES: Standard errors in brackets

Considering that the estimates obtained for the elasticities for each branch in tables I to IV were not very accurate, final estimates were obtained by averaging out the coefficients from free and constant-returns estimations, both with and without intercept.

However, in some branches this procedure produced negative point estimates for the labour elasticities (β). To address this, I used the ratio between the overall mean for labour and materials (γ) elasticities from Santos et al. (2022)[2] and multiplied by the gamma of the respective branch to adjust the beta to a plausible value.

6. Time-Series for Markups by Branch

This chapter focuses on the time-series evolution of markups across the ten two-digits branches in Portugal from 1995: I to 2021: IV, as given by the methodology described in the previous chapters. I analyse materials- and labour-based markups separately, as a way of checking the robustness of the findings.

Buying materials and hiring labour represent two different components of firm (hopefully variable) costs, in theory markups obtained through both these methods should give the same values, but since the real world is usually far away from this theoretical concept, they give different values. This is due to frictions in changing our labour or on making changes in materials. Assuming that it's easier to make changes in our material share, since it's easier to cancel orders than to fire people, we can also assume that markups calculated using our material shares are a better measure for our purpose.

2 The ratio between the overall mean for labour and materials elasticities in Santos et al. (2022) is 0.421.

6.1. Average Markups by Branch

6.1.1 Materials-Based Markups

Materials-based average markups, i.e. $\hat{\beta}_j / Sh_{jt}^{IC}$, exhibited unique trends across branches, as we can observe in Figure.

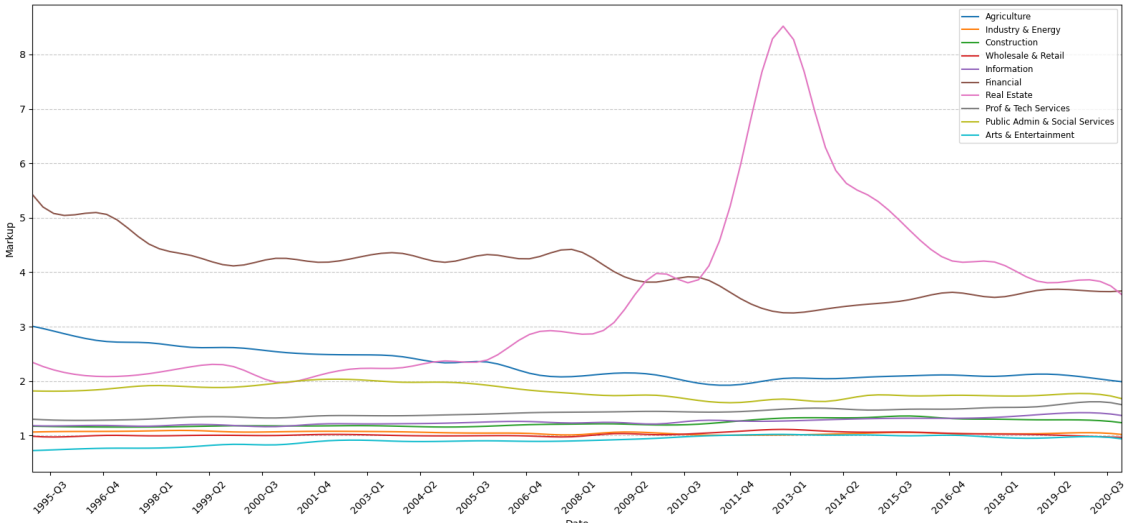

Figure 1 - Evolution of Materials-Based Markups by Branch

In agriculture, forestry, and fishing, the materials-based markup started at 3.01, a very high level, in 1995: I, but it gradually declined to 1.99, still a high level, in 2021: IV. In the real estate branch markups revealed a very interesting pattern where we can see a lot of fluctuation with the start at 2.34 and reaching a max value of 8.52 in 2012: IV, which coincides with the Troika period where this branch took its biggest hit.

When looking at the public administration and defence, compulsory social security, education, human health and social work activities branch we can see the markup is above one which raises some questions regarding the markups as measures. These branches are dominated by public or non-profit institutions, which do not have maximizing profits as a goal, and they do not set their prices according to market competition. Therefore, having markups that are high, and fluctuating cannot be a direct reflection of typical market power dynamics. These results suggest potential measurement issues as markups may not be fully suited to account for the unique structures that this branch presents.

6.1.2 Labour-Based Markups

Average labour-based markups, on the other hand, displayed a different set of dynamics, as depicted in the figure below.

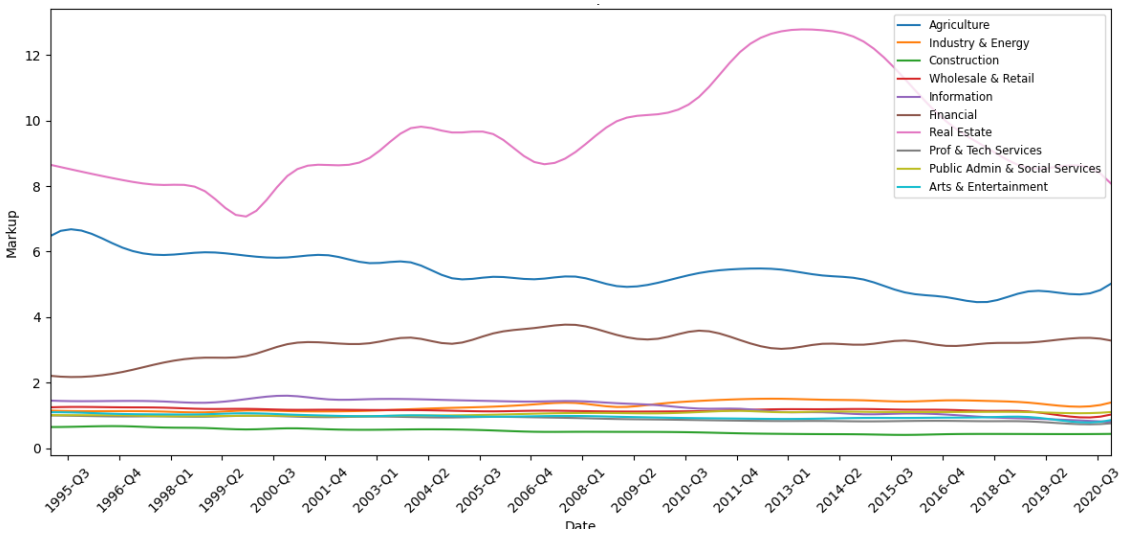

Figure 2 - Evolution of Labour-Based Markups by Branch

Source: Own calculations.

On the labour-based markups, agriculture, forestry, and fishing, the materials-based markup started at 6.45, a very high level, in 1995: I, declining to 5.02, still at a pretty high level, in 2021: IV. In the real estate branch markups, it is seen again a very interesting pattern, where we can see a lot of fluctuation with the start at 8.65 and reaching a max value of 12.78 in 2013: III, which complements the reason given before about the big hit the branch took because of the Troika period

6.1.3 Co-Movement of Materials- and Labour-Based Markups

The correlation ($\mathrm{Corr}\left(\mu_{jt}^{IC}, \mu_{jt}^{L}\right)$) between materials- and labour-based markups varies significantly across branches, which means that labour-market flexibility may also vary substantially across branches, thus distorting labour-based markups in economic activities that use labour hired in more inflexible segment.

Table V

Correlation between Materials- and Labour Based Markups

Branch 1	Branch 2	Branch 3	Branch 4	Branch 5	Branch 6	Branch 7	Branch 8	Branch 9	Branch 10
0.83	-0.9	-0.9	0.16	-0.93	-0.51	0.85	-0.95	-0.92	-0.87

Source: Own calculations.

High positive correlations are observed in branches such as agriculture, forestry, and fishing (0.83), real estate activities (0.85), which are some values that can be deemed as good.

Conversely, in industry, energy, water supply, and sewerage (-0.90), construction (-0.90), or information and communication (-0.93) exhibit a strong negative correlation, and professional, scientific, and technical activities (-0.95). Thus, we should be very careful when analysing the evolution of the labour-based markup measure, as it seems to be distorted by inflexible labour usage.

Looking at our special branch, public administration and defence (-0.922), we can say that here the government is clearly not setting prices above marginal cost in defence, education or public health.

6.2 Markups and Concentration

In this section, I analyse the relationship between the normalised Herfindahl-Hirschman (HH) index, which measures market concentration, and materials-based markups in each branch. In theory, markets where firms exhibit higher market power should be more concentrated. However, market structures could be complicated, as a contestable monopoly (or a homogeneous-good Bertrand duopoly) is highly concentrated, but has no monopoly power. On the other end, a cartel composed of a large number of coordinated firms may exhibit large monopoly power, but low concentration.

By examining the correlations ($\mathrm{Corr}\left(\mu_{jt}^{IC}, HH_{jt}\right)$) where

$$\mu_{jt}^{IC} = \frac{1}{\frac{IC_{jt}}{Y_{jt}}},$$

between these variables across branches, we observe all types of relationships, some negative, some positive.

Table VI

Materials-based Markup-Concentration Correlation[3]

Branch 1	Branch 2	Branch 3	Branch 4	Branch 5	Branch 7	Branch 8	Branch 9	Branch 10
0.69	-0.48	0.2	0.86	-0.26	-0.57	-0.76	0.49	-0.57

Source: Own calculations.

In agriculture, forestry and fishing (0.69), wholesale and retail trade, repair of motor vehicles and motorcycles, transportation and storage, accommodation and food service activities (0.86), all exhibit a strong positive correlation. Thus, changes in concentration and market power tend to move in the same direction over time in these branches, in line with the naïve theory of market structures.

On the other hand, industry, energy, water supply and sewerage (-0.48); real estate activities (-0.57); professional, scientific and technical activities, and administrative and support service activities branch (-0.76), indicating that changes in concentration and market power tend to move in opposite directions in these branches, deviating from the expectations of the naïve theory of market structures.

3 For the HH index there was no data related to Financial and insurance activities, and as such the branch is missing from the table.

7. Time Series for Aggregate Markups

The previous chapter focuses on analysing the market power in the Portuguese economy at the (two-digit) branch level. From this point onwards, all the branches will be aggregated so that I can produce an average markup for the economy as a whole. This chapter also examines the influence of significant economic events on the aggregate markups and explores potential policy implications of these trends.

The average aggregate markup was computed as a weighted average of individual (materials- and labour-based) branch markups, based on their contribution to total output (sales):

$$\mu_t^x = \sum_{j=1}^{10} \omega_{jt} . \mu_{jt}^x,$$

where $\omega_{jt} = Y_{jt} / \sum_{j=1}^{10} Y_{jt}$ represents the output weight and $x = L, IC$.

It was also calculated the aggregate markup without the public administration branch, calculating this way an aggregate markup that better reflects market-driven branches, hopefully providing a clearer picture of competition and pricing across the economy.

7.1. Aggregate Materials-Based Markups

Figure 3 depicts the evolution of the quarterly average materials-based markup in the Portuguese economy between 1995: I and 2021: IV.

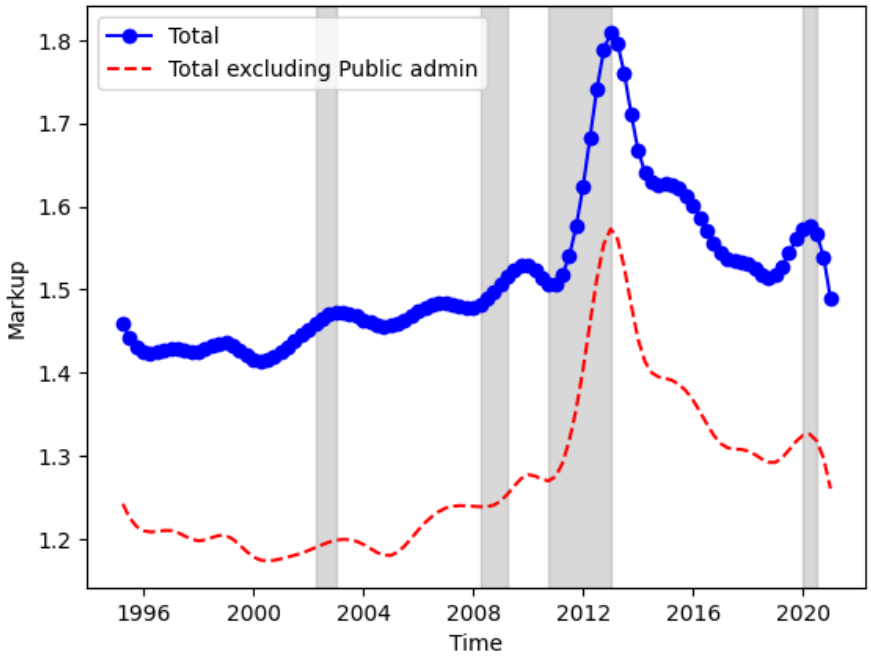

Figure 3 - Evolution of the Average Materials-Based Markup

Source: Own calculations.

The aggregate average materials-based markup in the Portuguese economy displayed several distinct sub-periods. From 1995: I to 1999: IV, the period leading up to the adoption of the Euro, the markup remained relatively stable around 1.42.

Between 2000: I and 2008: IV, the period that preceded the Great Recession, the average markup gradually increased.

From 2008: I to 2011: IV, the period that includes the Great Recession and precedes the European sovereign debt crisis, we can observe a sharp rise in the average markup.

From 2011: I to 2014: IV, the period that roughly corresponds to the Troika intervention, the average markup increased from 1.52 to a maximum of 1.81, then declining to 1.63, as the economy started its recovery.

From 2015: I to 2019: IV, the post-twin crises and pre-pandemic period, the average materials-based markup gradually decreased as the economy recovered and resumed its long-run balanced-growth path.

Finally, in the short period 2020: I to 2020: IV period, the markup had a steep decline going from 1.57 to 1.49.

The cyclical correlation of the materials-based markup, i.e. the correlation between $\Delta \ln \mu_t^{IC}$ and $\Delta \ln Y_t$ in this period is -0.26. This suggests that the aggregate materials-based markup is unconditionally mildly counter-cyclical, i.e. this markup measure decreases during economic expansions, and it increases in recessions. This result is consistent with Santos et al. (2022) that found a significant negative correlation in Portugal for a similar aggregate measure in the 2004-14 period with firm-level data. Bils et al. (2018) also a significant negative correlation for the US.

7.2 Aggregate Labour-Based Markups

The figure below depicts the evolution of the (alternative) labour-based measure for the average markup in the Portuguese economy.

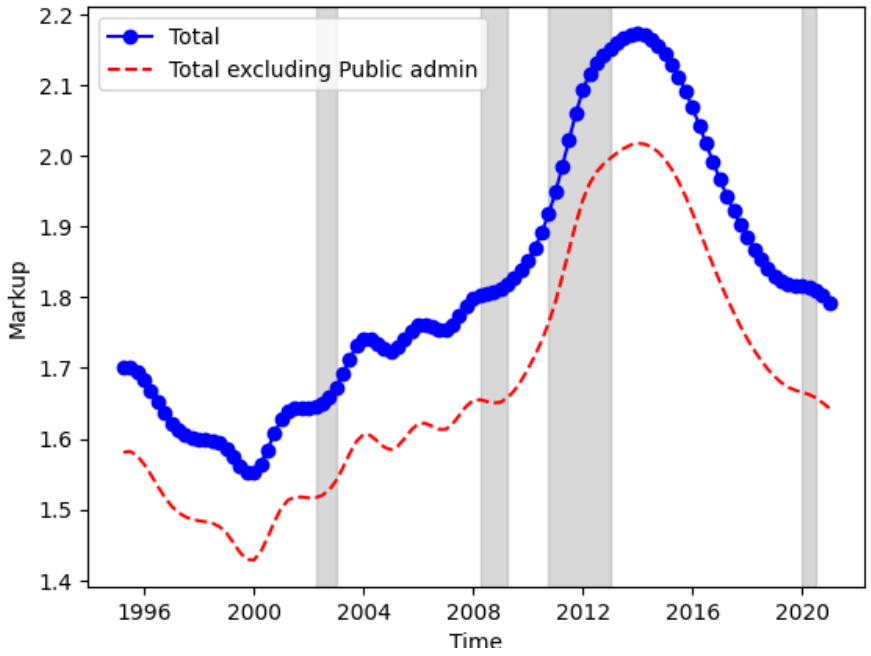

Figure 4 - Evolution of the Average Labour-Based Markup

Source: Own calculations.

Aggregate labour-based markup follows a pattern that is not very different, at least at first sight, from the one in Figure 3.

From 1995: I to 1999: IV, labour markups remained stable with a slight increase, from 1.70 to 1.55 as the economy prepared for Euro adoption, keeping labour costs at a relatively stable point.

Between 2000: I and 2008: IV, labour markups rose significantly, going from 1.56 to 1.81 driven by the post-Euro economic boom.

During the 2011: I to 2014: IV global financial crisis, labour markups spiked to 2.17 as firms attempted to cut costs by reducing the number of employees they carried, while prices continued to rise, increasing the labour price efficiency ratio.

From 2015: I to 2019: IV, labour markups gradually returned to the normal levels post-Troika, although they remained at pretty high levels of 1.82.

Lastly, in the short timeframe 2020: I to 2020: IV, there were no significant changes to the markup as it stayed around 1.80.

The cyclical correlation for the labour-based average markup, i.e. the correlation between $\Delta \ln \mu_t^L$ and $\Delta \ln Y_t$, is similarly negative, with a value of -0.36. Thus, the conclusion is similar to that for the materials-based average markup: aggregate markups are unconditionally counter-cyclical in Portugal.

The similar conclusion provides some evidence that this result may indeed be very robust, despite the fact that the labour-based measure tends to be qualitatively inferior to the materials-based one.

7.3 Co-Movement of Average Materials- and Labour-Based Markups

The correlation $(Corr(ln\mu_t^{IC}, ln\mu_t^L))$ between aggregate materials- and labour-based markups is 0.91, a very high value. This strong positive correlation indicates that, at an aggregate level, both types of markups tend to move in the same direction, i.e. they provide roughly the same information.

While labour and material markups both increased during periods of economic stress, as seen in the graphs being similar, such as the global financial crisis and the Troika intervention, as can be seen in all the grey highlighted areas in figure 3 and figure 4.

8. Cyclical Behaviour and Decomposition of Aggregate Markups

The cyclical behaviour of aggregate markups is one of the centre pieces to understand how economies react to different phases of the business cycle. By decomposing the evolution of aggregate markups into the contributions of changes in the markups themselves, changes in the weights of branches, and the interaction between both factors, we can explain why markups have changed over time.

We can obtain a counterfactual average markup using the weights of each branch in 1995 ($\omega_{j,1995}$) in order to assess the effect of the growth in sectorial markups. Another counterfactual average markup can be obtained using the initial markups in each branch ($\mu_{j,1995}$) in order to assess the effect of structural change. The interaction effect is obtained as a residual.

8.1. Decomposing the Growth of the Average Materials-Based Markup

The table below presents the decomposition of the average markup growth for the whole period and for five sub-periods.

The choice of sub-periods fell on the periods that had the most importance in Portugal's recent economic history. The first sub-period, 1995 to 1999, captures the pre-Euro years when Portugal was preparing to adopt the Euro. The second sub-period, 1999 to 2008, spans from the introduction of the Euro to the onset of the global financial crisis.

The third sub-period, 2008 to 2011, focuses on the immediate effects of the global financial crisis and the onset of Portugal's debt crisis. The next sub-period, 2011 to 2014, covers the years of the Troika intervention, during which austerity measures and structural reforms were implemented under the bailout program. The final sub-period, 2014 to 2019, captures the post-Troika recovery, highlighting the gradual economic stabilization and sectorial recovery following the intervention.

TABLE VII

GROWTH ACCOUNTING FOR THE AVERAGE MATERIALS-BASED MARKUP

Period	Whole	1995: I -1999: I	1999: I-2008: IV	2008: IV-2011: II	2011: II-2014: II	2014: II-2019: I
Change in markups	-0.052	-0.037	-0.075	-0.049	0.049	0.053
	(-175%)	(242%)	(61%)	(94%)	(21%)	(24%)
Change in weights	0.038	0.014	0.10	0.157	0.122	0.082
	(128%)	(45%)	(128%)	(270%)	(117%)	(74%)
Interaction	0.043	-0.003	-0.004	0.020	0.080	0.105
	(146%)	(-87%)	(10%)	(24%)	(60%)	(101%)

Source: Own calculations.

Between 1995: I and 2021: IV, the average markup increased by 2.9 percentage points. If structural change in the Portuguese economy had not existed, i.e. if the weight of each branch had remained unchanged, the average markup would have actually decreased by 5.2 percentage points, which corresponds to three quarters of the percentage change observed in the average markup. Had the sectorial markups remained unchanged, the average markup would have increased by 3.8 percentage points, corresponding to more than three times the percentage change observed. The interaction of the changes induced a 4.3 percentage points increase in average markups, almost half of the percentage change registered.

In the pre-euro period, the observed average markup decreased by 2.6 percentage points. For this sub-period, unlike what happens for the whole period, changes in sectorial markups actually explain a sharper drop of 3.7 percentage points, while contributed to explain the almost the entire difference in the opposite direction by 1.4 percentage points.

However, from 1999: I to 2008: IV, the decline in the average materials-based markup stopped and there was a 0.079 percentage point increase. In this timeframe changes in weights account for a 10% increase in percentage points.

In the post 2008 financial crisis, a marked shift was seen, the period from 2008 to 2011, with an increase of 0.034 percentage points. The biggest contributor for this increase was the change in weights that increased 15.7%.

As the economy entered the recovery phase between 2011 and 2014, the average markup increased 0.088 percentage points increase. The materials-based markup began to recover, with a positive 21% change in markups. The weight effect, however, continued to be a strong driver, contributing 117%, as the structural changes from the Troika intervention took hold.

In the 2014 to 2019 period, the average markup decreased 0.1 percentage point., while weight contributions, though still positive at 74%, showed signs of stabilizing. Interaction effects played a substantial role, contributing 101%, suggesting that the recovery was not only a matter of structural shifts but also involved a more synchronized movement between markups and sectorial weights.

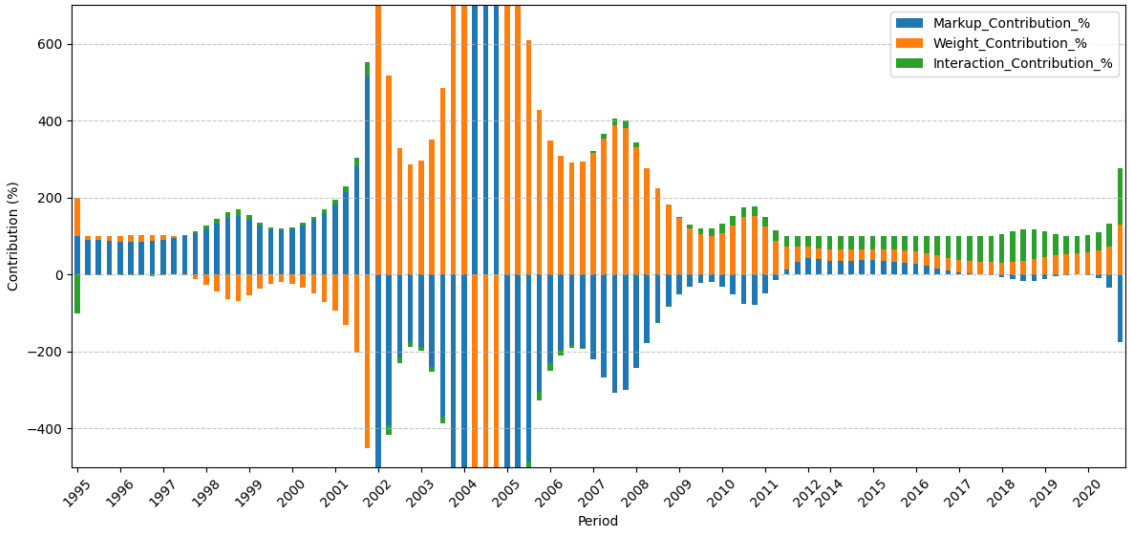

Figure 5 - Decomposition of Growth in Average Materials-Based Markup

Source: Own calculations.

The figure above provides a visual illustration of the contributions of each of the three factors on a quarterly basis. The figure is truncated above and below due to the large changes observed between 2002 and 2005.

7.2. Decomposing the Growth of the Average Labour-Based Markup

TABLE VII

GROWTH ACCOUNTING FOR THE AVERAGE LABOUR-BASED MARKUP

Period	Whole	1995: I -1999: I	1999: I-2008: IV	2008: IV-2011: II	2011: II-2014: II	2014: II-2019: I
Change in markups	-0.06	-0.085	-0.048	0.232	0.427	0.19
	-66%	-67%	-100%	-93%	-110%	-16%
Change in weights	0.15	-0.049	-0.032	0.069	0.168	0.258
	-165%	-38%	-53%	-31%	-41%	-141%
Interaction	0.002	0.007	0.065	0.132	0.191	0.138
	-1%	-5%	-46%	-75%	-48%	-42%

Source: Own calculations.

The evolution of labour-based markups between 1995 and 2021 reveals important dynamics in the labour share of the Portuguese economy. Both labour- and material-based markups followed similar overall trends, with a significant decline in the pre-Euro period (1995–1999) and a recovery following the financial crisis (2008–2011). However, labour-based markups showed smaller, steadier changes throughout these periods. For instance, while materials-based markups decreased by 2.6 percentage points in the pre-Euro period, labour-based markups dropped by only 0.04982 percentage points.

The post-crisis recovery also highlights differences in the behaviour of the markups. During the financial crisis (2008–2011), labour-based markups increased by 0.008 percentage points, reflecting a more moderate recovery compared to the 0.034 percentage point rise in materials-based markups. The Troika intervention and recovery period (2011–2014) saw a continued rise in labour-based markups, although the increase was smaller than for materials.

A notable divergence occurred in the post-Troika recovery (2014–2019), where labour-based markups continued to increase by 0.01 percentage points, while materials-based markups began to decline.

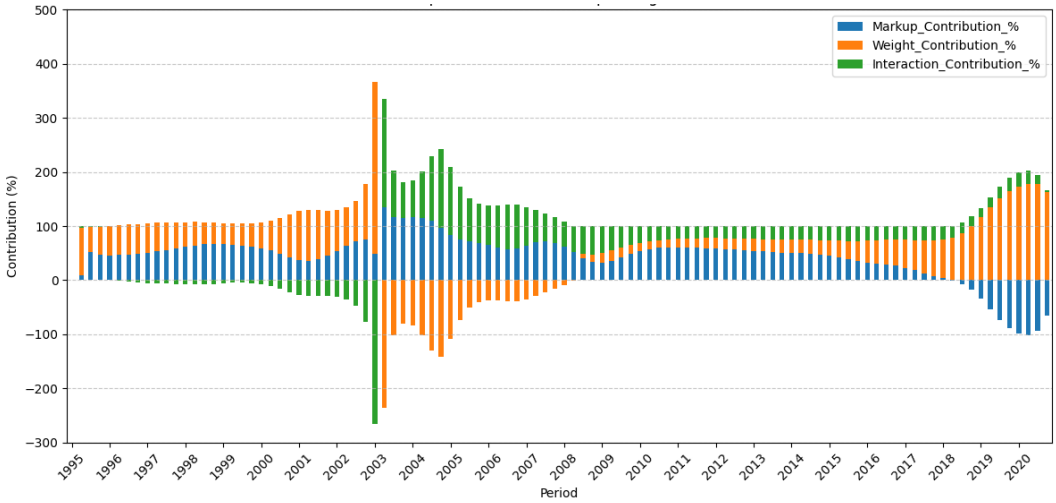

Figure 6 - Decomposition of Growth in Average Labour-Based Markup

Source: Own calculations.

7.3. Historical Context and Key Economic Events

As seen in the previous chapter, labour-based markups are steadier and fluctuate less when compared to material-based markups, this is expected as material-based markups are more sensitive to changes in inputs or in the market, since shifts in materials can be immediate, unlike changes in labour, which makes them a better measure to analyse market power.

The decomposition analysis allows us to link changes in aggregate markups to key historical events. The period from 1995 to 1999, before Portugal adopted the euro, was marked by a relatively stable behaviour of aggregate markups, though negative contributions from markup effects were prevalent in both labour and materials. Weight changes during this period were modest, with materials showing some structural adjustments as indicated by the 45% contribution of weight changes, while labour-based markups experienced a smaller negative adjustment. This period reflects the transition toward a more integrated European market, yet before major shifts in sectorial structures began.

During the 1999 to 2008 period, after Portugal adopted the euro, the economy experienced a period of growth that led to significant changes in sectorial weights. For labour-based markups, weight changes contributed 53%, while for materials, they contributed 128%, reflecting growing sectorial diversification, particularly in dynamic branches like information technology and financial services. This was a period of relatively high economic stability.

The global financial crisis of 2008 and the subsequent European sovereign debt crisis, particularly the 2011-2014 Troika intervention, were the complete contrast of the period prior, since it significantly impacted the cyclical behaviour of both labour- and materials-based markups. From 2008 to 2011, materials-based markups saw a sharp decline of 94%, while the weight effect surged, reflecting the relative shift in the importance of branches that were less impacted by the crisis, such as export-oriented industries. Similarly, labour-based markups experienced a recovery driven by the

increasing importance of weight changes and interaction effects. The period from 2011 to 2014 was dominated by austerity measures and restructuring, which led to significant shifts in labour markets, as indicated by the 110% increase in labour-based markups, largely driven by interaction effects.

Post-crisis, from 2014 to 2019, the economy entered a recovery phase. This period saw a steady recovery in both markups, driven by positive weight effects and stabilization in markup values. Materials-based markups increased by 24%, with weight contributions stabilizing at 74%, while interaction effects for both were particularly strong, reflecting a more coordinated recovery across branches. This period marked the beginning of Portugal's economic rebound, as labour-intensive industries began hiring again and key branches such as tourism and exports regained prominence.

The decomposition of aggregate markups for materials and labour provides crucial insights into the cyclical behaviour of the Portuguese economy over the past three decades. The analysis highlights how significant historical events, such as the financial crisis and the Troika intervention, shaped the evolution of aggregate markups. By breaking down the contributions of markup changes, sectorial weight changes, and their interactions, having gained a clearer understanding of how different forces contributed to the overall movement of aggregate markups.

8. Conclusion

This dissertation analysed the evolution of sectorial and aggregate markups in Portugal from 1995 to 2021, with a particular focus on how key economic events shaped the cyclical behaviour of markups. The results reveal that both labour- and material-based markups exhibit countercyclical patterns—markups tend to increase during economic downturns and decline during periods of expansion. This behaviour aligns with the broader literature on imperfect competition, where firms adjust markups to maintain profitability during recessions when competitive pressures ease.

The decomposition analysis highlights those changes in sectorial weights that played a particularly significant role during periods of economic instability, such as the 2008 global financial crisis and the European sovereign debt crisis. Weight effects were more pronounced during these periods, underscoring how structural shifts in the economy, especially the relative importance of different branches—were key drivers of the observed countercyclical behaviour. Interaction effects between markups and sectorial weights also became more prominent during these phases, reflecting the complex dynamics at play in sectorial adjustments.

In the pre-Euro period (1995-1999), markups remained relatively stable, with limited cyclicality observed. However, from 1999 to 2008, as Portugal integrated into the Eurozone, the cyclicality of markups became more evident, with weight changes reflecting the growing importance of branches like information technology and financial services. The 2008-2011 financial crisis marked a sharp increase in markups, driven by both rising costs and reduced competitive pressures, with significant contributions from sectorial weight shifts and interaction effects.

During the recovery phase (2011-2014), countercyclical behaviour persisted, particularly in labour markups, which saw significant increases due to wage cuts and structural reforms. Weight effects remained crucial during this period, reflecting the reallocation of resources across branches as the economy adjusted to post-crisis conditions. From 2014 to 2019, markups gradually stabilized, but the cyclicality remained, with sectorial recoveries contributing to a more synchronized movement in both labour and material markups.

The findings reinforce the importance of considering sectorial dynamics when analysing the cyclical behaviour of aggregate markups. Sectorial shifts, particularly in response to economic shocks, drive much of the countercyclical movement in markups. This decomposition analysis offers a clearer understanding of how economies like Portugal respond to crises and recover over time, highlighting the importance of branch-specific dynamics in shaping aggregate trends.

Future research could extend this analysis by exploring the impact of the COVID-19 pandemic on markup cyclicality. Additionally, incorporating firm-level data could provide deeper insights into the drivers of cyclicality at a more granular level. A comparative study with other European economies would also offer valuable perspectives on how different countries manage cyclicality in response to economic shocks.

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