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Who Benefits from inflation?

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Abstract

The primary objective of this project is to examine how inflation impacts different income quintiles in Spain, utilizing the Consumer Price Index (CPI) and segregating the data into 12 main categories of goods and services. This study focuses on analyzing the disparities in the effects of inflation across various income groups, particularly during significant economic periods such as the Financial Crisis (2006-2013), the Low Inflationary Period (2013-2019), and the Covid Crisis (2019-2022).

The methodology involves extensive data collection from the Instituto Nacional de Estadística (INE), including monthly CPI data and household expenditure surveys from 2002 to 2022. Data analysis was conducted using Excel, ensuring transparency and replicability. The study employs linear regressions to quantify the sensitivity of different income quintiles to inflation and examines the variances and spreads across these groups over time.

Key findings reveal that lower-income households are more affected by inflation, particularly in essential goods, while higher-income households experience greater inflationary effects in categories such as health and education. The econometric analysis indicates that lower-income groups, represented by Quintiles 1 and 2, are notably more sensitive to inflation, whereas higher-income groups, for instance, Quintiles 4 and 5, show less sensitivity due to their ability to diversify consumption and employ financial strategies. These findings align with existing literature, which also indicates that lower-income households are more adversely affected by inflation.

The study also highlights how economic shocks, like the Financial and COVID crises, tend to widen the income distribution gap, increasing inequality, whereas low inflation periods help maintain economic equality. These findings underscore the importance of targeted policies, including agile subsidies, competition promotion, and accurate CPI weighting, to protect vulnerable populations and promote social equity.

Limitations of the study include the sole focus on Spain, the simplicity of the methodology compared to the complexity of the topic, and reliance on data from INE, which may not fully capture urban consumption patterns. Future research should consider more diverse data sources and comparative studies across countries to enhance understanding of inflation's impact on income distribution.

Keywords: Inflation, Consumer Price Index (CPI), Income Quintiles, Economic Inequality, Financial Crisis, Covid Crisis, Spain, Econometric Analysis, Public Policy.

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1 Introduction

1.1 Background on Inflation

Inflation is understood as the generalized increase in the price of goods and services in an economy over a defined period. This economic phenomenon is known to affect all sectors of society and all individuals within it. However, this does not mean that inflation has a uniform effect across the board. Different segments of the population experience varying impacts due to their distinct consumption patterns, income levels, and access to resources.

This fact underscores important implications for economic and monetary policy as well as social justice for governments and central banks. These entities bear the responsibility of considering the different effects of their policies on various industries and across the income distribution. Ensuring that policies do not disproportionately disadvantage any group is crucial for maintaining social equity and economic stability.

Another relevant consideration is how inflation is evaluated. The Consumer Price Index (CPI) will be used, as it is a key measure of inflation that reflects changes in the cost of a fixed basket of goods and services over time. However, the overall CPI can obscure variations in how inflation affects different groups within society. For instance, low-income households tend to spend a larger proportion of their income on necessities like food and housing, which might inflate at different rates compared to luxury goods and services.

This project will try to understand the effects of inflation by taking into account the 5 quintiles of the income distribution using data from population surveys and the monthly CPI reported by Instituto Nacional de Estadística (INE) both generic and specific. The aim of this project is to have a better overview of the disparities in the effects of inflation.

1.2 Objectives of the Study

The main objectives of this study are:

1. Examine the CPI and its effects on the different income distribution quintiles.
2. Analyze the evolution of inflation across goods and services categories in the CPI over the last decade.
3. Frame some possible recommendations to mitigate the uneven effects of inflation in the income distribution.

With this comprehensive approach, the target was to extensively deconstruct the CPI Index to extract all its relevant information. This is key to understanding the underlying effects of inflation in our society and hence being able to create more egalitarian monetary policies and anti-inflationary measures. Additionally, this analysis will help us better understand the real effects of past policies, contributing to a more in-depth knowledge of maintaining economic stability. By doing so, it is hoped to contribute to

the literature on this novel topic within the macroeconomic community.

1.3 Structure of the Project

Let us delve into the structure of this project:

Firstly, a review of the existing literature on the topic will be addressed, establishing the theoretical framework regarding inflation and its effects on society. This will include an examination of prior studies that have analyzed how inflation impacts different income groups and the methodologies they have employed.

Secondly, the methodology of the project will be defined. This section will provide a detailed walkthrough of the computation of the different indexes and regressions, explaining the data sources, the variables used, and the statistical techniques applied. This ensures that the analysis is transparent and replicable.

Following this, the presentation, analysis, and discussion of the results will be conducted. This section will include graphical representations of the data, detailed tables, and a thorough interpretation of the findings. The aim is to clearly show how inflation impacts different income quintiles and which categories of goods and services are driving these effects.

To conclude, some final conclusions and recommendations will be presented. This will summarize the key findings, discuss their implications for economic and social policy, and propose specific measures that could mitigate the adverse effects of inflation on lower-income groups.

Lastly, the bibliography and annexes will be included at the end of the project. This section will acknowledge all the sources used and provide all the material that supports this study, including the original databases used to estimate all the figures and graphs in the project. This ensures that the study is well-documented and that all references are properly credited.

2 Theoretical Framework

Inflation, defined as the widespread and sustained increase in the prices of goods and services in an economy, has varied effects on different segments of the population. While all sectors of society are impacted by inflation, not all experience these effects in the same way. This theoretical framework will draw on three key articles to explore how inflation affects different income groups and what the underlying mechanisms are: "The Distributional Effects of Inflation" by Olivier Coibion, Yuriy Gorodnichenko, and Michael Weber; "Inflation and Income Inequality" by Marcos Chamon and the IMF; and "Who is Hurt by Inflation? Disentangling the Distributional Effects of Price Changes and Price Dispersion" by Roman Horvath and Lien Le Vinh.

Various studies have shown that low-income households are particularly vulnerable to the effects of inflation. An extensive analysis by Coibion et al. (2014) reveals that these households tend to spend a larger proportion of their income on essential goods and services whose prices rise more rapidly. This means that increases in the prices of essential goods, such as food and energy, disproportionately affect the budgets of lower-income households, thereby exacerbating economic inequality.

On the other hand, Chamon et al. (2016) explore the relationship between inflation and income inequality through an empirical analysis covering multiple countries and periods. The results indicate that inflation harms low-income households more, as they have less capacity to protect themselves against rising prices. This study suggests that policies aimed at controlling inflation can be effective in reducing income inequality. The authors argue that keeping inflation under control is not only crucial for economic stability but also for promoting social equity.

Additionally, the research by Horvath and Le Vinh (2019) offers a detailed perspective by breaking down inflation into price changes and price dispersion. Price changes refer to the average increase in prices, while price dispersion refers to the variability in the rates of price increases among different goods and services. The study found that price dispersion has a more pronounced negative effect on low-income households, who cannot adjust their consumption as easily in response to price variations. This is because lower-income households have less flexibility to substitute more expensive products with cheaper ones, increasing their economic vulnerability.

Together, these studies highlight the importance of considering both average price changes and price dispersion when analyzing the effects of inflation. The findings indicate that effective monetary policy must address not only the general rate of inflation but also the variability of prices across different categories of goods and services. To mitigate the adverse effects of inflation on lower-income groups, several policies are suggested. These include price regulation for essential goods, promoting competition in monopolistic markets, and developing social protection programs that help vulnerable households better manage their spending.

Let us take an overview of several economic theories regarding inflation and the income distribution:

Associated with Keynesian economics, **demand-pull inflation theory** suggests that inflation results from an increase in aggregate demand exceeding aggregate supply. John Maynard Keynes, in "The General Theory of Employment, Interest and Money" (1936), posits that when consumer demand outpaces an economy's capacity to produce goods and services, prices rise. This theory is essential for understanding how policies that boost demand can lead to inflation and impact households differently based on their income levels and spending patterns.

Cost-push inflation theory, associated with economists like Milton Friedman and Edmund Phelps, explains inflation as a result of rising production costs, such as wages and raw materials, which producers pass on to consumers. Friedman's work, especially "A Monetary History of the United States" (1963), emphasizes how monetary factors and cost increases contribute to inflationary pressures. This perspective helps analyze how different sectors react to production cost changes and how these reactions affect various income groups.

Advocated by Milton Friedman, the **monetarist theory** posits that inflation is primarily driven by changes in the money supply. Friedman famously stated, "Inflation is always and everywhere a monetary phenomenon." Controlling the money supply is crucial for managing inflation, highlighting the role of central bank policies. This theory is vital for understanding the broader economic impacts of monetary policy on inflation and income distribution.

Introduced by A.W. Phillips in 1958, the **Phillips Curve** illustrates an inverse relationship between inflation and unemployment. According to the Phillips Curve, lower unemployment rates are often associated with higher inflation, and vice versa. This relationship helps explain the trade-offs policymakers face between reducing unemployment and controlling inflation, impacting different income groups based on their employment status.

Simon Kuznets' work on income distribution theory, particularly the **Kuznets Curve**, suggests that income inequality first rises and then falls with economic development. This theory provides a framework for understanding how economic growth and policies affect income distribution over time. Integrating this with inflation theories allows a comprehensive analysis of how inflationary pressures influence income inequality.

2.1 Conclusion of the Theoretical Framework

Demand-pull inflation theory emphasizes how increased aggregate demand drives inflation, affecting households based on their income levels and spending patterns. Cost-push inflation theory highlights how rising production costs lead to inflationary pressures, impacting various sectors and income groups. Monetarist theory underscores the importance of controlling the money supply to manage inflation, affecting income distribution. The Phillips Curve illustrates the trade-offs between inflation and unemployment, influencing different income groups based on employment status. Income distribution theory, particularly the Kuznets Curve, provides a framework for understanding how economic growth and policies affect income inequality over time.

Empirical studies by Coibion et al. (2014), Chamon et al. (2016), and Horvath and Le Vinh (2019) build on these theories, revealing how inflation exacerbates economic inequality and offering recommendations for more equitable policies. These studies provide a solid foundation for understanding the mechanisms through which inflation affects income distribution.

Conclusively, the reviewed literature and economic theories suggest that inflation significantly impacts different income groups unequally, with low-income households being the most adversely affected.

2.1.1 Macroeconomic Context

Since the early 2000s, the Spanish economy has undergone various phases that have significantly influenced inflation rates. In the early years of the decade, Spain enjoyed robust economic growth, driven by the expansion of the construction sector and increased consumption. During this period, inflation remained relatively stable, although with an upward trend due to strong domestic demand.

The global financial crisis of 2008 marked a significant turning point. The Spanish economy experienced a deep recession, with a sharp contraction in GDP and a dramatic rise in unemployment. During this period, inflation moderated considerably, and there were even episodes of deflation at certain times, reflecting the drop in aggregate demand and declining asset prices.

Starting in 2014, the economy began to show signs of recovery, albeit slowly and unevenly. Structural reforms and stimulus policies helped stabilize the economy, and inflation rates remained low, influenced by the European Central Bank's expansive monetary policy and the gradual recovery of the labor market. However, unemployment levels and economic inequality remained high.

The COVID-19 pandemic in 2020 caused a new global recession that severely affected the Spanish economy. Initially, inflation was low due to falling demand and lockdown measures, but as the economy began to reopen in 2021, inflation increased notably. Energy and food prices rose significantly due to global supply chain disruptions and rising production costs.

In recent years, inflation in Spain has been influenced by both global and domestic factors. Rising energy prices, supply chain bottlenecks, and geopolitical tensions such as the Ukrainian war or the Israel-Hamas War, for instance, have led to higher inflation rates than those observed in the past decade. These persistent inflationary pressures have highlighted the need for economic policies that address not only price stability but also social equity. The government and the European Central Bank have implemented various policies to mitigate the inflationary impact, including energy subsidies and adjustments in interest rates.

3 Methodology

3.1 Purpose and Scope

The main purpose of this study is to observe and analyze the differences in the effects of inflation across various income groups in Spain, specifically focusing on the five income quintiles. By examining how inflation impacts different income groups, this research aims to uncover the intricate ways in which inflation affects households differently based on their income levels. This involves a detailed analysis of the segregated Consumer Price Index (CPI) across the 12 main categories of goods and services. Understanding these differences is crucial because it highlights how various sectors of the economy respond to inflation and how these responses, in turn, impact different income groups. By disaggregating the CPI, the study seeks to reveal the specific burdens placed on households within each income quintile and identify which sectors contribute most significantly to these disparities.

The scope of this study aims to achieve several important objectives. Firstly, it seeks to expand the existing literature on the relationship between inflation and income distribution. This area of research is relatively novel and carries significant implications for society. By providing new insights, this study aims to focus in depth on the Spanish economy and society providing a deeper understanding of its distribution and effects.

Secondly, the research aims to enhance our understanding of how various economic measures, such as subsidies, monetary policy, and governmental aid, influence not only inflation but also its effects on income distribution. This knowledge is critical for developing more effective and equitable anti-inflationary policies. By examining the impact of these measures, the study seeks to inform policymakers and central banks on how to design strategies that both control inflation and mitigate its adverse biased effects on the income quintiles, thereby promoting a more egalitarian approach to economic policy.

Additionally, the study will delve into the intricacies of consumption trends within different income quintiles in Spanish society, particularly in relation to inflation. By investigating how inflation in each of the 12 CPI categories affects consumption behaviors among various income groups, the research aims to provide a comprehensive understanding of these dynamics. This will involve examining how price changes in essential goods and services have impacted household budgets differently based on income levels.

Overall, this study aims to provide a thorough analysis of the differential effects of inflation on income distribution in Spain, utilizing detailed CPI category data to offer

insights that can inform more equitable economic policies. The ultimate goal is to support the creation of policies that promote economic stability and growth while ensuring fairness and equity for all segments of society.

3.2 Type of Study

This research is a quantitative study that leverages extensive time-series data to analyze the evolution of inflation across different income groups in Spain. The data utilized includes monthly Consumer Price Index (CPI) data from the *Instituto Nacional de Estadística* (INE) since 2002, capturing the variations in inflation rates across 12 main categories of goods and services. Additionally, household expenditure data from population surveys, collected from 2006 to 2022, provides a comprehensive view of consumption patterns across different income quintiles.

The quantitative nature of this study ensures robustness and significance, thanks to the large dataset and the reliability of the INE as a data source. The analysis focuses on identifying trends and patterns in inflation and how these impact different economic segments of the Spanish economy. By employing econometric research methodologies, including regression analysis, the study aims to uncover the intricate relationships between inflation and income distribution. This approach allows for a detailed examination of how inflationary pressures vary across different income groups and economic sectors, providing valuable insights into the broader economic implications.

By relying on quantitative methods, this study maintains a high level of objectivity and precision, ensuring that the findings are based on empirical evidence and statistically significant relationships. This methodological approach is well-suited to the study's goals of identifying and understanding the differential impacts of inflation on various income groups, ultimately contributing to more informed and effective economic policies.

3.3 Data Collection

The data for this study has been meticulously gathered from the INE, ensuring high reliability and robustness. The primary datasets utilized are the monthly Consumer Price Index (CPI) data and household expenditure surveys.

The Consumer Price Index (CPI) data, spanning from 2002 to 2022, is sourced from INE. This dataset includes monthly price information across 12 categories of goods and services such as: covering a wide range of expenditure categories such as food, housing, transportation, health, education, etc. This is essential for analyzing inflation trends over time. The CPI is a critical indicator used to measure the average change in prices paid by consumers for a market basket of goods and services, providing a clear picture of inflationary pressures within the economy.

The Household Expenditure Surveys (Encuesta de Presupuestos Familiares) offer detailed data on household spending from 2006 to 2022. Conducted by the INE, these surveys gather extensive information on consumption patterns across different demographic groups, making it possible to assess how inflation impacts various income quintiles differently.

For the CPI data, INE employs a comprehensive sampling method that involves collecting prices from over 29.000 outlets across 177 municipalities in Spain. This extensive coverage ensures that the CPI reflects a broad spectrum of consumer expenditures, capturing price variations accurately across different regions and sectors.

The Household Expenditure Surveys are based on a stratified sampling method, ensuring representativeness across Spain's diverse population. Approximately 24.000 households are surveyed annually, selected to reflect various demographic and regional characteristics. The initial interviews are conducted in person by trained INE interviewers, while follow-up surveys may be conducted by phone or face-to-face to maintain consistency and reliability in the data collected.

In summary, the data collection process for this study involves the use of reliable and extensive datasets from the INE, with robust sampling methods and detailed data collection instruments. This ensures that the study's findings on the impact of inflation on income distribution are well-supported and representative of the broader Spanish population. The comprehensive nature of the data enhances the robustness and significance of the analysis, ensuring that the data obtained is reliable.

3.4 Data Analysis

To ensure the analysis is straightforward and replicable for individuals with minimal programming experience or econometric knowledge, the entire data analysis was conducted using Excel. This approach guarantees that the methodology is accessible and can be easily replicated. Below is a detailed and expanded description of the steps and methodologies employed in this analysis.

3.4.1 Data Cleaning and Standardization

First, it was essential to clean the data and standardize the unitary metrics of both the Encuestas de Población and the monthly historical data of the CPI. This process was executed using the Excel sheet named "Summations CPI" provided in the Annexes.

3.4.2 Standardizing Monthly CPI to Yearly

The CPI monthly data was converted to yearly data to match the time horizon of the Encuestas de Población (2006-2022). This conversion was crucial for ensuring that the CPI data aligned with the survey periods, facilitating a coherent analysis.

Example Formula:

$$Yearly\ CPI = \frac{SUM('Monthly\ CPI'!\$R9:\$AC9)}{12} \quad (1)$$

Which sums the monthly data and divides by 12 to obtain the annual average. This step ensures consistency and comparability across different time periods.

3.4.3 Creating Indexes for Quintiles and Categories

After standardizing the data, the next step was to create a methodology for performing regressions needed to analyze the income inequality structure of the quintiles and to segregate them by the 12 categories representing Spanish consumption patterns. This involved constructing indexes that could provide a detailed breakdown of CPI changes over time for different income groups and expenditure categories.

Formula:

1 General index

Define index per category

$$\text{Expenditure share on } i \text{ in } t = \frac{\text{Exp. on category } i, 2020}{\text{Total expenditure in 2020}} \quad (2)$$

$$\text{Index per category } i_{t,2020} = \frac{\text{Price of category } i \text{ at } t}{\text{Price of category } i \text{ at 2020}} \quad (3)$$

$$CPI_{t,base2020} = \sum_{i=1}^{12} \text{Exp. share on } i \text{ in 2020} \times \text{Index per category } i_{t,2020} \quad (4)$$

2 By quintile

$$\text{Expenditure share on } i \text{ in } t \text{ by quintile } j = \frac{\text{Exp. on category } i, 2020 \text{ by quintile } j}{\text{Total expenditure in 2020 by quintile } j} \quad (5)$$

$$\text{Index per category } i_{t,base2020} = \frac{\text{Price of category } i \text{ at } t}{\text{Price of category } i \text{ at 2020}} \quad (6)$$

$$CPI_{t,base2020,j} = \sum_{i=1}^{12} \text{Exp. share on } i \text{ in 2020 by quintile } j \times \text{Index per category } i_{t,base2020}$$

This formula calculates the relative importance of each category within the total expenditure, its expenditure share -fixing it in 2020-, and adjusts it based on the general index per category also with the price level in 2020 as the basis. By normalizing expenditure data to a base year, this method allows for meaningful

comparisons over time, accounting for inflationary impacts on different sectors and more importantly, calculating the relative importance of each quintile's category expenditure in contrast to the total expenditure of the quintile and adjusting it similarly based on 2020 price levels. This approach helps in understanding how inflation affects different income groups, highlighting disparities in spending power and inflationary burden. To later analyze this same effect over the quintiles we rerun the same procedure however with the expenditure per category of the quintiles and the total expenditure of each one of them, this will be key to be able to perform the regressions later on.

The decision to use 2020 as the base year stems from the significant economic disruption caused by the COVID-19 pandemic. Setting 2020 as a reference allows for a clearer comparison of inflationary impacts and more striking visual data. However, it is important to note that choosing any other fixed year would not significantly alter the results. The year 2020 provides a unique baseline due to the global economic shock and subsequent inflationary pressures, making it an ideal reference point for this analysis.

The next step would be the Implementation in Excel to ensure transparency and ease of replication, detailed calculations were performed in specific Excel sheets.

Used Formulas in Excel:

$$\text{Expenditure share on } i \text{ in } t = \frac{\text{'Population Surveys'\$D11}}{\text{'Population Surveys'\$D\$10}} \quad (7)$$

$$\text{Index per category } i, t, 2020 = \frac{\text{'Summations CPI'\$B14}}{\text{'Summations CPI'\$D14}} \quad (8)$$

$$\begin{aligned} \text{CPI } t, \text{ base } 2020 &= \sum_{i=1}^{12} \text{Exp. share on } i \text{ in } 2020 \times \text{Index per category } t, 2020 = \\ &= \$C\$11 * B\$24 + \$C\$12 * B\$25 + \$C\$13 * B\$26 + \$C\$14 * B\$27 + \$C\$15 * B\$28 \\ &+ \$C\$16 * B\$29 + \$C\$17 * B\$30 + \$C\$18 * B\$31 + \$C\$19 * B\$32 + \$C\$20 * B\$33 + \\ &+ \$C\$21 * B\$34 + \$C\$22 * B\$35 \end{aligned} \quad (9)$$

By constructing these indexes, a detailed view of the inflationary pressures on different segments of the economy over time is obtained. These indexes serve as a foundation for further analysis, including the computation of growth rates and regression analysis, which will be covered in subsequent sections.

The next step in our analysis involves computing the growth rates for the quintiles and categories. Growth rates are used to express the annual change in a variable as a percentage, making it easier to visualize and interpret economic data. This method is preferred over logarithms in this project to ensure accessibility and comprehensibility for a broader audience. Growth rates are straightforward and familiar to most people, whereas logarithms, though common in economic modeling, may not be as easily understood by the general public.

The formula for calculating the growth rate is:

$$Growth\ rate = \frac{(Index\ in\ year\ t - Index\ in\ year\ (t-1))}{Index\ in\ year\ (t-1)} \quad (10)$$

By applying this formula, the year-over-year changes in our constructed CPI indexes, broken down by quintiles and categories can be quantified.

Implementation in Excel:

$$Growth\ rate = \frac{('Indexes\ for\ categories\ and\ quintiles\ over\ time'!B36-'Indexes\ for\ categories\ and\ quintiles\ over\ time'!C36)}{'Indexes\ for\ categories\ and\ quintiles\ over\ time'!C36} \quad (11)$$

Some important considerations are: firstly for the computation of the quintiles, reference the sheet "Indexes for quintiles over time". Moreover, the results are formatted to appear in percentages (%). Without this formatting, the computation would be in decimal form (per 1) This structured approach ensures that the growth rates are clearly presented and easily interpretable.

3.4.4 Computing Linear Regressions

For the final part of our data analysis, linear regressions will be performed. This statistical method will help us understand the relationship between the growth rates of the quintile estimations and the growth rates of the general index estimations. Linear regressions are chosen for their simplicity and ease of interpretation. Including a constant term in the regression is crucial because it represents the y-intercept of the regression line, accounting for the value of the dependent variable when all independent variables are zero. This ensures a more accurate and unbiased estimate of the relationship.

The formula for a simple linear regression is:

3 Regression

$$\frac{CPI_{t+1,base2020,j} - CPI_{t,base2020,j}}{CPI_{t,base2020,j}} = const + \beta_j \frac{CPI_{t+1,base2020} - CPI_{t,base2020}}{CPI_{t,base2020}} + \varepsilon_{t+1} \quad (12)$$

Where:

Y is the dependent variable (growth rates of the quintile).

X is the independent variable (growth rate of the general index).

const is the constant term (y-intercept).

β_j is the coefficient for the independent variable.

ϵ is the error term.

Linear regression is used to select a large number of data points—in our case, the previously computed growth rates—and generate linear trends over them. This allows us to observe patterns and conduct an econometric analysis of inflation's impact on income distribution.

In the Excel sheet named "Linear Regressions," the following formulas are used to calculate the regression coefficients and the constant term:

These formulas work as follows:

LINEST Function: Performs linear regression analysis and returns an array of statistics that describe the line that best fits the data. The parameters include the known y-values (dependent variable), known x-values (independent variable), a boolean to determine if the constant should be included, and another boolean to return additional regression statistics.

INDEX Function: Returns a value from an array based on row and column numbers. In this context, it extracts specific elements (coefficients and constants) from the array returned by LINEST.

VAR.S: Performs the computation of the sample Variance for the selected data.

Implementation in Excel:

Use the LINEST function to compute the coefficients and constants for each regression.

- Example for calculating the coefficient:

$$\text{Coefficient} = \text{INDEX}(\text{LINEST}('Growth rates CPI's'! \$B11: \$Q11; 'Growth rates CPI's'! \$B\$10: \$Q\$10; \text{TRUE}; \text{True}); 1; 1) \quad (13)$$

- Example for calculating the constant:

$$\text{Constant} = \text{INDEX}(\text{LINEST}('Growth rates CPI's'! \$B11: \$Q11; 'Growth rates CPI's'! \$B\$10: \$Q\$10; \text{TRUE}; \text{True}); 1; 2) \quad (14)$$

- Example for calculating R2:

$$R2 = \text{INDEX}(\text{LINEST}('Growth rates CPI's'! \$B11: \$Q11;$$

'Growth rates CPI's'! \$B\$10: \$Q\$10; TRUE; True); 2; 1) (15)

- Example for calculating the Variance:

$VARIANCE = VAR.S('Indexes for categories and quintiles over time'! B36: R36)$

It is also worth mentioning that in order to follow a more cohesive structure the interpretation of the first 2 will be conducted in the following Chapter and the R2 evaluation will be discussed in the next section the Limitations.

Together with the computation of the Coefficient, Intercept, and R2, the linear regression Y values for X=0 to X=6 were also computed, this data will be utilized later on for the creation of the linear regression graphs. The formula used to do so was $Y=\beta_0+\beta_1X+\epsilon$ with $\epsilon=0$ which in Excel would equal a simple multiplication and a sum; for instance, =B11*H\$8+\$C11. However, since this is just to plot the information there is no need to delve deeper into its explanation.

3.5 Limitations

While the data analysis methodology is robust and replicable, several limitations should be acknowledged. The data from the Encuestas de Población and the CPI are collected and updated regularly by the INE, but changes in data collection methodologies over time could introduce inconsistencies. Additionally, household expenditure data relies on self-reported surveys, which can be prone to response bias, leading to inaccuracies.

The use of linear regression, while simple and interpretable, may not capture the full complexity of the relationship between inflation and income distribution. Including a constant term in the regression models helps adjust the baseline but may not fully account for all underlying factors, furthermore, while growth rates are chosen for their simplicity, they may not always accurately reflect underlying economic dynamics, especially in the presence of high volatility. The choice of 2020 as the base year due to the COVID-19 pandemic provides a unique baseline but also means that the growth rates and trends may be influenced by this outlier event, potentially skewing results. Other unforeseen economic events could also introduce volatility, not fully accounted for in the models.

A significant limitation of this study is its focus solely on Spain without including control variables. This limits the generalizability of the findings and may affect the explanatory power (R-squared) of the regression models. The absence of controls for factors like regional economic variations, employment rates, and government interventions restricts the robustness of the analysis, suggesting a need for a more comprehensive approach to fully understand the dynamics between inflation and income distribution.

The R-squared values obtained from the regression models indicate the model's explanatory power. However, a high R-squared value does not imply causation, as unobserved factors and omitted variables could influence the relationship between inflation and income distribution. There is also a risk of multicollinearity, where independent variables are highly correlated, potentially distorting regression coefficients.

The R-squared values from my analysis range from 0.04 to 0.01. The R-squared value indicates the proportion of variance in the dependent variable (growth rates of quintiles/categories) that can be explained by the independent variable (growth rate of the general index). An R-squared value closer to 1 indicates a stronger explanatory power, while a value closer to 0 indicates a weaker explanatory power.

When comparing these results to the literature, such as the studies by Coibion et al. (2014), Chamon et al. (2016), and Horvath and Le Vinh (2019), whose R-squared values generally range from 0.25 to 0.60, it is evident that the analysis of the project has a narrower and lower range of explanatory power.

This discrepancy could be attributed to differences in datasets, periods analyzed, or methodological approaches. The lower R-squared values in my analysis indicate that additional factors not captured in the current models might be influencing the relationship between inflation and income distribution. This underscores the complexity of these dynamics and the potential need for further research and more sophisticated modeling techniques to capture a fuller picture. Especially the simplicity of my methodology combined with the complexity of the topic makes the R-squared values found somewhat logical.

4 Presentation, Analyses, and Discussion of Results

4.1 Main Findings

The analysis of inflation trends in Spain, as detailed in point 4.2, reveals a distinction between regular and anomalous trends across different categories. Regular trends closely follow the general inflation index, albeit at varying magnitudes, while anomalous trends exhibit unique patterns due to regulatory changes, seasonality, and technological advancements. The pie chart analysis highlights the significant impact of heavily weighted categories like food, transport, and housing on the overall CPI, underscoring their crucial role in driving inflation.

In point 4.3, the econometric analysis examines the impact of inflation on different income quintiles. The purpose of performing linear regressions in this study is to analyze how inflation affects different income quintiles compared to the general index. Lower-income households, with a coefficient of 1.092 for Quintile 1, are notably more affected by inflation, reflecting their high sensitivity to essential goods. Quintile 2, with a

coefficient of 1.078, also shows a significant impact. Quintile 3, with a coefficient of 1.036, represents middle-income households moderately affected. Higher-income households, represented by Quintile 4 (0.996) and Quintile 5 (0.926), are less impacted by inflation. These findings align with existing literature, reflecting that despite Spain's policy environment where strong social policies and subsidies cushion lower-income groups, lower-income groups are still more affected than the higher-income quartiles. The analysis highlights the need for targeted policies and competition to mitigate inflation's effects and promote social equity.

4.2 Descriptive Analyses

4.2.1 CPI Evolution (Logs)

Evolution of the CPI (Logs)

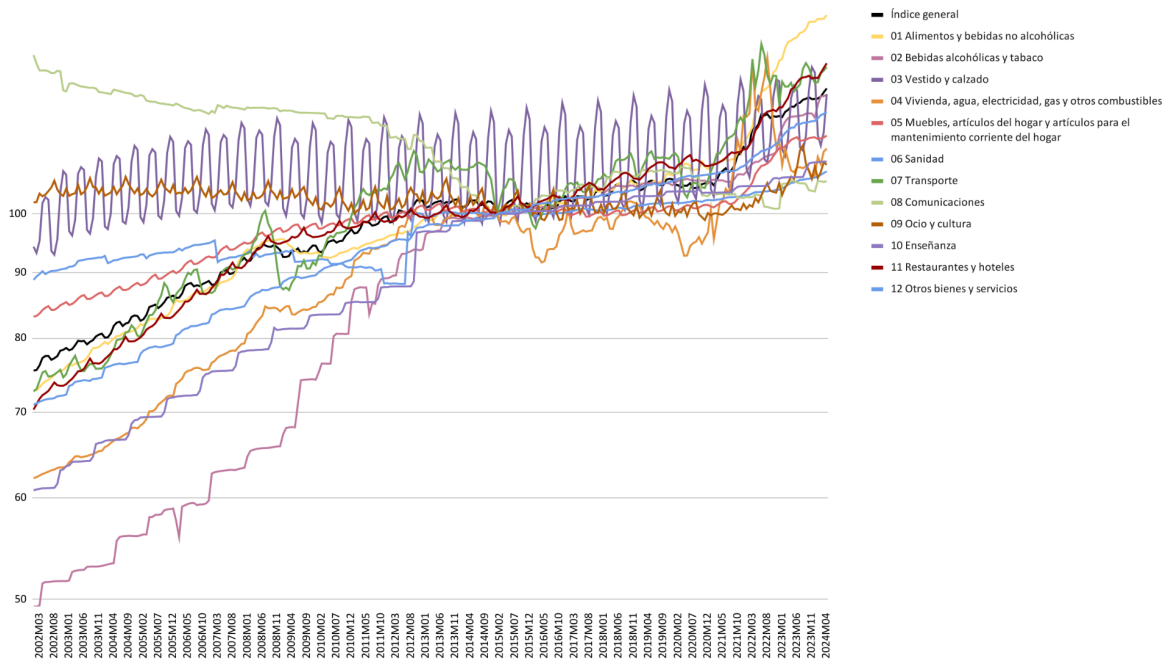


Fig. 1 CPI Evolution (Logs)

Source: Own elaboration

To better understand inflation trends in Spain, the analysis was divided into two parts: regular trends and anomalous/seasonal trends.

Categories show an inflationary behavior that follows the same direction as the general index, although at different magnitudes, naming them regular trends.

- **Education:** It shows steady and gradual growth. This can be attributed to regular increases in education costs, including tuition and books, reflecting general inflation.
- **Housing, water, electricity, gas, and other fuels:** this category has an upward trend similar to the general index. Housing and utility prices are subject to regular increases due to inflation, housing demand, and fluctuations in energy prices.

- **Other goods and services:** this category also follows a trend similar to the general index, with steady growth. It includes a wide range of products and services that tend to follow general inflation.
- **Restaurants and hotels:** the hospitality sector shows an upward trend that follows the general index. Increases in operating costs and growing demand for leisure and tourism services drive this trend.
- **Furniture and household items:** this category reflects general inflation with steady growth, driven by increases in material and production costs.
- **Transport:** It shows an upward trend with fluctuations. Fuel prices and transportation fares significantly influence this category, following general inflation.
- **Food and non-alcoholic beverages:** this category presents a steady upward trend and follows general inflation, influenced by agricultural production costs and the demand for staple foods.
- **Alcoholic beverages and tobacco:** although this category follows the direction of general inflation, it shows a more exaggerated inflationary trend. High taxes and strict regulations contribute to these increases.

These anomalous categories exhibit seasonal behaviors or follow particularities to the general index.

- **Health:** It shows an almost flat trend with a notable jump in 2012, possibly due to a change in the calculation of the index. Excluding this jump, the trend is stable. This may be due to the regulation of prices for medical and pharmaceutical services.
- **Clothing and footwear:** this category has exacerbated seasonality with regular peaks and valleys. Seasonal sales and fashion collections influence these patterns, although the annualized trend is upward.
- **Leisure and culture:** the trend is almost flat with moderate seasonality. Seasonal fluctuations may be related to cultural events and holiday periods.
- **Communications:** this category follows a downward trend, entirely opposite to the general index. The decrease in technology and telecommunications costs, along with market competition, drives this downward trend.

4.2.2 Interpretation of the Pie Chart

Pie Chart of CPI weights (%)

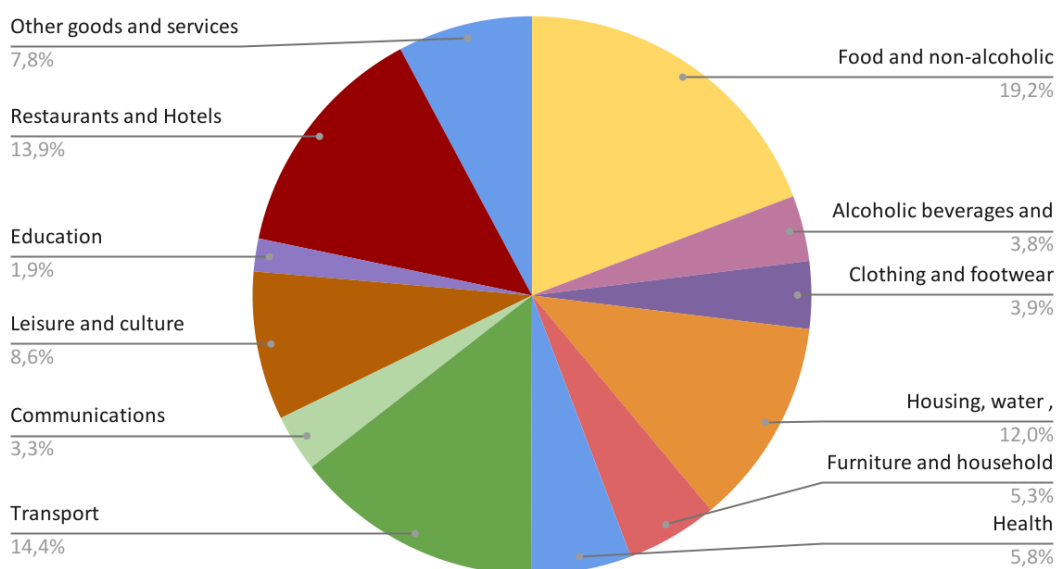


Fig. 2 CPI Weights in percentage

Source: Own elaboration

The pie chart shows the weightings of the different categories in the general CPI index. The most relevant categories and their weightings are:

- **Food and non-alcoholic beverages** (19.2%): the main driver of inflation in Spain due to its high weight. This category follows an inflationary trend similar to the general index, reflecting its significant impact on the CPI.
- **Transport** (14.4%): with considerable weighting, transport also strongly influences the CPI. Volatility in fuel prices and transport fares affects this category, closely following general inflation.
- **Restaurant and Hotels** (13.9%): another category with high weighting, influenced by tourism and operating costs in the hospitality industry. It follows a trend similar to the general index, showing steady growth.
- **Housing** (12.0%): includes rents and utilities, and its trend closely follows general inflation due to regular increases in these costs.
- **Leisure and culture** (8.6%): although it has a lower weighting, its seasonal behavior influences the CPI but does not follow a marked inflationary trend.

The weightings reflect how key categories align with the inflationary trends of the general index, underscoring their importance in the overall inflation of the Spanish economy.

4.3 Econometric Analyses

4.3.1. Purpose and Interpretation

The purpose of performing linear regressions in this study is to analyze how inflation affects different income quintiles compared to the general index. By calculating the

regression coefficients for each quintile, a better understanding of the sensitivity of each income group to changes in inflation can be achieved. This methodology allows for the identification of which quintiles are more affected or benefited by inflation and provides a solid basis for discussing the economic and social implications of these findings.

To interpret the results of the linear regressions, the coefficients obtained for the general index and the different quintiles are analyzed. The coefficients represent the degree of sensitivity of each quintile to changes in general inflation. In other words, the general index is fixed at a coefficient of 1 with an intercept of 0 to facilitate interpretation. For instance, if quintile 5 has a coefficient of 1.2, the interpretation would be that Quintile 5 experiences a 1.2% increase in its price index for every 1% increase in general inflation.

4.3.2 Interpretation of Linear Regressions by Quintiles

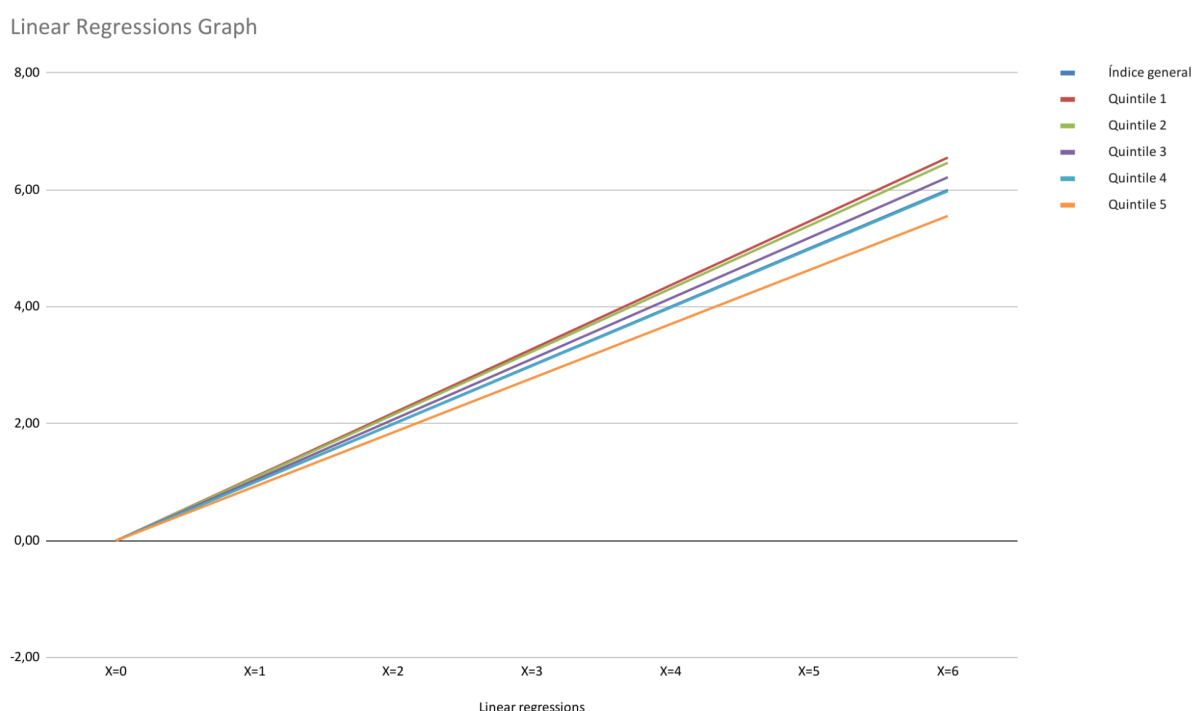


Fig. 3 General Index Regression

Source: Own elaboration

Quintile 1

The coefficient of 1.092 for Quintile 1 indicates that the lowest-income households experience a 1.092% increase in their price index for every 1% increase in overall inflation. This suggests that lower-income households are notably more affected by inflation than the general index. This higher sensitivity can be attributed to the fact that a large portion of their spending is allocated to essential goods such as food, energy, and transportation, which tend to be more volatile. Macroeconomic factors such as the 2008 financial crisis and the COVID-19 pandemic have increased price volatility in

these essential goods. Government policies, such as energy subsidies and direct assistance to low-income households, along with ECB stimulus measures, have attempted to mitigate these effects, but the high dependence on essential goods continues to expose this group to greater inflationary risks.

Quintile 2

With a coefficient of 1.078, Quintile 2 shows that these households experience a 1.078% increase in their price index for every 1% increase in overall inflation. This result indicates that low-to-middle-income households are also notably more affected by inflation than the general index. The high sensitivity to essential goods prices and relatively low incomes compared to higher quintiles cause these households to suffer considerably from price increases. The economic recovery following the 2008 crisis has allowed these households to stabilize their consumption patterns somewhat better than Quintile 1. However, they remain vulnerable to changes in the prices of essential goods. Government support policies, such as social assistance programs and ECB interventions to keep interest rates low, have helped contain inflation for these households, although they still face significant impacts.

Quintile 3

The coefficient of 1.036 for Quintile 3 suggests that middle-income households experience a 1.036% increase in their price index for every 1% increase in overall inflation. This group, representing middle incomes, spends on a variety of goods and services, including both essential and discretionary items. Macroeconomic factors such as labor market fluctuations and the 2008 crisis have had a significant impact on this group, reducing their spending capacity on non-essential goods during recession periods. Policies such as labor market reforms and tax incentives have been essential to support this group, enabling them to recover and maintain their purchasing power during times of inflation. However, these households still remain somewhat affected by inflation.

Quintile 4

The coefficient of 0.996 for Quintile 4 indicates that these households experience a 0.996% increase in their price index for every 1% increase in overall inflation. This suggests that higher-income households are affected by inflation to a degree similar to the general index. This group, which allocates a larger proportion of its income to more volatile-priced goods and services such as luxury goods and high-end services, is influenced by economic recovery and asset price variations. Economic and fiscal policies, such as investment incentives and the stability in interest rates provided by the ECB, have been crucial in containing inflation in this segment, although their sensitivity remains high due to their diversified consumption. These households, despite their greater financial capacity allowing for better maneuvering against inflation, do not benefit from it as much as we will see is the case for Quintile 5.

Quintile 5

With a coefficient of 0.926, Quintile 5 shows that the highest-income households experience a 0.926% increase in their price index for every 1% increase in overall inflation. This suggests that these households are less affected by inflation compared to the general index, but still face significant impacts. This can be explained by their ability to adjust their consumption and allocate a greater proportion of their income to investments and savings, which are less affected by inflation. Additionally, Quintile 5 households tend to have higher financial literacy, allowing them to manage their finances more effectively and better protect themselves against inflation. ECB policies, such as low interest rates and asset purchase programs, along with fiscal policies favoring investment, have contributed to this lower sensitivity, providing a cushion against inflationary fluctuations. Nevertheless, the inflation burden remains notable.

4.3.4 Analyses of Variances

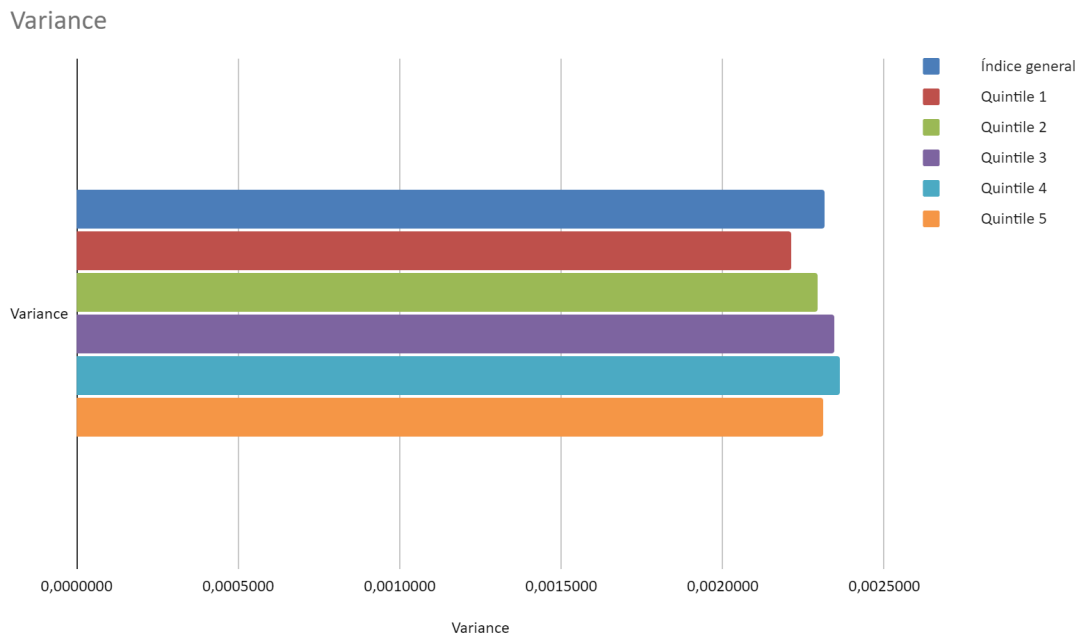


Fig. 4: Variances per Quintile

Source: Own source

The variances reflect the dispersion of data around the fitted regression lines. The variance of the general index is 0.0023135. Quintile 1 has lower variability (0.0022127), indicating stability in the prices of essential goods. Quintile 2, with a variance of 0.0022937, reflects the general average. Quintile 3 shows greater variability (0.0023463) due to a mix of essential and discretionary goods. Quintile 4 has the highest variance (0.0023624), suggesting high dispersion in the prices of luxury goods and services. Quintile 5, with a variance of 0.0023105, is similar to the general index, showing stability due to diversified consumption.

In summary, higher-income quintiles show greater variability, especially Quintile 4, while lower-income quintiles present lower variability. This underscores the need for policies to address inequalities in inflationary impacts.

4.4 Spread Analyses on the CPI's for Category and Quintile Over Time

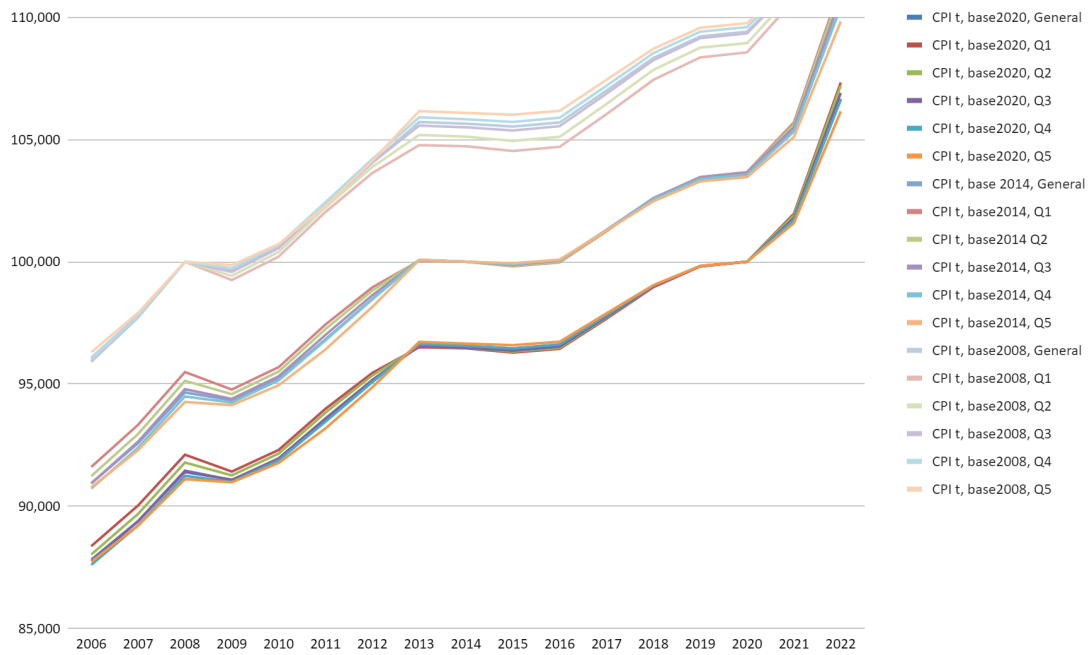


Fig. 5: Spread analyses for quintiles over time
 Source: Own source



Fig. 6: Spread analyses for quintiles per periods with base years 2020, 2014 and 2008
 Source: Own source

During the Financial Crisis (2006-2013), the spread between quintiles increased significantly after 2008, indicating that economic crises tend to widen income inequality. Lower-income households faced greater financial instability and higher unemployment rates, making them more vulnerable to economic shocks, whereas higher-income households had financial buffers that mitigated the impact. We are also able to observe how the different period effects on the income distribution, despite not aggravating inequality in low inflationary eras, persist over time which could evolve into structural problems.

During the Low Inflationary Period (2013-2019) period, the spread between quintiles remained relatively stable. The minimal differences in inflation impact suggest that low inflation periods help maintain economic equality. Factors contributing to this stability include economic recovery efforts, social policies, and interventions by the ECB, which ensured a uniform economic environment across income groups.

The Covid Crisis (2019-2022) saw a significant increase in the spread between quintiles, more pronounced than during the Financial Crisis. Lower-income households were disproportionately affected by job losses and price fluctuations in essential goods, while higher-income households benefited from flexible work arrangements and greater savings. This highlights that unexpected economic shocks can greatly widen income inequality.

Economic shocks widen the inflation impact spread across income quintiles, increasing inequality. In contrast, low inflation periods help maintain economic stability and

equality. These findings emphasize the need for targeted policies to mitigate the adverse effects of inflation, particularly during crises, to promote a more equitable economic environment. Moreover, if we take a look at cumulative inflation for all the quartiles in the periods the COVID crisis has around a 7% inflation entailing a yearly inflation of 1,7%, and the financial crisis also has an inflation rate of around 7% with a yearly inflation rate of approximately 0,9%, in contrast we see that the inflation for the low inflation period is roughly 2,4% with a yearly rate of 0,4%, considering this applies equally for all categories giving us a better numeric notion of the evolution of the data and interpretation of the same over time.

5 Main Conclusions

5.1 Summary of Findings

The analysis reveals that inflation impacts different income quintiles in Spain unevenly, with higher-income households often experiencing greater inflationary effects in categories such as health, and education, while lower-income households are notably more affected by essential goods. The econometric analysis showed that lower-income groups, represented by Quintiles 1 and 2, are more sensitive to inflation, reflecting their higher expenditure on essential goods. Higher-income groups (Quintiles 4 and 5) showed less sensitivity, suggesting their ability to mitigate inflation's impact through diversified consumption and financial strategies. Additionally, economic shocks, such as the Financial and the COVID-19 crisis, tend to widen the income distribution gap, while low inflation periods help maintain economic equality. It is also worth noting that different inflationary periods affect income distribution, and even though low inflation periods do not aggravate inequality, their effects persist over time and might lead to long-term structural issues.

5.2 Comparison with Existing Literature

These findings align with the existing literature, which also indicates that lower-income households are more adversely affected by inflation. Notwithstanding, it's worth mentioning that the Spanish context highlights strong social policies and subsidies that provide some cushion for lower-income groups, in spite of this, the lower-income population is still significantly more affected in comparison to higher-income groups. Studies by Coibion et al., Chamon et al., and Horvath and Le Vinh suggest similar trends, but the unique policy environment in Spain, including energy subsidies and social assistance programs, plays a crucial role in trying to reshape these dynamics.

5.3 Practical Implications of the Results and Recommendations

The findings underscore the importance of targeted policies to protect vulnerable populations from inflation. Policymakers should focus on:

Implementing Agile Subsidies and Price Controls; maintaining and enhancing subsidies for essential goods and services, especially, in the presence of economic shocks to protect lower-income households from inflationary pressures.

Promoting Advancement: Encouraging competition, digitalization, and innovation in key sectors such as transport and communications or alimentation to reduce costs and stabilize prices.

Monitoring and Adjusting CPI Weights: Ensuring that the CPI weights accurately reflect current consumption patterns, particularly for urban populations, to better capture the inflation experienced by different income groups

5.4 Recap of Limitations and Ways to Address Them

The study has several limitations. The reliance on data from the Spanish National Institute of Statistics (INE) may not capture all nuances of urban consumption patterns, leading to potential discrepancies. Moreover, the study focuses solely on Spain, limiting the generalizability of the findings. Future research could address these limitations by including more diverse data sources, considering urban-specific indices, and conducting comparative studies across different countries to provide a broader perspective on inflation's impact on income distribution. Lastly as mentioned in the methodologies the regressions used and the lack of controls can notably influence the accuracy and reliability of the estimations and data obtained

5.5 Final Thoughts

In conclusion, the study highlights the uneven impact of inflation across different income quintiles in Spain, emphasizing the role of targeted policies in mitigating these effects. The analysis underscores the importance of maintaining low inflation to promote economic stability and equality. By enhancing social safety nets, promoting competition, and implementing flexible policies, policymakers can better address the challenges posed by inflation and ensure a more equitable economic environment for all income groups. This study contributes to the understanding of inflation's impact on income distribution and provides valuable insights for shaping effective economic policies.

"The policy maker must ensure the safety and equity of all citizens by implementing fair policies that neither favor nor harm any group deliberately."

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7 Annexes

Annex 1: Total expenditure per categories and quintiles of households, individuals, vertical and horizontal percentages.

Gasto total, gastos medios y distribución del gasto de los hogares						
Gasto medio por hogar, gasto medio por persona y distribución del gasto (porcentajes verticales y horizontales) por grupos de gasto y por quintiles de gasto						
Gasto medio por hogar, gasto medio por persona y distribución del gasto (porcentajes verticales y horizontales) por grupos de gasto y por quintiles de gasto						
Unidades: €, %						
	2022	2021	2020	2019	2018	2017
Gasto medio por hogar						
Total						
Índice general	31.567,71	29.243,61	26.995,76	30.242,76	29.871,28	29.188,1
01 Alimentos y bebidas no alcohólicas	5.050,24	4.805,82	4.578,87	4.286,00	4.223,33	4.107,6
02 Bebidas alcohólicas y tabaco	480,75	495,63	510,21	516,29	518,88	536,2
03 Vestido y calzado	1.231,61	1.155,97	1.009,03	1.417,49	1.463,11	1.514,8
04 Vivienda, agua, electricidad, gas y combustible	10.242,59	9.893,03	9.621,46	9.441,17	9.180,75	8.774,1
05 Muebles, artículos del hogar y artículos de decoración	1.298,13	1.286,20	1.170,34	1.330,46	1.371,91	1.337,5
06 Sanidad	1.228,27	1.203,71	1.000,96	1.047,71	1.009,72	980,3
07 Transporte	3.794,37	3.230,17	2.741,47	3.888,03	3.790,21	3.667,2
08 Comunicaciones	924,61	936,62	939,69	946,12	964,01	929,6
09 Ocio y cultura	1.534,44	1.293,60	1.125,89	1.653,69	1.643,16	1.662,1
10 Enseñanza	467,57	438,59	437,28	480,59	460,66	414,2
11 Restaurantes y hoteles	2.953,27	2.288,09	1.752,21	2.944,35	2.947,56	3.002,7
12 Otros bienes y servicios	2.363,88	2.216,18	2.108,35	2.290,88	2.297,98	2.261,3
Quintil 1						
Índice general	15.573,89	14.534,83	13.497,60	14.324,20	14.075,96	13.734,1
01 Alimentos y bebidas no alcohólicas	3.187,63	3.001,45	2.983,37	2.901,76	2.860,54	2.788,5
02 Bebidas alcohólicas y tabaco	236,08	237,36	260,05	318,86	311,22	341,0
03 Vestido y calzado	503,71	445,50	355,54	519,75	522,15	515,7
04 Vivienda, agua, electricidad, gas y combustible	6.640,44	6.339,99	5.944,75	5.792,81	5.631,70	5.437,2
05 Muebles, artículos del hogar y artículos de decoración	464,80	457,17	423,22	465,56	444,39	439,6
06 Sanidad	402,74	400,70	334,83	359,11	326,06	308,7
07 Transporte	1.027,19	836,57	669,65	1.004,92	1.062,37	983,5
08 Comunicaciones	693,01	692,41	703,37	641,54	665,65	634,4
09 Ocio y cultura	416,36	370,70	305,78	428,95	412,00	417,0
10 Enseñanza	133,02	111,60	112,20	97,51	93,88	82,0
11 Restaurantes y hoteles	758,06	562,88	431,16	799,50	766,31	811,0
12 Otros bienes y servicios	1.110,83	1.078,50	973,68	993,93	979,69	974,9

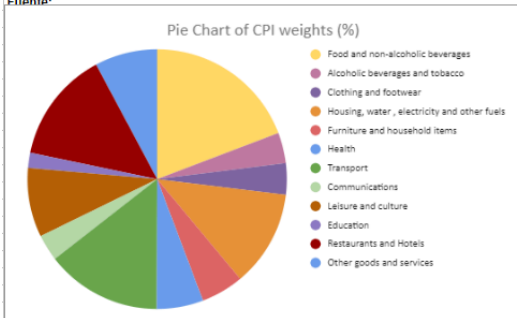
Annex 2: Descriptive Analyses: Monthly Spanish CPI evolution, Linear trends of CPI's categories (2024-2002), and Pie Chart of CPI's weighted average composition according to INE.

	Índice															
	2024M04	2024M03	2024M02	2024M01	2023M12	2023M11	2023M10	2023M09	2023M08	2023M07	2023M06	2023M05	2023M04	2023M03	2023M02	2023M01
Índice general	115,472	114,674	113,807	113,404	113,308	113,280	113,076	113,348	113,140	112,544	112,354	111,719	111,773	111,111	110,703	109,888
01 Food and non-alcoholic beverages	129,317	128,439	128,357	128,395	127,728	127,761	127,630	126,029	125,420	125,193	124,245	123,935	123,474	123,144	121,849	119,498
02 Alcoholic beverages and tobacco	116,374	116,088	116,028	114,299	111,879	112,505	112,555	112,487	112,135	112,073	111,976	111,694	111,839	111,575	110,847	109,853
03 Clothing and footwear	108,812	101,600	99,217	101,057	113,150	114,238	109,614	100,897	98,313	98,918	109,585	110,465	107,954	100,440	97,357	98,595
04 Housing, water, electricity and other fuels	106,295	105,747	103,426	104,745	101,376	100,848	102,309	103,028	102,818	102,815	102,744	101,889	102,225	104,138	108,287	103,156
05 Furniture and household items	112,882	112,312	112,134	112,007	112,330	112,289	112,175	111,844	111,730	111,617	112,367	112,130	111,823	111,173	110,557	110,157
06 Health	104,900	104,598	104,269	103,942	103,748	103,655	103,527	103,483	103,347	103,306	103,073	102,858	102,722	102,424	102,051	101,743
07 Transport	114,355	113,628	113,057	111,209	111,137	112,508	114,176	115,170	113,997	110,807	110,153	109,471	111,156	110,399	110,368	111,388
08 Communications	102,483	102,375	102,467	102,546	100,624	100,745	100,839	101,909	102,120	102,085	102,282	102,553	102,600	101,963	102,079	101,988
09 Leisure and culture	108,649	109,133	107,212	108,078	108,375	105,913	107,440	108,876	112,511	111,487	108,187	105,929	106,347	105,196	104,261	102,902
10 Education	105,389	105,380	105,304	105,259	105,224	105,178	105,012	103,831	102,494	102,462	102,473	102,466	102,461	102,458	102,428	102,378
11 Restaurants and Hotels	118,410	117,418	116,379	115,299	115,408	115,212	115,778	115,524	115,433	115,114	114,372	113,349	112,952	111,285	110,328	109,379
12 Other goods and services	111,277	110,816	110,595	109,916	109,424	109,393	109,220	109,093	109,051	108,805	108,906	108,136	108,105	107,638	107,064	106,349

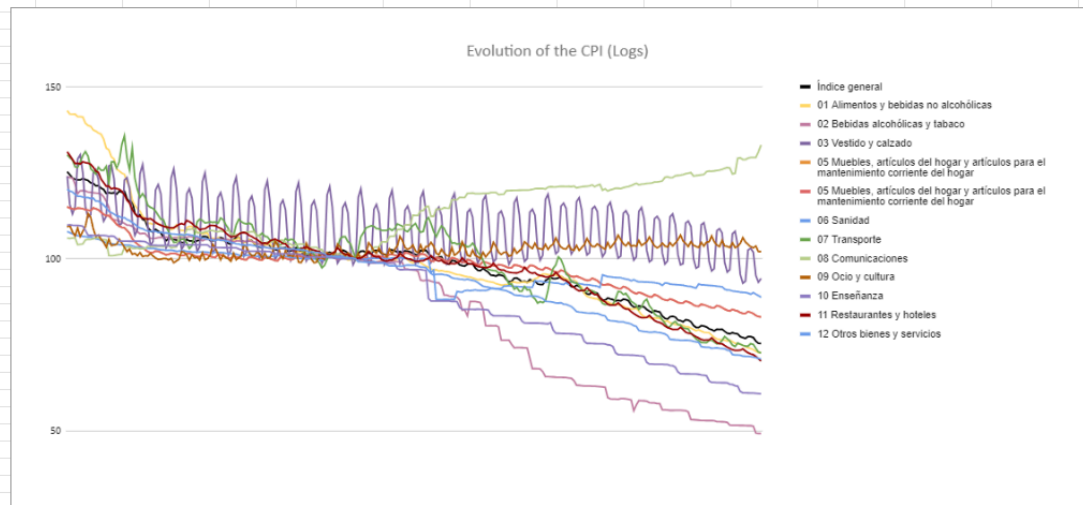
112,2194167

Notas:

Fuente:



Sectores	Ponderaciones (%)	Índice
1 Food and non-alcoholic beverages	0,192	24,828864
2 Alcoholic beverages and tobacco	0,038	4,422212
3 Clothing and footwear	0,039	4,243668
4 Housing, water, electricity and other fuels	0,12	12,7554
5 Furniture and household items	0,053	5,972146
6 Health	0,058	6,0842
7 Transport	0,144	16,46712
8 Communications	0,033	3,381939
9 Leisure and culture	0,086	9,343614
10 Education	0,019	2,002391
11 Restaurants and Hotels	0,139	16,45899
12 Other goods and services	0,078	8,679606



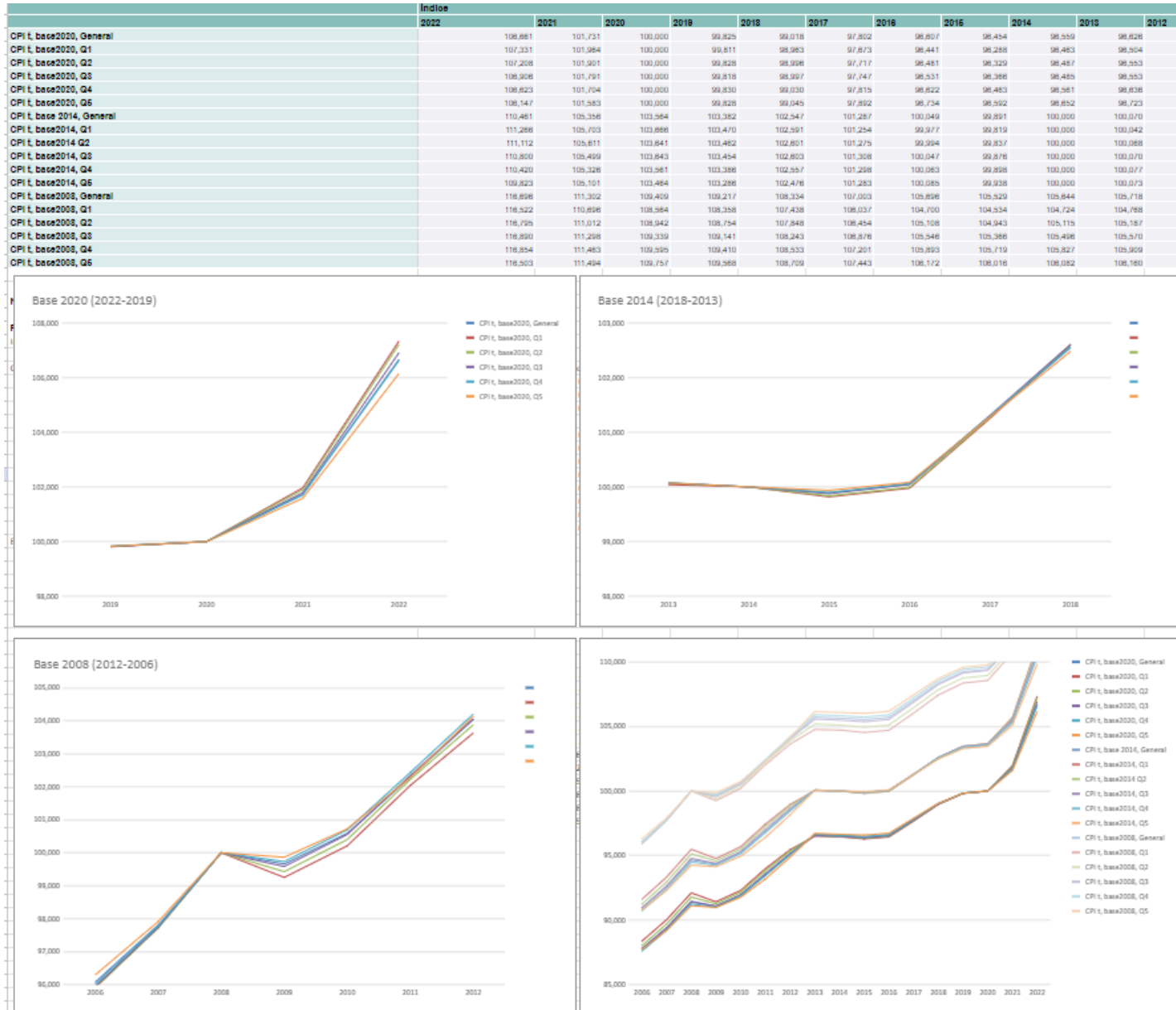
Annex 3: Yearly Sumations of the Spanish CPI between 2022 and 2006.

	2022	2021	2020	2019	2018	2017	2016	2015	2014	2013	2012	2
Yearly Sum of the general and segregated CPI												
Sumatorio anual del ICP general y por categorías												
Índice general	108,39	100,00	97,00	97,31	96,64	95,05	93,22	93,41	93,88	94,02	92,72	
01 Alimentos y bebidas no alcohólicas	111,64	100,00	98,19	95,93	94,95	93,41	92,27	91,00	89,94	90,26	87,81	
02 Bebidas alcohólicas y tabaco	103,87	100,00	99,70	99,16	98,50	96,70	95,09	94,62	93,36	92,03	86,75	
03 Vestido y calzado	102,67	100,00	98,99	98,02	97,12	96,29	95,83	95,22	94,91	94,81	94,77	
04 Vivienda, agua, electricidad, gas y	115,50	100,00	89,98	93,28	94,66	92,48	88,99	92,93	94,93	93,69	92,84	
05 Muebles, artículos del hogar y artíc	106,34	100,00	99,07	98,69	98,05	97,92	98,35	98,20	98,42	98,96	98,05	
06 Sanidad	101,10	100,00	99,32	98,96	98,16	97,87	97,15	97,39	97,25	97,12	90,87	
07 Transporte	112,15	100,00	93,20	96,87	95,77	92,48	88,78	90,64	94,88	95,79	95,40	
08 Comunicaciones	98,75	100,00	103,09	104,33	103,53	101,26	99,96	97,46	99,28	105,73	110,40	
09 Ocio y cultura	102,80	100,00	99,84	100,45	100,91	101,10	100,03	100,99	101,38	102,77	102,03	
10 Enseñanza	101,25	100,00	99,85	99,25	98,29	97,53	96,64	96,05	95,04	93,39	86,41	
11 Restaurantes y hoteles	106,40	100,00	99,14	98,07	96,15	94,33	92,61	91,59	90,83	90,39	89,94	
12 Otros bienes y servicios	103,52	100,00	99,01	97,63	96,26	95,42	94,58	93,10	91,64	90,75	88,93	
IPC Growth (Variation)												
Variación IPC												
Índice general	8,39%	3,09%	-0,32%	0,70%	1,67%	1,96%	-0,20%	-0,50%	-0,15%	1,41%	2,45%	
01 Alimentos y bebidas no alcohólicas	11,64%	1,85%	2,35%	1,03%	1,65%	1,23%	1,40%	1,17%	-0,35%	2,79%	2,33%	
02 Bebidas alcohólicas y tabaco	3,67%	0,30%	0,54%	0,67%	1,86%	1,70%	0,49%	1,36%	1,45%	6,09%	5,91%	
03 Vestido y calzado	2,67%	1,02%	0,99%	0,93%	0,86%	0,48%	0,63%	0,33%	0,11%	0,04%	0,27%	
04 Vivienda, agua, electricidad, gas y	15,51%	11,14%	-3,54%	-1,46%	2,36%	3,92%	-4,24%	-2,11%	1,33%	0,91%	5,07%	
05 Muebles, artículos del hogar y artíc	6,34%	0,94%	0,38%	0,65%	0,14%	-0,44%	0,16%	-0,22%	-0,55%	0,93%	0,88%	
06 Sanidad	1,10%	0,68%	0,37%	0,81%	0,29%	0,74%	-0,24%	0,14%	0,13%	6,88%	3,54%	
07 Transporte	12,15%	7,30%	-3,79%	1,14%	3,56%	4,17%	-2,06%	-4,47%	-0,95%	0,41%	4,79%	
08 Comunicaciones	-1,25%	-2,99%	-1,20%	0,77%	2,24%	1,30%	2,56%	-1,82%	-6,11%	-4,23%	-3,39%	
09 Ocio y cultura	2,80%	0,16%	-0,61%	-0,46%	-0,19%	1,07%	-0,95%	-0,38%	-1,36%	0,73%	0,69%	
10 Enseñanza	1,25%	0,15%	0,60%	0,97%	0,79%	0,92%	0,61%	1,07%	1,77%	8,08%	4,80%	
11 Restaurantes y hoteles	6,40%	0,87%	1,09%	2,00%	1,92%	1,86%	1,11%	0,84%	0,48%	0,50%	0,89%	
12 Otros bienes y servicios	3,52%	1,00%	1,42%	1,39%	0,90%	0,89%	1,59%	1,59%	0,99%	2,04%	2,33%	
IPC Growth fixed 2020 (Variation)												
Variación IPC ponderado												
Índice general	11,74%	3,09%	0,00%	0,32%	-0,37%	-2,01%	-3,89%	-3,70%	-3,21%	-3,07%	-4,41%	
01 Alimentos y bebidas no alcohólicas	13,70%	1,85%	0,00%	-2,30%	-3,30%	-4,87%	-6,02%	-7,32%	-8,40%	-8,08%	-10,57%	
02 Bebidas alcohólicas y tabaco	4,18%	0,30%	0,00%	-0,54%	-1,20%	-3,01%	-4,62%	-5,09%	-6,36%	-7,70%	-12,99%	
03 Vestido y calzado	3,72%	1,02%	0,00%	-0,96%	-1,90%	-2,73%	-3,20%	-3,81%	-4,12%	-4,23%	-4,27%	
04 Vivienda, agua, electricidad, gas y	28,37%	11,14%	0,00%	3,67%	5,21%	2,79%	-1,09%	3,29%	5,51%	4,13%	3,19%	
05 Muebles, artículos del hogar y artíc	7,34%	0,94%	0,00%	-0,38%	-1,03%	-1,16%	-0,72%	-0,88%	-0,66%	-0,11%	-1,03%	
06 Sanidad	1,79%	0,68%	0,00%	-0,37%	-1,17%	-1,46%	-2,19%	-1,95%	-2,09%	-2,21%	-8,51%	
07 Transporte	20,34%	7,30%	0,00%	3,94%	2,76%	-0,77%	-4,74%	-2,74%	1,81%	2,78%	2,36%	
08 Comunicaciones	-4,21%	-2,99%	0,00%	1,21%	0,43%	-1,77%	-3,03%	-5,45%	-3,70%	2,57%	7,10%	
09 Ocio y cultura	2,96%	0,16%	0,00%	0,61%	1,07%	1,26%	0,19%	1,15%	1,54%	2,93%	2,19%	
10 Enseñanza	1,41%	0,15%	0,00%	-0,60%	-1,55%	-2,32%	-3,21%	-3,80%	-4,81%	-6,46%	-13,46%	
11 Restaurantes y hoteles	7,33%	0,87%	0,00%	-1,08%	-3,01%	-4,84%	-6,58%	-7,61%	-8,38%	-8,62%	-9,27%	
12 Otros bienes y servicios	4,55%	1,00%	0,00%	-1,40%	-2,76%	-3,63%	-4,47%	-5,97%	-7,44%	-8,35%	-10,18%	

Annex 4: Expenditure shares per category in 2020 with Indexes per categories in t, 2020 and CPI's, t, base 2020, generic and per quintil.

	2022	2021	2020	2019	2018	2017	2016	2015	2014
Expenditure Share on i n t									
Total	BASE 2020 (general)	BASE 2020 (Q1)	BASE 2020 (Q2)	BASE 2020 (Q3)	BASE 2020 (Q4)	BASE 2020 (Q5)			
Índice general	1,000	1,000	1,000	1,000	1,000	1,000	1,000		
01 Alimentos y bebidas no alcohólicas	0,170	0,221	0,215	0,195	0,167	0,125			
02 Bebidas alcohólicas y tabaco	0,019	0,019	0,021	0,021	0,020	0,016			
03 Vestido y calzado	0,037	0,026	0,031	0,036	0,040	0,042			
04 Vivienda, agua, electricidad, gas y otros	0,356	0,440	0,397	0,370	0,344	0,317			
05 Muebles, artículos del hogar y artículos	0,043	0,031	0,036	0,038	0,044	0,052			
06 Sanidad	0,037	0,025	0,031	0,034	0,041	0,042			
07 Transporte	0,102	0,050	0,065	0,080	0,097	0,145			
08 Comunicaciones	0,035	0,052	0,045	0,038	0,033	0,025			
09 Ocio y cultura	0,042	0,023	0,031	0,038	0,045	0,051			
10 Enseñanza	0,016	0,008	0,010	0,014	0,018	0,021			
11 Restaurantes y hoteles	0,065	0,032	0,042	0,057	0,073	0,083			
12 Otros bienes y servicios	0,078	0,072	0,076	0,078	0,077	0,081			
Index per category i t,2020									
01 Alimentos y bebidas no alcohólicas	1,117	1,031	1,000	1,003	0,996	0,980	0,961	0,963	0,968
02 Bebidas alcohólicas y tabaco	1,137	1,018	1,000	0,977	0,967	0,951	0,940	0,927	0,916
03 Vestido y calzado	1,042	1,003	1,000	0,995	0,988	0,970	0,954	0,949	0,936
04 Vivienda, agua, electricidad, gas y otros	1,037	1,010	1,000	0,990	0,981	0,973	0,968	0,962	0,959
05 Muebles, artículos del hogar y artículos	1,284	1,111	1,000	1,037	1,052	1,028	0,989	1,033	1,055
06 Sanidad	1,073	1,009	1,000	0,996	0,990	0,988	0,993	0,991	0,993
07 Transporte	1,018	1,007	1,000	0,996	0,988	0,985	0,978	0,981	0,979
08 Comunicaciones	1,203	1,073	1,000	1,039	1,028	0,992	0,953	0,973	1,018
09 Ocio y cultura	0,958	0,970	1,000	1,012	1,004	0,982	0,970	0,945	0,963
10 Enseñanza	1,030	1,002	1,000	1,006	1,011	1,013	1,002	1,012	1,015
11 Restaurantes y hoteles	1,014	1,002	1,000	0,994	0,984	0,977	0,968	0,962	0,952
12 Otros bienes y servicios	1,073	1,009	1,000	0,989	0,970	0,952	0,934	0,924	0,916
CPI t, base2020, General	1,067	1,017	1,000	0,998	0,990	0,978	0,966	0,965	0,966
CPI t, base2020, Q1	1,073	1,020	1,000	0,998	0,990	0,977	0,964	0,963	0,965
CPI t, base2020, Q2	1,072	1,019	1,000	0,998	0,990	0,977	0,965	0,963	0,965
CPI t, base2020, Q3	1,069	1,018	1,000	0,998	0,990	0,977	0,965	0,964	0,965
CPI t, base2020, Q4	1,066	1,017	1,000	0,998	0,990	0,978	0,966	0,965	0,966
CPI t, base2020, Q5	1,061	1,016	1,000	0,998	0,990	0,979	0,967	0,966	0,967

Annex 5: Spread Analyses: CPI's with bases 2008, 2014, and 2020 for General Index and the 5 Income distribution quintiles, and visual representation of the Spread analysis per period and combined.

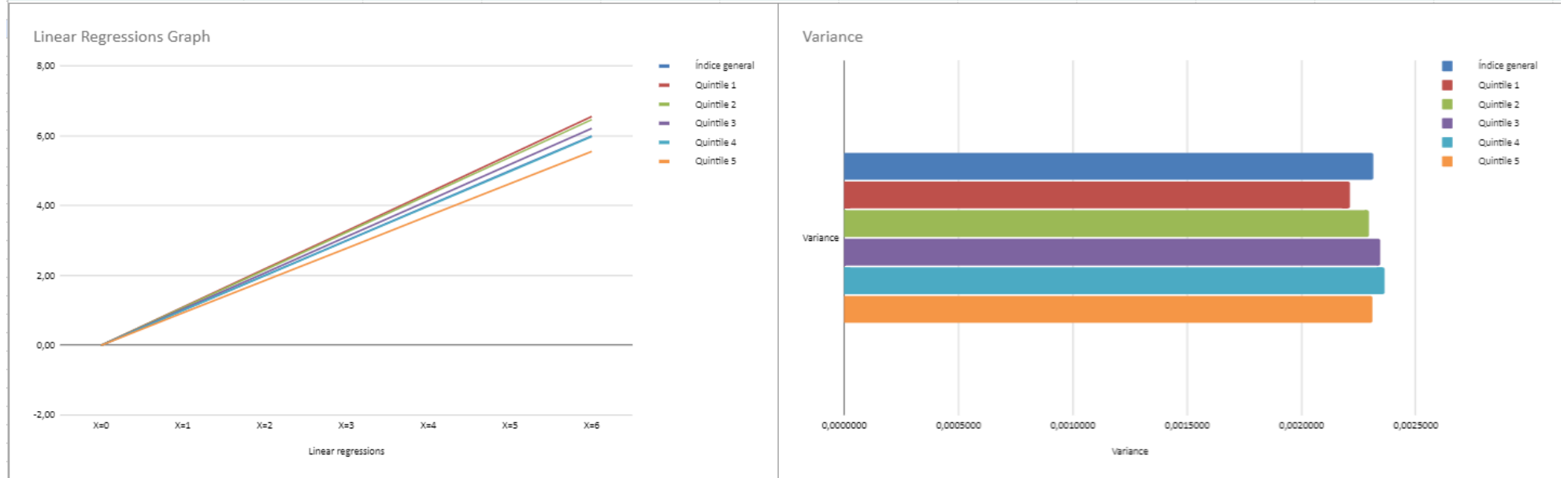


Annex 6: Growth rates for the CPI's, t, base 2020, generic and per quintil.

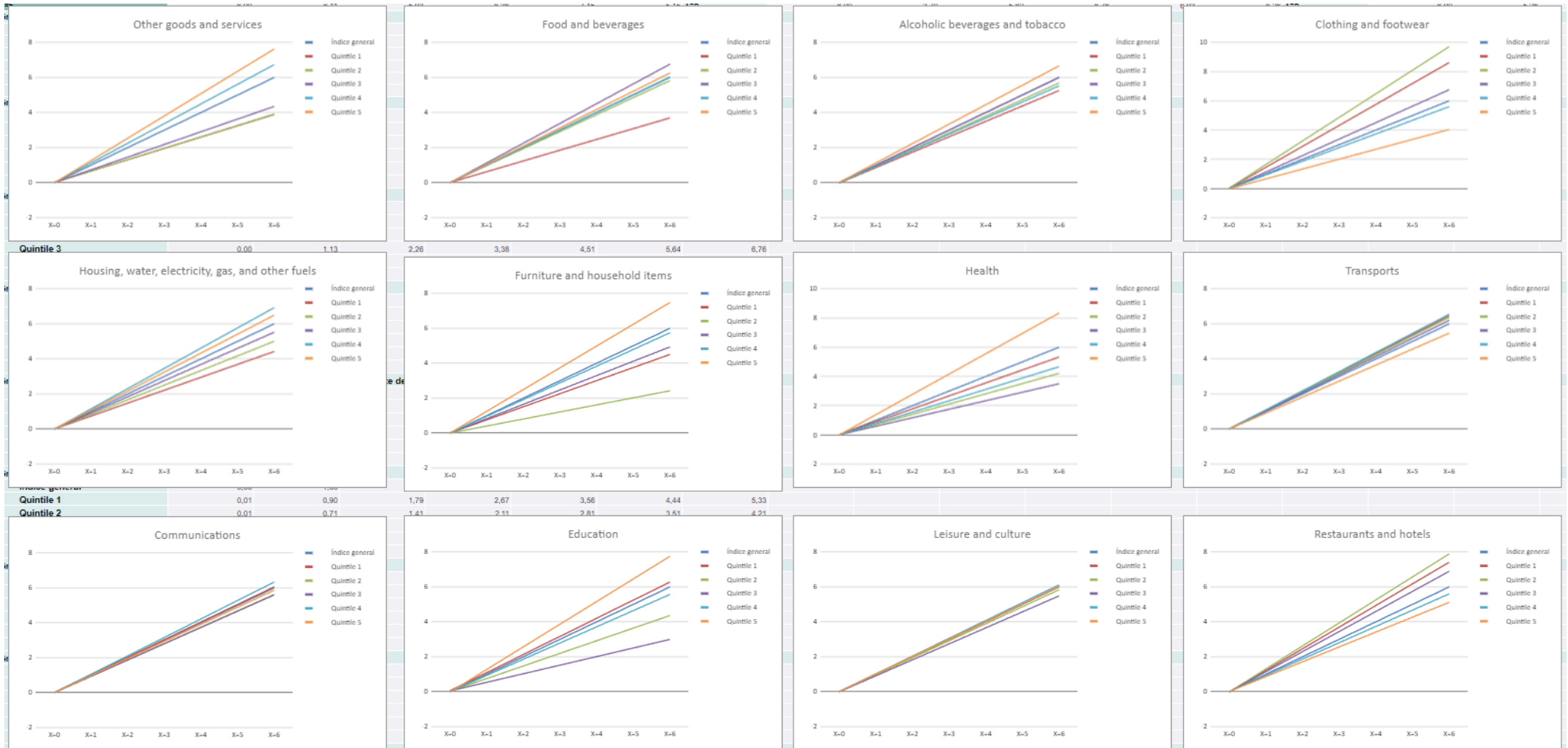
Growth rates for CPI's					
Units: %					
	2022	2021	2020	2019	2018
Gasto medio por hogar					
Growth rates of					
CPI t, base2020, General	4,85%	1,73%	0,18%	0,81%	1,24%
CPI t, base2020, Q1	5,26%	1,96%	0,19%	0,86%	1,32%
CPI t, base2020, Q2	5,21%	1,90%	0,17%	0,84%	1,31%
CPI t, base2020, Q3	5,02%	1,79%	0,18%	0,83%	1,28%
CPI t, base2020, Q4	4,84%	1,70%	0,17%	0,81%	1,24%
CPI t, base2020, Q5	4,49%	1,58%	0,17%	0,79%	1,18%

Annex 7: Econometric Analyses: Linear regression and Variance Analysis.

Linear regressions	Coefficient	Intercept	R2	Variance	X=0	X=1	X=2	X=3	X=4	X=5	X=6
Índice general	1,000	0,0000	0,000	0,0023135	0	1	2	3	4	5	6
Quintile 1	1,092	-0,0011	0,040	0,0022127	0,00	1,09	2,18	3,28	4,37	5,46	6,55
Quintile 2	1,078	-0,0008	0,027	0,0022937	0,00	1,08	2,15	3,23	4,31	5,39	6,47
Quintile 3	1,038	-0,0002	0,012	0,0023463	0,00	1,04	2,07	3,11	4,14	5,18	6,22
Quintile 4	0,998	0,0002	0,005	0,0023624	0,00	1,00	1,99	2,99	3,99	4,98	5,98
Quintile 5	0,928	0,0007	0,027	0,0023105	0,00	0,93	1,85	2,78	3,70	4,63	5,58



Annex 8: Expenditure Share Compositions per Quintiles for all the Categories in form of Linear Regressions




Annex 9: Real Income analysis by using Adjusted Earnings to CPI Indexes formed on Expenditure Composition

	2022	2021	2020	2019	2018	2017	2016	2015	2014	2013	2012
Adjusted Earnings analysis (porcentajes verticales)											
Total											
Índice general	29.124,01	29.243,59	27.830,75	31.077,55	30.910,54	30.709,59	Recorte 30.250,13	29.410,74	28.855,40	28.876,58	30.411,76
01 Alimentos y bebidas no alcohólicas	4.859,84	4.804,72	4.720,10	4.403,69	4.370,75	4.320,84	4.422,57	4.417,49	4.290,80	4.357,48	4.464,45
02 Bebidas alcohólicas y tabaco	442,68	494,22	526,00	531,43	537,84	565,06	574,75	558,80	542,48	565,98	623,44
03 Vestido y calzado	1.135,84	1.155,12	1.040,87	1.457,54	1.514,62	1.593,83	1.557,88	1.494,07	1.465,85	1.435,17	1.514,51
04 Vivienda, agua, electricidad, gas y	9.450,74	9.893,11	9.918,88	9.702,41	9.400,00	9.400,00	9.400,00	9.400,00	9.400,00	9.400,00	9.813,88
05 Muebles, artículos del hogar y artí	1.197,00	1.288,72	1.207,85	1.367,41	1.400,00	1.400,00	1.400,00	1.400,00	1.400,00	1.400,00	1.338,12
06 Sanidad	1.132,92	1.204,84	1.032,52	1.075,28	1.000,00	1.000,00	1.000,00	1.000,00	1.000,00	1.000,00	967,09
07 Transporte	3.500,71	3.231,42	2.827,80	3.996,57	3.900,00	3.900,00	3.900,00	3.900,00	3.900,00	3.900,00	3.582,51
08 Comunicaciones	853,33	935,79	988,51	972,73	900,00	900,00	900,00	900,00	900,00	900,00	927,58
09 Ocio y cultura	1.415,43	1.292,57	1.160,54	1.699,94	1.700,00	1.700,00	1.700,00	1.700,00	1.700,00	1.700,00	1.800,38
10 Enseñanza	431,04	438,65	460,86	494,13	400,00	400,00	400,00	400,00	400,00	400,00	389,27
11 Restaurantes y hoteles	2.728,01	2.288,85	1.806,22	3.028,95	3.000,00	3.000,00	3.000,00	3.000,00	3.000,00	3.000,00	2.703,61
12 Otros bienes y servicios	2.181,39	2.216,66	2.173,58	2.352,57	2.300,00	2.300,00	2.300,00	2.300,00	2.300,00	2.300,00	2.288,96
Quintil 1											
Índice general	29.124,01	29.243,59	27.830,75	31.077,55	30.910,54	30.709,59	30.250,13	29.410,74	28.855,40	28.876,58	30.411,76
01 Alimentos y bebidas no alcohólicas	5.961,69	6.038,80	6.150,60	6.266,31	6.200,00	6.200,00	6.200,00	6.200,00	6.200,00	6.200,00	6.377,35
02 Bebidas alcohólicas y tabaco	442,68	476,67	537,13	603,03	600,00	600,00	600,00	600,00	600,00	600,00	683,69
03 Vestido y calzado	940,71	897,78	731,95	1.128,12	1.100,00	1.100,00	1.100,00	1.100,00	1.100,00	1.100,00	1.109,99
04 Vivienda, agua, electricidad, gas y	12.418,48	12.756,05	12.256,66	12.567,76	12.300,00	12.300,00	12.300,00	12.300,00	12.300,00	12.300,00	12.398,88
05 Muebles, artículos del hogar y artí	867,90	921,17	873,89	1.010,02	900,00	900,00	900,00	900,00	900,00	900,00	854,57
06 Sanidad	754,31	807,12	690,20	780,05	700,00	700,00	700,00	700,00	700,00	700,00	504,84
07 Transporte	1.922,18	1.684,43	1.380,41	2.181,64	2.300,00	2.300,00	2.300,00	2.300,00	2.300,00	2.300,00	2.299,13
08 Comunicaciones	1.296,02	1.391,99	1.449,98	1.392,27	1.400,00	1.400,00	1.400,00	1.400,00	1.400,00	1.400,00	1.216,47
09 Ocio y cultura	777,61	745,71	631,76	929,22	900,00	900,00	900,00	900,00	900,00	900,00	1.097,86
10 Enseñanza	247,55	225,18	231,00	211,33	200,00	200,00	200,00	200,00	200,00	200,00	139,89
11 Restaurantes y hoteles	1.418,34	1.131,73	887,80	1.734,13	1.600,00	1.600,00	1.600,00	1.600,00	1.600,00	1.600,00	1.605,74
12 Otros bienes y servicios	2.076,54	2.169,87	2.006,60	2.156,78	2.151,37	2.180,38	2.081,21	1.864,05	1.846,75	1.845,21	1.949,39
Quintil 2											
Índice general	29.124,01	29.243,59	27.830,75	31.077,55	30.910,54	30.709,59	30.250,13	29.410,74	28.855,40	28.876,58	30.411,76
01 Alimentos y bebidas no alcohólicas	5.670,44	5.918,90	5.969,70	5.612,61	5.650,45	5.524,66	5.659,80	5.576,28	5.427,70	5.526,98	5.617,05
02 Bebidas alcohólicas y tabaco	457,25	549,78	576,10	643,31	649,12	737,03	732,05	699,98	678,10	704,59	793,75
03 Vestido y calzado	1.141,66	1.082,01	854,40	1.351,87	1.403,34	1.400,36	1.367,31	1.258,78	1.235,01	1.195,49	1.325,95
04 Vivienda, agua, electricidad, gas y	11.014,70	11.238,31	11.054,37	11.107,12	10.973,24	10.890,01	10.717,62	10.758,45	10.685,15	10.629,47	10.993,85
05 Muebles, artículos del hogar y artí	969,83	1.049,84	1.010,26	1.084,61	1.162,24	1.120,90	1.076,60	997,02	988,85	932,71	1.012,71
06 Sanidad	952,36	1.011,83	854,40	913,68	887,13	909,00	892,38	791,15	724,27	739,24	745,09
07 Transporte	2.329,92	2.099,69	1.806,22	2.781,44	2.673,76	2.745,44	2.547,06	2.496,97	2.547,93	2.604,67	2.819,17
08 Comunicaciones	1.097,98	1.210,68	1.244,03	1.258,64	1.276,61	1.265,24	1.213,03	1.097,02	1.087,85	1.117,52	1.167,81
09 Ocio y cultura	1.080,11	941,64	873,89	1.227,56	1.264,24	1.292,87	1.237,23	1.311,72	1.220,58	1.238,81	1.414,15



Annex 10: Link to the Excel sheets

 TFG Database 2.xlsx