Revisiting the Consumption-Wealth Nexus: A Nonparametric Exploration

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ABSTRACT

This study investigates the relationship between non-durable consumption and asset prices in 12 developed and 11 emerging economies, members of the European Union, emphasising the presence of nonlinearities through a nonparametric framework. Utilising the Categorical Regression Splines (CRS) approach, the analysis challenges traditional parametric models by allowing data to dictate the functional form of the relationship. The findings reveal distinct consumption-wealth dynamics: income remains the key driver in the emerging economies sample, with stock market fluctuations exhibiting potentially non-linear effects. Furthermore, consumption is primarily income-driven, with housing wealth playing a more pronounced role due to less-developed mortgage and financial markets in these emerging economies. Money wealth effects vary in significance, depending on the economic context and time period. These results underscore the advantages of nonparametric methods in accurately capturing complex economic relationships, providing insights for policymakers in designing effective strategies to support household consumption and economic stability.

Keywords: *non-durable consumption, asset prices, nonparametric analysis, Categorical Regression Splines*

JEL Classification: C22, C53, E21

INTRODUCTION

The relationship between non-durable consumption and key macroeconomic variables, such as income, wealth, and interest rates, is central to understanding household behavior and macroeconomic dynamics. Although durable consumption may reveal more information about periods of economic expansion or downturn, analysing semi-durable and non-durable consumption is essential, as it can give a comprehensive understanding of the overall consumption patterns and their role in evaluating economic stability and resilience.

Non-durable consumption, which includes recurring expenditures like food and utilities, constitutes a stable component of aggregate consumption and serves as a reliable indicator of household well-being and financial resilience during periods of economic turmoil (Funke, 2004; Peltonen, 2012; de Bondt et al., 2019). During economic distress, households adjust their non-durable consumption patterns not only based on income but also changes in their asset values, reflecting their perceived wealth (Arellano et al., 2017; Coskun et al., 2022). These adjustments, however, may not always follow a linear trend, as suggested in much of the existing literature.

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Although numerous studies have examined the linear relationship between consumption and wealth, many fail to assess whether this specification appropriately captures potential nonlinearities (Casni, 2018; Nicolau, 2020; Singh, 2022, among others). Research employing non-linear frameworks has demonstrated their capacity to uncover turning points and structural breaks in these relationships, offering valuable supplementary insights (Racine and Nie, 2011; Ma and Racine, 2013; Bernard et al., 2015; Baker & Yannelis, 2017). By allowing for a flexible analysis, these methods challenge conventional assumptions and reveal particularly relevant nuances during periods of economic distress.

This paper aims to contribute to the literature by analysing the functional shape of the relationship between non-durable consumption, household wealth components (such as housing and stock prices), and interest rates in developed European and emerging economies. A key focus is uncovering nonlinearities and regime shifts in the consumption-wealth nexus. Using a flexible, nonparametric approach, precisely the Categorical Regression Splines (CRS) method proposed by Racine and Nie (2011) and Ma and Racine (2013), this study explores whether the relationship diverges from linearity and identifies potential turning points.

Beyond methodological innovation, this study provides novel empirical evidence by disaggregating household wealth and examining its influence on non-durable consumption. The analysis spans two subsamples, covering the first quarter of 2000 to the fourth quarter of 2019, and focuses on periods of economic distress while excluding the exceptional disruptions caused by the COVID-19 pandemic. This temporal segmentation enables a more precise assessment of the dynamics during economic turmoil.

Moreover, this paper identifies differences between developed and emerging economies when defining the relationship between non-durable spending and its main determinants, shedding light on the adjustments of household non-durable spending to changes in financial conditions. Understanding these variations is essential for policymakers to design tailored macroeconomic stabilisation and stimulus measures, particularly in economies experiencing pronounced asset price fluctuations.

The remainder of the paper is structured as follows. The next section reviews the relevant literature on the relationship between consumption and wealth in developed and advanced economies. The following two sections detail the data and subsamples used in the analysis and the identification strategy, and place the research question within existing theoretical frameworks. The results and their implications are discussed in a separate section, followed by conclusions, policy recommendations, and avenues for future research.

LITERATURE REVIEW

The wealth effect is a key indicator in economic theory, with an increasing interest in understanding how changes in wealth influence household consumption. While some economists argue that increased wealth significantly boosts spending and consumer confidence, others suggest that such effects are limited unless households transform their assets into liquidity, either by selling them or borrowing against them (Aruoba et al., 2019; Kaplan et al., 2020; Cocco et al., 2020; Aruoba et al., 2022). In other words, perceived increases in wealth may not directly stimulate consumption unless they translate into available resources. Despite varying views, growing empirical evidence supports a positive relationship between rising asset values and household consumption, with ongoing discussions about its magnitude and mechanisms.

In theoretical terms, the relationship between consumption and wealth is grounded in the life-cycle hypothesis (Ando and Modigliani, 1963) and the permanent income hypothesis (Friedman, 1957), both of which suggest that individuals smooth consumption based on their expected lifetime resources. However, these models typically assume a simplified and homogeneous consumption-wealth nexus. Over the recent decades, the empirical adaptation of these models has

revealed heterogeneities across types of assets considered as measures for wealth, as well as across samples and periods analysed.

While financial wealth, such as equity, may dominate household asset portfolios in developed economies, housing wealth typically constitutes a larger share of household assets in emerging economies (Singh, 2022). This composition matters because different asset classes influence consumption through distinct channels—e.g., housing wealth may affect consumption indirectly via collateral or expectations about future income, while financial wealth can be more easily transformed into liquidity (Sousa, 2009; Cocco et al., 2020).

These asset-based differences are further amplified by institutional factors. Developed economies typically feature robust financial systems, which enable greater asset liquidity and diversified investment opportunities, thereby enhancing the transmission of wealth effects into consumption (Rodil-Marzabal and Menezes-Ferreira-Junior, 2016; Kaplan et al., 2020). By contrast, emerging economies often have less-developed financial markets, limited access to credit and mortgages, and stronger precautionary saving motives—all of which may weaken or distort the expected impact of wealth on consumption (Ciarlone, 2011; Peltonen et al., 2012).

Therefore, comparing these two groups of countries is not only empirically insightful but also necessary from a theoretical standpoint, as it reveals how institutional factors and asset categories mediate the transmission of wealth effects into household consumption behaviour.

This theoretical divergence across asset types and institutional settings has motivated a growing body of empirical research focused on the distinctive wealth effects across economies. Empirical studies have extensively analysed the wealth-consumption relationship using various methodologies, including cointegration analysis and nonlinear models. Cointegration studies, such as those by Lettau and Ludvigson (2004), Ciarlone (2011), and Singh (2022), among others, typically assume linear relationships and find stable long-term interactions between consumption, income, and asset wealth. However, linear model limitations emerge during economic downturns, where nonlinear responses are more appropriate.

Focusing on specific regions, Vizek (2013) found lasting consumption responses to housing market shocks in Central and Eastern European (CEE) countries. Recent studies by Casni (2018) and Nicolau (2020) also confirmed the predominance of housing wealth effects in European emerging economies, notably before the 2008 crisis. All the above-mentioned studies employed a series of cointegration-based methodologies, from the pooled mean group (PMG) estimators to General Method of Moments (GMM) methods.

More recent literature has begun to explore alternative econometric methods that account for these heterogeneities (such as Bampinas et al., 2017), yet such studies remain limited, especially in emerging markets. Coskun et al. (2022) emphasise nonlinearities in wealth effects, identifying asymmetric and time-varying responses to housing wealth, financial wealth, income, and interest rates across 25 countries. This study finds more significant and persistent effects of housing wealth compared to financial wealth, especially during economic expansions, but does not differentiate between durable and non-durable consumption. However, it is essential to note that non-durable consumption is the more stable component of aggregate consumption, being a strong indicator of a household's financial stability and well-being. Durable consumption, on the other hand, is the more volatile component, having a procyclical evolution over time.

As for the economies that were typically the centre of attention in the empirical literature, most studies focus on developed economies, specifically the U.S., due to robust datasets. These studies generally show a positive relationship between financial wealth and consumption, influenced by asset types and macroeconomic conditions. For example, stock wealth fluctuations notably impact consumption in the U.S. (Catte, 2004; Lettau and Ludvigson, 2004). In contrast, European economies have shown that financial wealth affects consumption more than housing wealth, with Rodil-Marzabal and Menezes-Ferreira-Junior (2016) noting that this dynamic shifted during the global financial crisis.

Emerging economies, though less studied, offer valuable insights. Funke (2004) was among the first to report significant wealth effects in these markets, albeit smaller than developed ones. Subsequent research by Ciarlone (2011) showed that both housing and financial wealth positively influence consumption in these contexts, with housing wealth exerting a stronger effect. Peltonen et al. (2012) reinforced this, highlighting heightened wealth effects in countries with substantial capitalisation. Nevertheless, in the case of emerging economies from the European Union, the empirical literature is very limited (Casni, 2018; Nicolau, 2020), and so is the usage of non-linear approaches.

Comparative studies reveal key differences in wealth effects between developed and emerging economies. In developed economies, financial wealth tends to dominate, while housing wealth has a more substantial impact in emerging ones, where residential property is a significant share of household assets (Rodil-Marzabal and Menezes-Ferreira-Junior, 2016; Ciarlone, 2011). Singh (2022) further noted the transient nature of stock wealth effects in emerging markets, often due to concentrated ownership and market volatility.

This study builds on this literature by analysing the shape of the wealth-consumption relationship through a flexible nonparametric framework. By focusing on disaggregated wealth components and accounting for non-linearities, the study aims to provide novel insights into the differential impacts of asset price fluctuations on non-durable consumption in 12 developed and 11 emerging economies from the European Union and to bridge a gap in the related literature.

DATA AND STYLISED FACTS

Data

This paper examines the relationship between non-durable consumption, income, wealth, and interest rates across 23 European Union (EU) members, including the EU11 economies. The emerging economies considered are the members that acceded to the European Union between 2004 and 2013. We use quarterly data from 2000Q1 to 2019Q4, which provides up to 80 observations per country.

Our dependent variable is proxied by household expenditure on semi-durable and non-durable goods and services, and we will treat non-durable consumption as endogenous (Mehra, 2001; Lettau and Ludvigson, 2004). We also explore how income changes influence consumption behaviour, using compensation of employees rather than disposable income since the latter includes income from other sources (de Bondt et al., 2019; Vizek, 2013). The use of disaggregated income data in the literature is limited, often due to data availability issues.

The inconsistency in measuring the value of housing and financial wealth in the case of the emerging economies sample calls for alternative proxies, which are more readily available, such as asset prices. As a consequence, we measure housing health by house prices and stock wealth by stock prices. As delimited in the literature (Sousa, 2009), financial wealth includes a broader range of assets like deposits and pension funds, which are not considered in this study. Another component of wealth that is considered distinctively is money wealth, as motivated by Sousa (2009). This wealth component is proxied by Broad money (M2) and represents the most liquid form of wealth in this study. Distinguishing between these measures is crucial, as they can lead to different household responses. Using asset prices, we can identify the pure "wealth effect," which reflects changes in wealth due to price fluctuations rather than portfolio decisions. For more details, refer to Paiella and Pistaferri (2017).

We recognise the limitations of using price indices as proxies, as they may not accurately reflect wealth changes, leading to inconsistent results (Rodil-Marzabal and Menezes-Ferreira-Junior, 2016). However, the availability of housing price indices influenced our choice. While asset prices do not fully capture asset value evolution, they are vital for assessment. We opted for house price indices to minimise measurement errors and to ensure comparability with prior research

(Ciarlone, 2011; Casni, 2016, 2018; Singh, 2022, among others). Additionally, we considered Broad Money (M2) as a liquid wealth measure that reflects monetary policy's effects. Although the literature on the money wealth effect is limited (Funke, 2004; Mallick and Mohsin, 2010; Peltonen et al., 2012), Sousa (2009) emphasises the importance of analysing different wealth components, finding significant wealth effects from currency, deposits, shares, and mutual funds, alongside the influence of financial liabilities and mortgage loans on consumption.

While price indices may not fully capture the value of household wealth, particularly in emerging economies, they offer the most consistent and widely available proxy data across countries. In the case of the house price series, which occasionally contained missing values, we employed a multiple imputation technique to address this limitation. This step was essential, as the CRS methodology requires a complete data series. Given the limited proportion of missing observations relative to the total, multiple imputation allowed us to preserve the integrity of the data and maintain the relationships between key variables without introducing structural distortions.

Slow macroeconomic fluctuations and liquidity constraints may influence consumption, making interest rates a key variable (Hall and Mishkin, 1980; Jawadi and Sousa, 2014). Several studies indicate a significant negative effect of interest rates on consumption since high interest rates reduce consumption by increasing credit costs and enhancing financial returns (Rodil-Marzabal and Menezes-Ferreira-Junior, 2016; Nicolau, 2020).

We believe household spending on semi-durable and non-durable goods is less influenced by interest rate changes, as these often involve shorter-term credit or no financing (Jappelli and Scognamiglio, 2018). However, short-term interest rates can have an indirect effect by impacting borrowing costs and disposable income (Cloyne et al., 2020). Thus, our analysis included the short-term interest rate, focusing on the money market or treasury bill rate, which affects liquid assets easily converted to cash for consumption (Nagel, 2016).

The data series are publicly available and were obtained from the following sources: the series for non-durable spending, compensation of employees and house prices were obtained from EUROSTAT, while the series for stock prices was obtained from investing.com, the series for broad money was obtained from Trading Economics, and the series for short-term interest rates were obtained from the national bank of each country in the sample.

Stylised Facts on Non-durable Spending

As the first step of our analysis, we look at the descriptive statistics for each variable and each sample, described in Table 1, and each graphical representation of the non-durable spending, presented in Figures 1 and 2. The first part of the table is dedicated to developed countries, while the second part presents the descriptive statistics for the sample of emerging economies.

Table 1. Descriptive statistics on variables for each sample

Variable	Obs.	Mean	Std. dev.	Min	Max
Developed economies					
Non-durable consumption	960	986.28	61.28	772.19	1171.57
Compensation of employees	960	998.69	79.90	761.48	1239.35
House prices	928	99.17	22.31	41.88	169.12
Stock prices	960	95.07	32.91	26.08	249.50
Broad money	960	904.31	157.66	569.22	1438.42
Short-term interest rate	960	1.69	1.77	-0.77	5.84
Emerging economies					
Non-durable consumption	880	922.98	181.58	397.38	1340.64
Compensation of employees	880	917.94	234.33	352.72	1617.43
House prices	726	105.92	17.33	50.59	173.22

Variable	Obs.	Mean	Std. dev.	Min	Max
Stock prices	880	116.63	65.26	24.20	566.33
Broad money	880	783.95	313.56	83.53	2006.10
Short-term interest rate	880	3.87	5.59	-0.55	56.9

Source: Author's calculations in STATA 17.

Note: The table presents the descriptive statistics for the initial values of the series.

We want to emphasise the preliminary steps that were required before being able to run the Categorical Regression Splines (CRS) method, namely, the missing values that can be observed in the series of house price indices in Table 1 were obtained through a technique called the multiple imputations method that generates the missing values in such a manner that it preserves the identified relationship between the outcome and the factors of interest. This is an important step, as the CRS function requires data with no missing values; therefore, employing the multiple imputation method was the necessary and most suitable step to preserve the initial relationship without distorting the results.
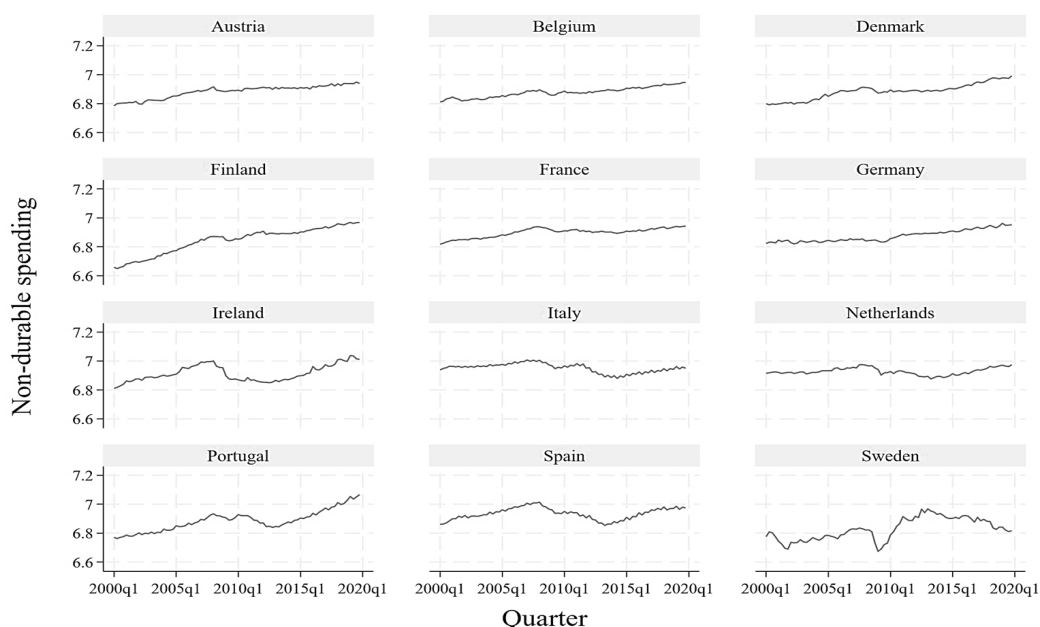

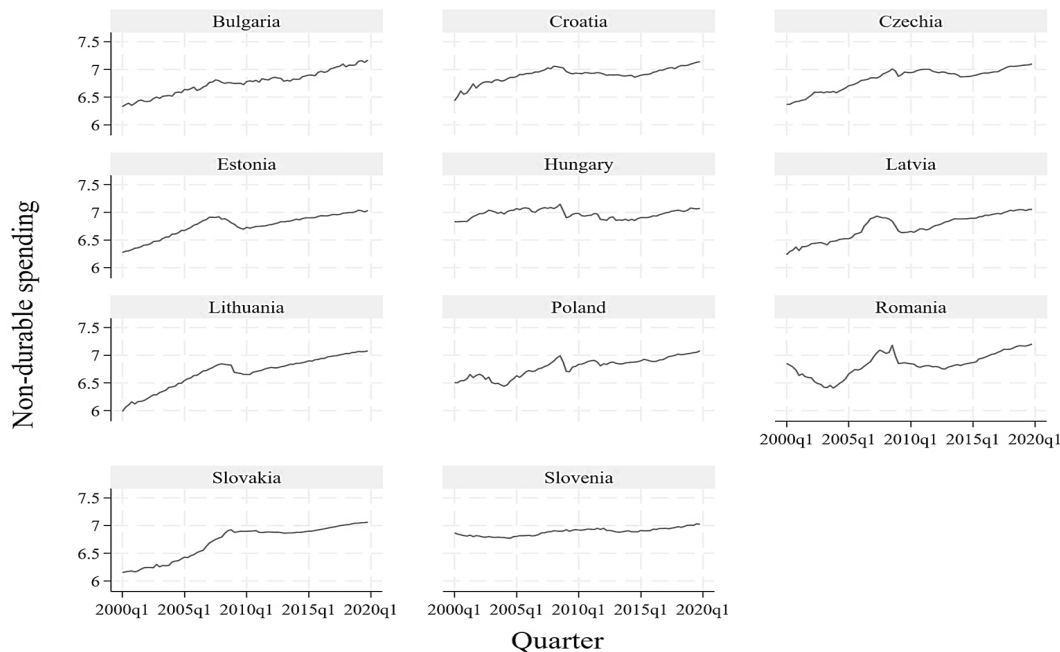**Figure 1.** The evolution of non-durable spending over the analysed period – Developed economies sample

Source: Author's calculations in STATA 17.

Between 2000 and 2019, semi-durable and non-durable consumption in the case of advanced economies from the European Union experienced a series of ups and downs. The early 2000s saw moderate growth due to economic expansion, the introduction of the euro, and EU enlargement. However, the Global Financial Crisis in 2008-2009 led to a sharp decline in consumption, with bank failures and high unemployment causing reduced spending.

The subsequent European Sovereign Debt Crisis (2010-2012) worsened the situation, further decreasing consumption due to austerity measures and declining consumer confidence in countries like Greece, Portugal, and Ireland. A slow and uneven recovery followed, with semi-durable and non-durable consumption gradually increasing from 2013 to 2019 as the economy improved, consumer confidence returned, and unemployment rates fell. The recovery varied across countries, with some experiencing more substantial growth than others. Overall, the evolution of consumption during this period was shaped by global economic events, regional crises, and country-specific factors.

At the same time, semi-durable and non-durable consumption in emerging countries followed a pattern of steep growth, decline, and recovery. In the early 2000s, strong growth occurred as these countries transitioned to market economies and anticipated EU membership, with several CEE countries joining the EU in 2004 and 2007. However, the Global Financial Crisis in 2008-2009 caused a decline in consumption due to reduced credit, lower export demand, and rising unemployment. The European Sovereign Debt Crisis (2010-2012) further impacted consumption, even though the emerging countries had lower public debt than their Eurozone counterparts. Economic slowdowns, austerity measures, and decreased demand from trading partners further contributed to the decline in consumption.

Figure 2. The evolution of non-durable spending over the analysed period – Emerging economies sample

Source: Author's calculations in STATA 17.

From 2013 to 2019, a faster recovery in consumption occurred compared to developed EU countries, driven by low interest rates, increased domestic demand, infrastructure investment, and an increasingly competitive export sector. Countries like Poland, for instance, experienced stable growth, while others, such as Romania and Hungary, faced fluctuations. Overall, the evolution of consumption in emerging countries was shaped by these global economic events and regional integration, while country-specific factors remained relevant.

METHODOLOGY

Panel data regressions often face bias from trending, endogeneity, heterogeneity, or pooling issues. This may lead to fragile estimations of the key coefficients, specifically regarding housing, stock, and money wealth. Unreliable estimates can compromise other objectives, such as policy implications and conclusions about the elasticity of consumption in response to changes in these three components of wealth.

Most literature focuses on results obtained through panel cointegration-based methods, generally indicating a positive wealth effect, though this varies depending on the specific wealth component examined. Recent research has focused on the functional forms, control variables, assumptions, and trends in the datasets used. However, questions remain about the estimation

uncertainty associated with elasticity coefficients, as it might happen in our case, which involves working with asset price indices rather than actual values of wealth.

To study the empirical relationship between consumption and wealth, we adopt the nonparametric, nonlinear modelling approach that Racine and Nie (2011) and Ma and Racine (2013) proposed. This method, called the Categorical Regression Splines (CRS) method, offers a simpler alternative to the classical Markov regime-switching model, as it does not rely on assumptions about the presence of distinct regimes in the data-generating process. Importantly, this approach allows us to capture any potential regime changes that may occur.

The Categorical Regression Splines (CRS) method was selected for its ability to flexibly model complex nonlinear relationships between household consumption and its determinants without imposing strict functional form assumptions. Compared to other nonparametric approaches - such as kernel-weighted local polynomial regression, an alternative method considered for this empirical exercise but omitted for brevity - CRS offers several advantages. First, CRS handles mixed data types—continuous and categorical—efficiently, making it suitable even for our panel structure. Second, spline-based estimation is computationally more stable and facilitates the easier interpretation of partial effects through smooth approximating functions (Racine & Nie, 2011; Ma & Racine, 2013). This makes CRS particularly well-suited to capturing turning points, threshold effects, and asymmetric relationships often observed in macroeconomic data (Bernard et al., 2015).

Unlike kernel-based approaches, which can become unstable with high persistence or multicollinearity, this method assumes smoothness in the underlying functional relationship but does not require specification of a parametric form or the number of regimes a priori, unlike threshold or Markov-switching models.

Similar to the empirical exercise proposed by Bernard et al. (2015), these estimators account for the high degree of persistence in the data and the presence of endogeneity. Disaggregating our panel into sub-regions also places the estimation method within a "small sample" framework, particularly with small N, where N denotes the number of countries involved.

We employ non-parametric regression to identify the best-fitting model for our data while also considering the baseline linear model commonly used in previous studies. We assume the conditional mean follows a non-linear and unknown function, approximated using best-fit B-splines. This approach allows for heteroskedasticity of an unknown form, which we presume depends on income, the three components of wealth, interest rates, and other control variables (Bernard et al., 2015).

$$LNC_{it} = f(LINC_{it}, LHW_{it}, LSW_{it}, LMW_{it}, IRST_{it}) \\ + \sigma(LINC_{it}, LHW_{it}, LSW_{it}, LMW_{it}, IRST_{it}) \cdot \omega_{it} \qquad (1)$$

with $f(.)$ and $\sigma(.)$ unknown, where ω_{it} are i.i.d. We define the variables as follows: LNC - non-durable consumption proxied by the household expenditure on semi-durable and non-durable goods and services; LINC – compensation of employees, used as a proxy for income; LHW – logarithm of household wealth which we proxy by house prices; LFW – logarithm of financial wealth, proxied by stock prices; LMW – logarithm of money wealth which we proxy by broad money; IRST denotes the short-term interest rate. Using the CRS estimation procedure, we conduct estimations that assume exogenous and possibly endogenous covariates.

Since $f(.)$ is unknown, as mentioned above, we estimate the function by employing the B-spline function introduced by Ma and Racine (2013), a combination of B-splines of degree m. The paper of Ma and Racine (2013) offers a complete representation of the linear combination of these B-splines. We will briefly outline the estimation steps for the unknown function $f(.)$, which is estimated using least squares as follows:

$$\hat{\mathcal{B}}(LINC_{it}; LHW_{it}; LSW_{it}; LMW_{it}; IRST_{it}) \qquad (2)$$
$$= argmin_{\mathcal{B}(.)} \sum_{i=1}^{n} \sum_{t=1}^{T} [LNC_{it} - \mathcal{B}(LINC_{it}; LHW_{it}; LSW_{it}; LMW_{it}; IRST_{it})]^2$$

When generating the partial $LNC|LINC$ curve, generated from the conditional mean, we denote the following specification:

$$\hat{f}_{LINC} = \hat{f}(LINC|LHW, LSW, LMW, IRST) \qquad (3)$$

Similarly, we generate the partial $LnNC|Other\ variables$ curves, denoted as:

$$\hat{f}_{LHW} = \hat{f}(LHW|LINC, LSW, LMW, IRST) \qquad (4)$$

$$\hat{f}_{LSW} = \hat{f}(LSW|LINC, LHW, LMW, IRST) \qquad (5)$$

$$\hat{f}_{LMW} = \hat{f}(LMW|LINC, LHW, LSW, IRST \qquad (6)$$

$$\hat{f}_{IRST} = \hat{f}(IRST|LINC, LHW, LSW, LMW) \qquad (7)$$

More specifically, the estimation output will illustrate two main elements: (i) the fitted function that is adjusted for each covariate and (ii) accompanying point-wise confidence bands. This type of estimation overlooks the panel structure of the data and its time series properties, imposing the assumption of stationarity. While there is a shape constraint, the non-parametric assumptions are not always less stringent than some of our parametric assumptions. Consequently, the estimated curves are not used to test the fit of the parametric model; instead, we consider them as summary representations of our data. In the absence of a consensus in the literature regarding the fit of the linear model, relaxing the shape restriction can still provide valuable insights. (Bernard et al, 2015).

As our linear parametric equation assumes symmetry, we look for asymmetries in the estimated function and identify turning points. As a robustness check for our findings, we also investigate potential time instabilities, as outlined by Bernard et al. (2015), by dividing the period into three sub-periods for estimation: (i) developed economies: pre-crisis (2000q1 – 2007q3), crisis (2007q4 – 2013q4), post-crisis (2014q1 – 2019q4); (ii) emerging economies: pre-crisis (2000q1 – 2007q2), crisis (2007q3 – 2012q2), post-crisis (2012q3 – 2019q4). These sub-samples are defined to reflect global economic cycles and financial crises in accordance with the European Financial Crises Database prepared by Lo Duca et al. (2017), which considers both systemic crises and residual events. It is important to note that our analysis of these split periods is not intended as a formal examination of breaks or stability tests. Instead, we aim to identify any inconsistencies over time by checking for consistency of results across both developed and emerging economies samples, and visually inspecting the confidence intervals surrounding the fitted functions to assess the degree of uncertainty and local significance.

RESULTS AND DISCUSSION

One of the central strengths of the CRS approach lies in its capacity to reveal nonlinear patterns that would remain obscured under linear specifications. By allowing the data to dictate the functional shape of relationships, this method enables the identification of turning points, thresholds, and varying marginal effects between consumption and its determinants. In the case of non-durable consumption, these nonlinearities are particularly important because they reflect

asymmetric household responses to changes in income and wealth under different macroeconomic conditions.

The estimations presented in the following sub-sections were obtained using the "crs" package in R, introduced by Racine and Nie (2011). The code is available upon reasonable request.

Results of the CRS Estimations for the Sample of Developed Economies

The results of the non-parametric model estimation are presented in Figures 3, 4, and 5 for the developed economies and Figures 7, 8, 9, and 10 for the emerging economies. The graphs report partial regression surfaces for non-durable consumption for the entire period and the three sub-periods (pre-crisis, crisis, and post-crisis), as defined in the previous section. In some cases, the observed best-fit curves deviate from the linear model supported by consumption theory.
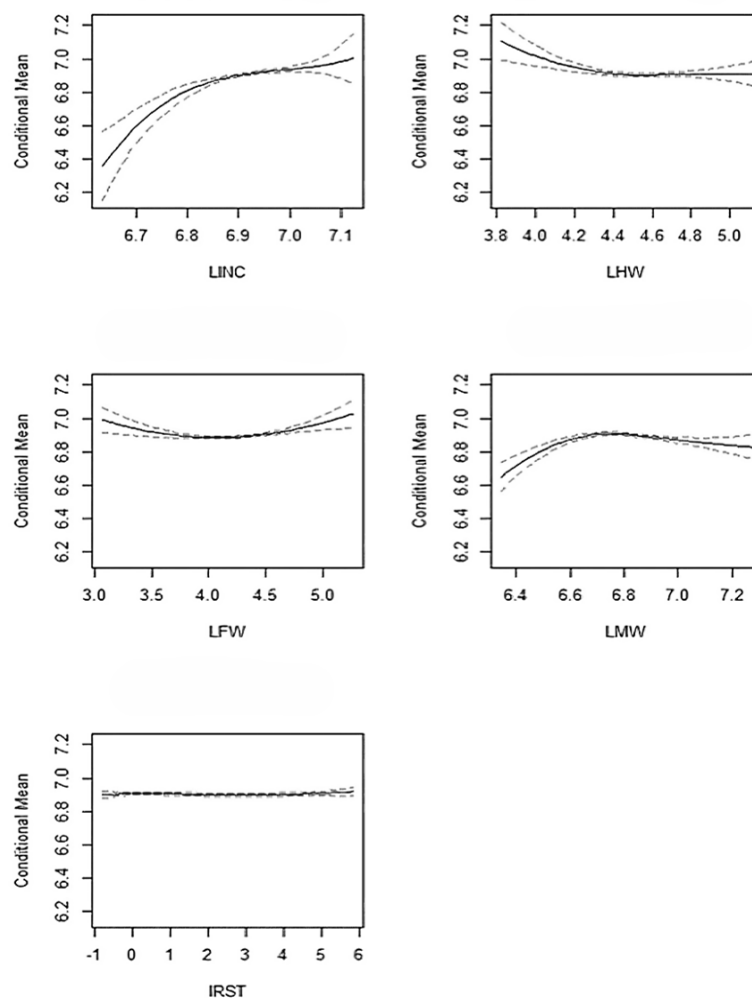
Figure 3. CRS estimates for the entire period (2000Q1 – 2019Q4) – Developed economies

Source: Author's calculations in R. Note: The abbreviations refer to LINC - Ln of Compensation of employees; LHW - Ln of House Price Index; LSW - Ln of Stock Price Index; LMW - Ln of Broad money M1; IRST - Short-term Interest Rate.

From the partial regression surfaces generated for the sample of developed countries over the entire period considered for the analysis, 2000Q1 – 2019Q4, we identify that compensation of employees (LINC) has a positive and increasing relationship with household spending, meaning higher compensation leads to increased expenditure. Conversely, the house price index (LHW)

shows a weaker link to non-durable spending, indicated by a flatter graph. In contrast, the stock price index (LFW) exhibits a mild U-shaped relationship, initially correlating negatively but later positively. This may reflect diverse wealth effects among households. Broad money (LMW) displays a slightly inverted U-shape, indicating that while increased money supply boosts consumption, the effect diminishes beyond a certain point. Lastly, the flat curve identified for the short-term interest rate (IRST) suggests a negligible direct effect on non-durable spending within the observed range.

The weaker response in house prices and short-term interest rates might suggest that these factors in current values are not direct drivers of consumption in the developed economies, possibly due to financial market stability or credit access smoothing consumption over time.
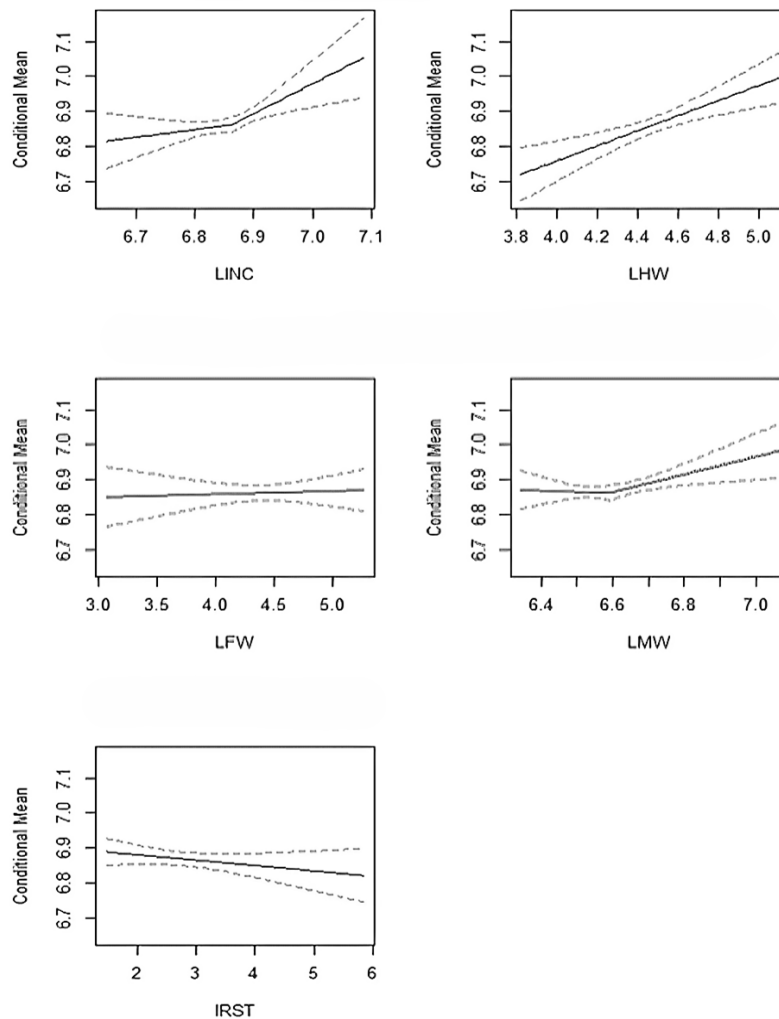

Figure 4. CRS estimates for the pre-crisis period (2000Q1-2007Q2) – Developed economies

Source: Author's calculations in R. Note: The abbreviations refer to LINC - Ln of Compensation of employees; LHW - Ln of House Price Index; LSW - Ln of Stock Price Index; LMW - Ln of Broad money M1; IRST - Short-term Interest Rate.

Although the estimations for the entire period offer some information about the shape of the relationship between non-durable spending and the proposed set of determinants, we proceed with estimating the same CRS regression over three main sub-periods (pre-crisis, crisis, and post-crisis) separately.

During the pre-crisis period, compensation of employees (LINC) exhibits a steeper curve at higher income levels, indicating a stronger marginal effect on non-durable spending. The house price index (LHW) shows a positive relationship, suggesting that rising house prices drove household spending due to a wealth effect. In contrast, the wide confidence intervals for the stock price index (LFW) indicate limited significance, as most middle-income households were not reliant on stock wealth. The broad money (LMW) suggests a mild U-shaped relationship, hinting at a possible liquidity effect. Lastly, the short-term interest rate (IRST) reveals a weak negative relationship, indicating stable credit access that diminished the impact of interest rate changes on spending decisions.
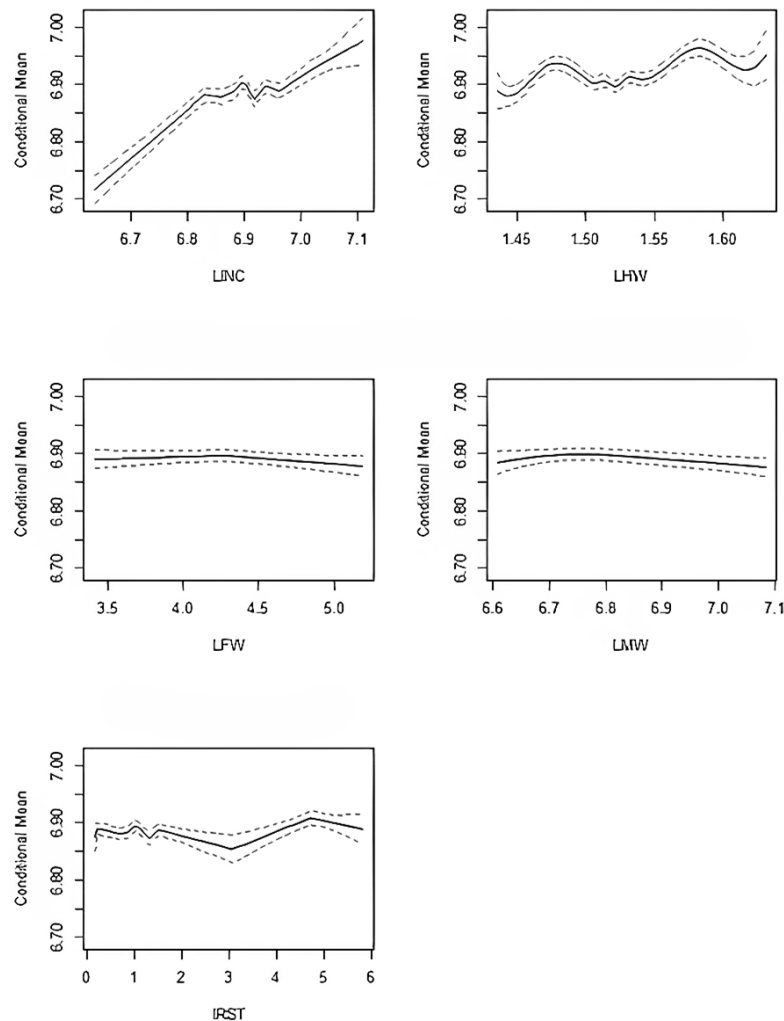

Figure 5. CRS estimates for the crisis period (2007Q3-2012Q2) – Developed economies

Source: Author's calculations in R. Note: The abbreviations refer to LINC - Ln of Compensation of employees; LHW - Ln of House Price Index; LSW - Ln of Stock Price Index; LMW - Ln of Broad money M1; IRST - Short-term Interest Rate.

During the crisis period (2007Q4–2013Q4), the link between income (LINC) and household expenditure remained positive but exhibited non-linearity, as rising compensation was tempered by labour market volatility and policy changes. House prices (LHW) had an unstable relationship with consumption, affected by declining values and mortgage instability, which increased uncertainty in non-durable spending. The influence of stock prices (LFW) on spending diminished due to financial risk aversion and a shift toward saving. Broad money (LMW) showed a flat

relationship with consumption, indicating limited effects from monetary expansion amid consumer confidence issues. Short-term interest rates (IRST) also had minimal impact, as households prioritised deleveraging over spending.
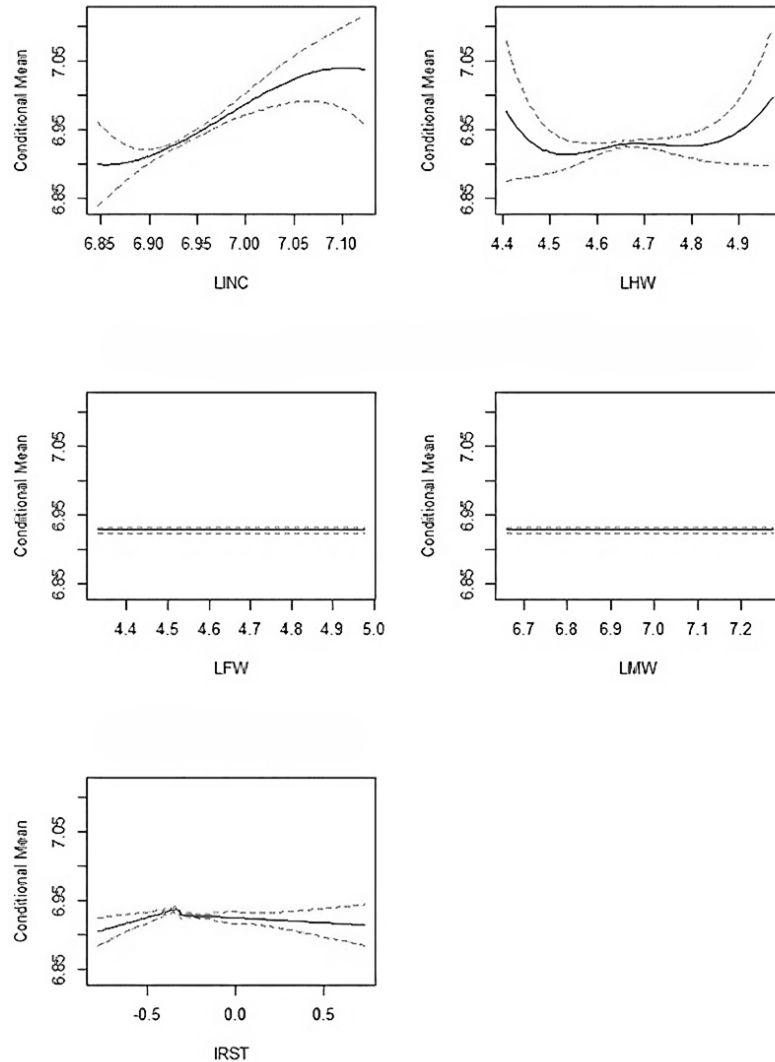

Figure 6. CRS estimates for the post-crisis period (2012Q3-2019Q4) – Developed economies

Source: Author's calculations in R. Note: The abbreviations refer to LINC - Ln of Compensation of employees; LHW - Ln of House Price Index; LSW - Ln of Stock Price Index; LMW - Ln of Broad money M1; IRST - Short-term Interest Rate.

During the post-crisis period (2014Q1–2019Q4), household expenditure on non-durables remained primarily driven by income (LINC), with a stronger marginal effect at higher income levels, reflecting improved economic stability. House prices (LHW) exhibited a U-shaped relationship with consumption, suggesting that while initial declines dampened spending, rising home values eventually supported it, likely due to improved credit conditions. In contrast, stock prices (LFW) and broad money (LMW) had no significant impact, indicating that equity wealth effects were weak and monetary expansion did not translate into higher household spending. Short-term interest rates (IRST) showed a positive but small effect, suggesting that while monetary policy provided stability, its direct influence on consumption remained limited. Overall, post-crisis consumption patterns became more income-driven, with housing regaining importance.

Results of the CRS Estimations for the Sample of Emerging Economies

Based on our CRS estimations, we do not have strong reasons to rule out any of the considered forms, either linear or non-linear, although imposing a quadratic or cubic curve, for instance, weakly identifies the tipping point if the curve is closer to a linear specification, namely of the bandwidth of the confidence intervals around the function are very wide.
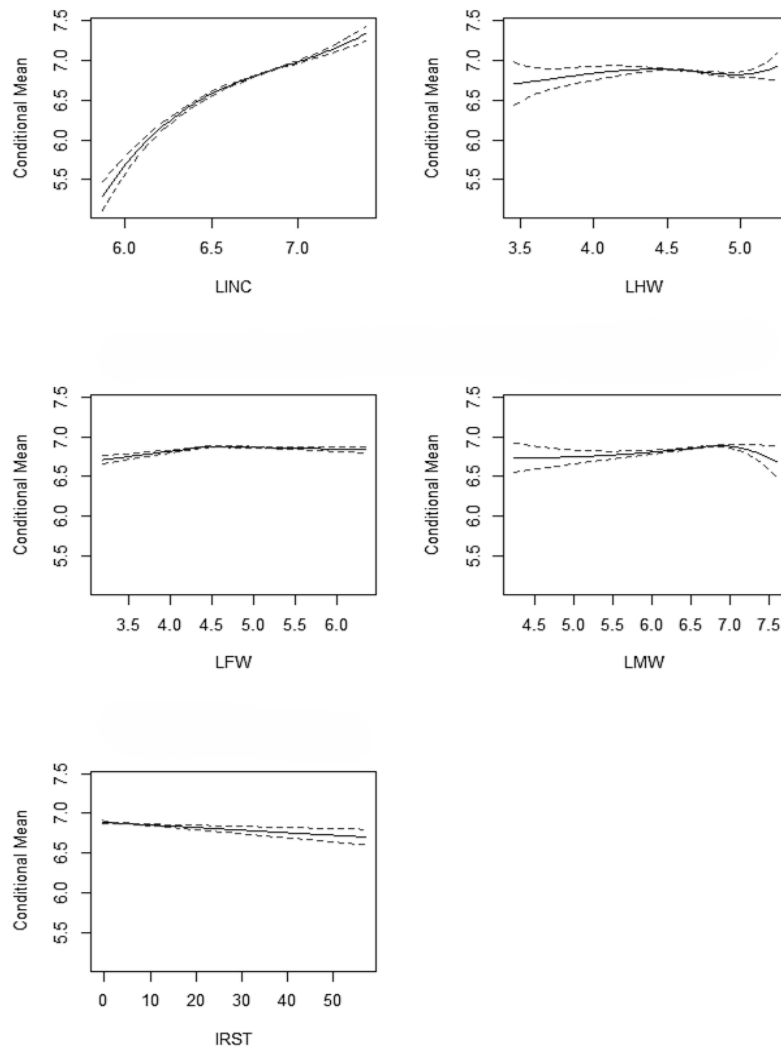

Figure 7. CRS estimates for the full period (2000Q1-2019Q4) – Emerging economies

Source: Author's calculations in R. Note: The abbreviations refer to LINC - Ln of Compensation of employees; LHW - Ln of House Price Index; LSW - Ln of Stock Price Index; LMW - Ln of Broad money M1; IRST - Short-term Interest Rate.

For the emerging economies over the full period (2000Q1–2019Q4), non-durable consumption is primarily driven by income (LINC), reflecting the strong role of income. House prices (LHW) show a weak but positive relationship with spending, suggesting limited housing wealth effects, likely due to lower homeownership or less-developed mortgage markets. Stock prices (LFW) and broad money (LMW) have minimal influence, indicating that financial market fluctuations and liquidity expansion play a minor role in shaping household demand. Short-term interest rates (IRST) exhibit a slightly negative relationship, implying that higher borrowing costs may constrain spending, though the effect is weak. Overall, consumption in emerging economies is

largely income-driven, with financial factors playing a much smaller role compared to the developed economies.
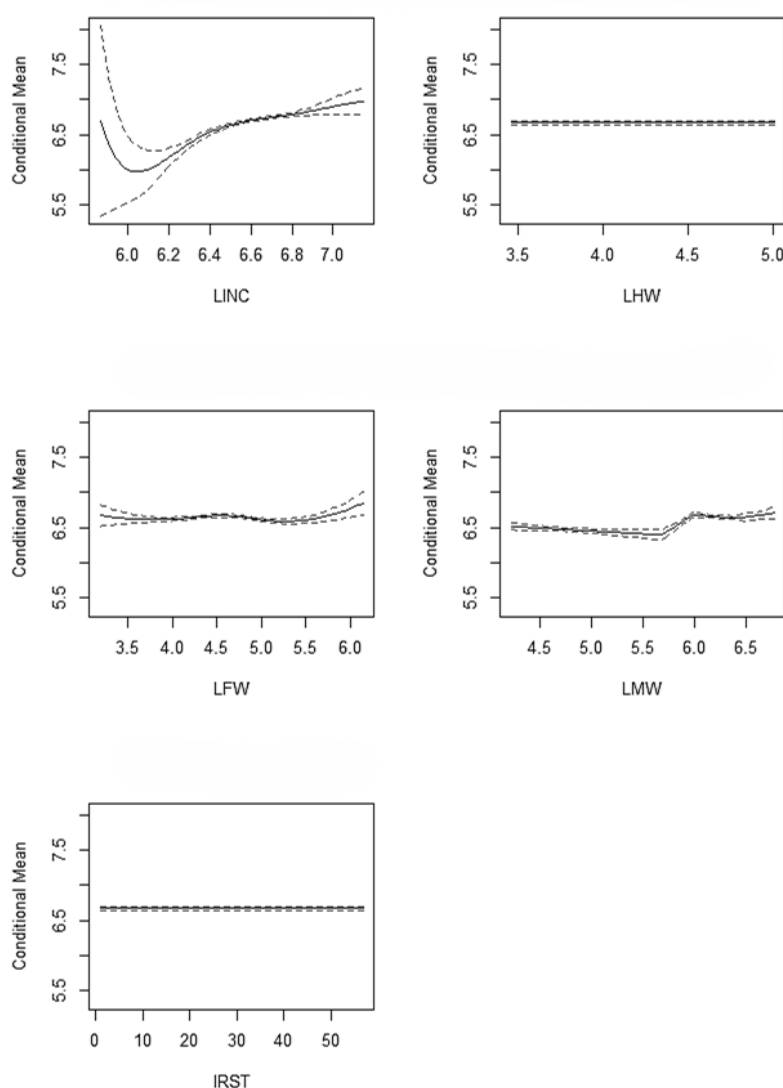

Figure 8. CRS estimates for the pre-crisis period (2000Q1-2007Q2) – Emerging economies

Source: Author's calculations in R. Note: The abbreviations refer to LINC - Ln of Compensation of employees; LHW - Ln of House Price Index; LSW - Ln of Stock Price Index; LMW - Ln of Broad money M1; IRST - Short-term Interest Rate.

During the pre-crisis period (2000Q1–2007Q2) in emerging economies, household consumption was strongly driven by income (LINC), displaying a positive relationship consistent with rising wages and employment that supported spending. House prices (LHW) had a minimal effect on consumption, suggesting that housing wealth effects were weak, likely due to less-developed mortgage markets. Although exhibiting non-linearities, stock prices (LSW) and broad money (LMW) also showed little influence, indicating that financial conditions played a secondary role in shaping consumption behaviour. Short-term interest rates (IRST) had a mildly negative impact, suggesting that higher borrowing costs slightly constrained spending but were not a major determinant. Overall, consumption in this period was predominantly income-driven, with limited responsiveness to financial and monetary variables.
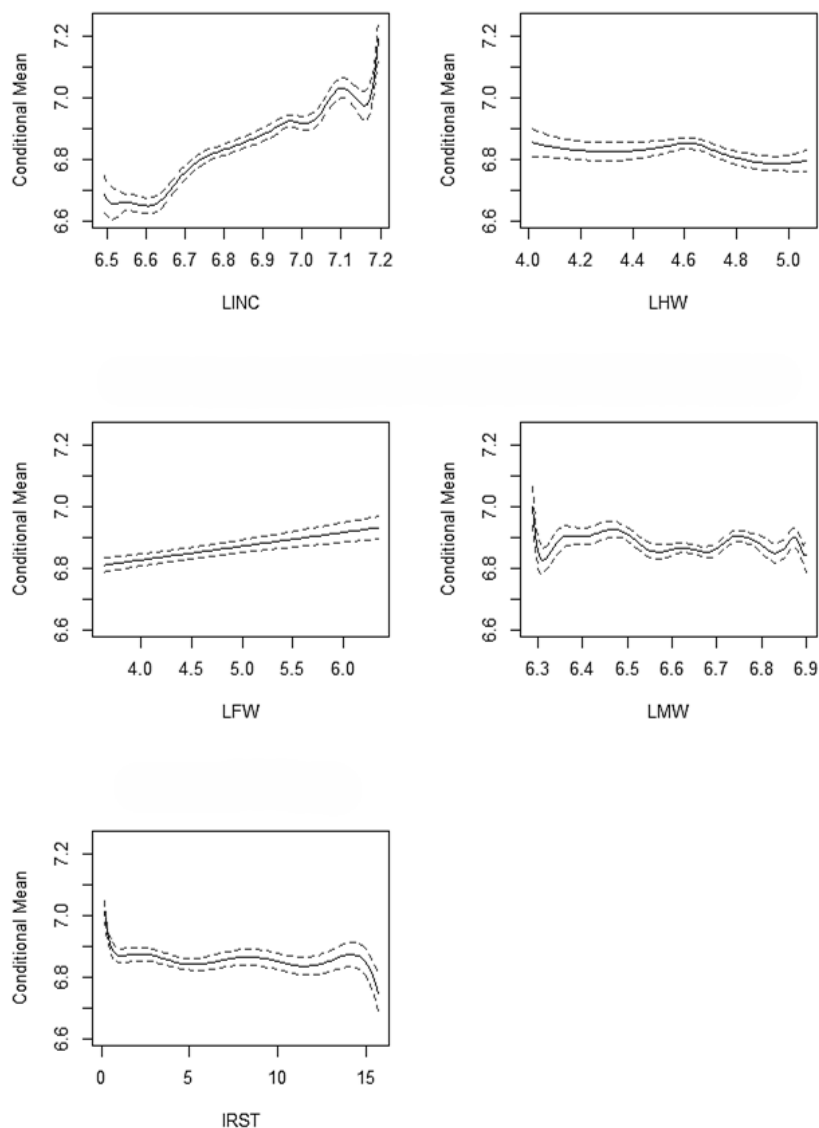
Figure 9. CRS estimates for the crisis period (2007Q3-2012Q2) – Emerging economies

Source: Author's calculations in R. Note: The abbreviations refer to LINC - Ln of Compensation of employees; LHW - Ln of House Price Index; LSW - Ln of Stock Price Index; LMW - Ln of Broad money M1; IRST - Short-term Interest Rate.

During the crisis period (2007Q3–2012Q2) in emerging economies, household consumption remained positively linked to income (LINC), though with increased non-linearity, suggesting heightened sensitivity to income changes amidst economic distress. House prices (LHW) had a weak and slightly negative effect, indicating that declining property values may have dampened spending, but the effect was not strong. Stock prices (LFW) showed a mild positive influence on consumption, possibly reflecting the growing importance of financial assets despite overall market volatility. Broad money (LMW) exhibited fluctuations, suggesting instability in liquidity effects, while short-term interest rates (IRST) displayed a non-monotonic relationship, indicating that monetary policy responses to the crisis may have had mixed effects on household spending. Overall, the crisis period saw greater uncertainty in consumption responses, with income remaining the dominant driver of consumption.
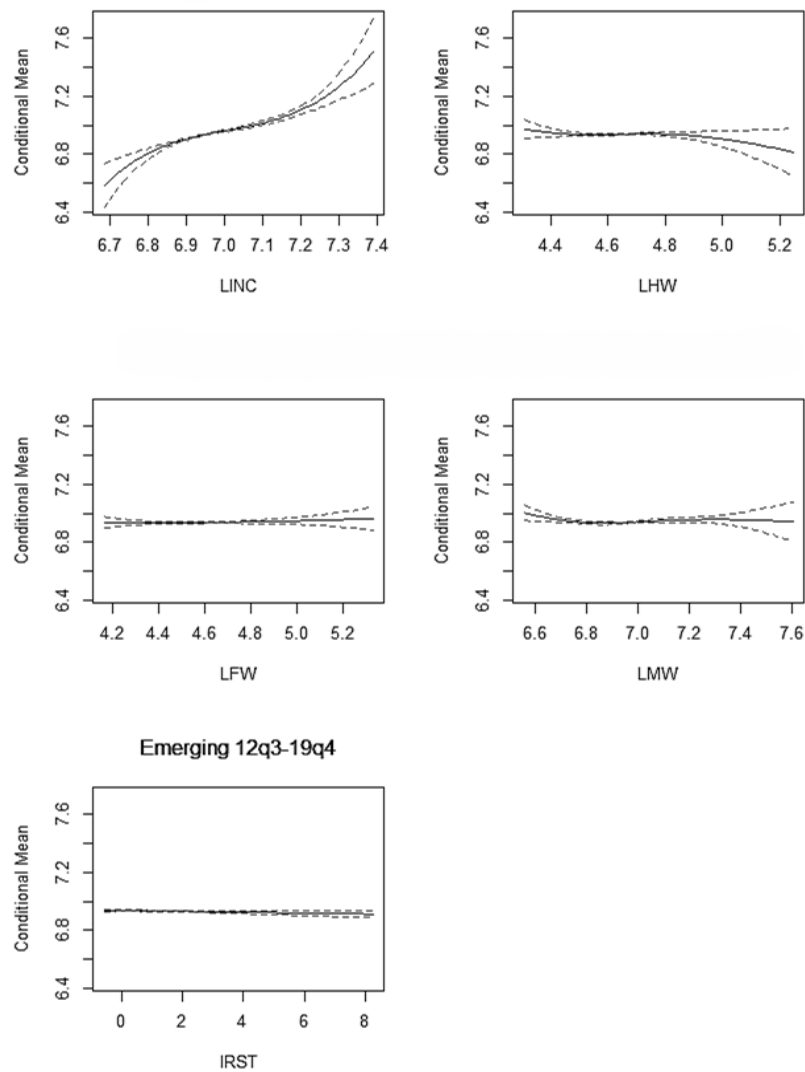
Figure 10. CRS estimates for the post-crisis period (2012Q3-2019Q4) – Emerging economies

Source: Author's calculations in R. Note: The abbreviations refer to LINC - Ln of Compensation of employees; LHW - Ln of House Price Index; LSW - Ln of Stock Price Index; LMW - Ln of Broad money M1; IRST - Short-term Interest Rate.

During the post-crisis period (2012Q3–2019Q4) in emerging economies, household consumption continued to be strongly driven by income (LINC), with a steeper relationship at higher income levels, suggesting that wage growth and employment expansion played an increasing role in sustaining spending. House prices (LHW) had a lower effect, indicating that housing wealth effects remained weak. Stock prices (LFW) and broad money (LMW) showed minimal influence, suggesting that financial and liquidity conditions had little direct impact on household expenditure. Short-term interest rates (IRST) exhibited no significant relationship with consumption, reflecting a period of monetary stability where borrowing costs did not materially affect spending decisions. Overall, the post-crisis period in emerging economies was marked by a return to income-driven consumption, with financial and monetary variables playing a limited role in shaping household demand.

We can identify a non-linear form of the partial regression surface between the non-durable consumption and its main determinants, with distinctions between developed and emerging economies, as follows:

Table 2. Potential non-linearities detected by the CRS method

Period	Full period	Pre-crisis	Crisis	Post-crisis
Developed economies				
LNC and LINC	*	*	*	/
LNC and LHW	/	/	*	*
LNC and LSW	*	/	/	/
LNC and LMW	*	*	/	/
LNC and IRST	/	/	*	*
Emerging economies				
LNC and LINC	*	/	*	*
LNC and LHW	*	/	*	/
LNC and LSW	/	*	/	/
LNC and LMW	*	*	*	/
LNC and IRST	/	*	*	/

Source: Author's processing. Note: The non-linear specification is noted as "", while a linear specification is noted as "/".*

Overall, our findings highlight the utility of nonparametric techniques in revealing subtle nonlinear dynamics in the consumption–wealth relationship that may be overlooked under standard parametric approaches. The result that income remains the dominant driver of non-durable consumption, particularly in emerging economies, aligns with previous literature (e.g., Ciarlone, 2011; Casni, 2018; Singh, 2022, among others), while also highlighting that wealth effects may be more context-dependent and nonlinear than commonly assumed. These insights help refine the understanding of household behaviour during financial cycles and offer a more nuanced view of how different wealth channels function across economies. As such, the findings may inform macroeconomic modelling and targeted policy design, especially in settings with underdeveloped financial systems.

CONCLUSION

This study provides a comprehensive analysis of the relationship between non-durable consumption and key wealth components—housing, financial, and money wealth—as well as short-term interest rates across developed and emerging economies and members of the European Union. By employing a nonparametric approach based on the Categorical Regression Splines (CRS) method, the findings reveal nonlinearities in the consumption-wealth relationship, underscoring the complexity of these interactions beyond the linear specification.

The empirical contribution of this study lies in the employed nonparametric framework, which allows for greater flexibility in identifying the true shape of relationships without imposing restrictive parametric assumptions. This approach reveals functional forms that might otherwise be concealed; therefore, this empirical exercise underscores the necessity of considering such non-parametric techniques as a preliminary step in empirical analysis.

Empirical findings indicate distinct patterns between developed and emerging economies. In the developed economies, income remains the primary driver of non-durable consumption, while wealth effects, particularly from stock market fluctuations, exhibit non-linear characteristics. The role of housing wealth is less pronounced, reflecting greater financial market stability and diversified household portfolios. In contrast, emerging economies display a stronger reliance on income, with housing wealth playing a more significant role in shaping non-durable consumption, likely due to the relatively underdeveloped mortgage and financial markets. Money wealth and liquidity effects, while present, show variations in significance depending on the economic context and period analysed.

Furthermore, important differences have been identified across economic cycles. Pre-crisis periods show a more pronounced role of income and, in some cases, stock wealth, whereas crisis

periods exhibit weakened wealth effects and increased uncertainty in consumption behaviour. The post-crisis recovery is largely income-driven, with housing wealth regaining some influence in the developed economies but remaining weaker in emerging economies.

In developed economies, maintaining income stability and financial market resilience may help support spending, while in emerging economies, where housing plays a more central role, improving mortgage access and liquidity mechanisms may be more effective. These differentiated patterns highlight the need for tailored policy responses that reflect structural differences and observed nonlinearities. Further research could investigate the asymmetries and nonlinearities observed in this study. Understanding these complex interactions can help policymakers avoid the "one-size-fits-all" trap and design more effective strategies to support household consumption, considering both wealth constraints and monetary policy interventions.

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