

Economics and Business Review

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POZNAŃ UNIVERSITY OF ECONOMICS AND BUSINESS PRESS
ul. Powstańców Wielkopolskich 16, 61-895 Poznań, Poland
phone +48 61 854 31 54, +48 61 854 31 55
<https://wydawnictwo.ue.poznan.pl>, e-mail: wydawnictwo@ue.poznan.pl
postal address: Al. Niepodległości 10, 61-875 Poznań, Poland

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Editorial introduction

The simplest model of an economy, presented to first-year students to explain why various methods of calculating GDP should yield similar results, consists of only two types of actors: households and firms. These actors are connected by four arrows that highlight the different ways in which they are interconnected. This issue of *Economics and Business Review* serves as a reminder of how useful such approximations remain despite their simplicity. It contains five articles written by fourteen authors working in Hungary, Japan, Poland, and Romania. The issue examines households' savings, which are used to finance firms' development, as well as household debt, which is incurred to purchase companies' products. The analysis then goes deeper, exploring how households can make more informed decisions about their savings, either by focusing on the fundamentals of publicly listed companies or by paying attention to narratives in the mass media. Finally, the issue asks how corporate welfare should be defined and how it relates to consumer welfare. As the Editors, we hope that this issue of *Economics and Business Review* will be well received by its readers and stimulate further discussion of the interdependencies within the economy.

The first article in this issue, **Two Europes, two saving behaviours. An analysis of structural differences between EU-15 and CEE households**, authored by Ana-Maria Giurgi and Ionuț-Andrei Pricop, investigates differences in household saving behaviour across 27 EU Member States. The authors use data from 1996–2023 to show that behaviour in countries in the EU-15 group differs from behaviour in post-2004 member states. More specifically, occupational and institutional factors are more prominent in the EU-15, whereas income and fiscal conditions play a greater role among post-2004 members. As a result, the study suggests that policies aimed at promoting saving behaviour should be different in the “two Europes”: while in the EU-15 countries more attention should be paid to financial literacy, in newer EU members, the focus should be on strengthening household saving capacity, e.g., through taxation policies. More broadly, the findings provide further evidence that country-level economic and institutional differences must be taken into account when designing policies meant to encourage household saving.

The second article, titled **Household debt persistence and its drivers: Evidence from cross-country growth heterogeneity**, is authored by Agata Wierzbowska, Renata Karkowska, Zbigniew Korzeb, and Paweł Niedziółka.

The research discusses what drove household indebtedness in 36 countries between 2012 and 2022. The study considers consumer confidence in relation to bank capitalisation, private-sector credit and demographic variables using dynamic system GMM estimators. The main result is that higher confidence, greater credit availability and longer life expectancy are associated with higher household debt. Better-capitalised banks and the pandemic period are related to lower debt. It was observed that the confidence effect is stronger in faster-growing economies. The article will be especially interesting for readers concerned with household finance, financial stability and the role of sentiment in credit dynamics.

The third paper, **How environmental media narratives shape the sustainability premium**, by Attila Zoltán Nagy, Beatrix Steiner, and Vivien Csapi, starts from an important question: Can the way the news covers environmental topics help explain the returns of ESG-based portfolios in the United States? To address the issue, the monthly return gap between high- and low-ESG stocks is related to indicators derived from some 220 million articles. What seems to matter more is how much space a topic occupies in the news, not whether the coverage is positive or negative. The associations are clearer for equal-weighted than for value-weighted portfolios. The relationship also differs by topic of the news article as fossil-fuel coverage is positively related to the premium, while climate-risk coverage is negatively related. The authors caution that the underlying mechanism, such as investor attention, is not tested. Nevertheless, readers interested in using news data in finance, particularly in relation to ESG returns, will find the article a useful reference.

The fourth article, **Accounting-based CAPM: Symmetrical and downside risk approaches**, is authored by Lesław Markowski, Przemysław Garsztka, Jacek Mizerka, and Anna Rutkowska-Miczka. Their research examines whether stock returns are explained better when the capital asset pricing model is enriched with accounting information and a downside risk perspective. The sample covers 74 firms from the DAX40, MDAX and SDAX indices. The conventional and downside betas are compared with accounting betas (based on return on assets and return on equity), on individual securities as well as on equally weighted portfolios. It seems that market betas, whether conventional or downside, earn no significant premium, whereas profitability ratios are positively priced and raise explanatory power. Accounting betas give more mixed results: ROE-based downside betas are associated with a positive premium in large-cap portfolios, but the accounting variables are not significant for small companies. The article will interest readers working on asset pricing and the use of financial statement data in estimating the cost of equity.

In the last article in this issue, **Rethinking corporate welfare: Unpacking its meaning and misconceptions**, Adam Piłat revisits the meaning and economic justification of state support for businesses. A stark and relatively recent example of such support was how governments across the world offered

preferential loans, tax deferrals or grants to businesses after the outbreak of the COVID-19 pandemic. Drawing on a critical review of the literature, the author proposes a definition centred on state actions that benefit businesses, grant them a privileged position, and primarily aim to support them or protect them against market risks. Two case studies—the bankruptcy of Solyndra and the Polish *de minimis* guarantee programme—illustrate the boundaries of the proposed definition. Overall, the proposed framework builds a more nuanced view of corporate welfare, highlighting that interventions can be socially desirable, yet governments must remain vigilant and assertive to counter rent-seeking pressures from corporations.

Joanna Lizińska
Paweł Niszczoła
Michał Pilc
Lead Editors

Two Europes, two saving behaviours. An analysis of structural differences between EU-15 and CEE households

 Ana-Maria Giurgi¹

 Ionuț-Andrei Pricop²

Abstract

The aim of the article is to examine structural differences in household saving behaviour across European countries, arguing that European integration has not led to convergence in saving patterns. Using data from 27 EU Member States (1996–2023), it compares the EU-15 with post-2004 members through Lasso variable selection and fixed-effects panel models. By combining machine learning-based variable selection with panel regression, the study offers a novel analytical perspective on the determinants of household savings. The findings reveal significant structural differences between the two groups: taxation and monetary freedom show stronger associations with household saving in post-2004 member states, whereas education-related factors are more prominent in the EU15. These results suggest that policies should strengthen precautionary saving mechanisms and promote financial education to encourage household saving.

Keywords

- household savings
- economic freedom
- employment
- education
- saving behaviour

JEL codes: E21, E22, R20.

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¹ Faculty of Economics and Business Administration, Alexandru Ioan Cuza University, Bulevardul Carol I, nr. 22, Iași, 700505, România, corresponding author: anny.giurgi@yahoo.com, <https://orcid.org/0009-0003-9716-852X>.

² Faculty of Economics and Business Administration, Alexandru Ioan Cuza University, Bulevardul Carol I, nr. 22, Iași, 700505, România, ap.pricop@gmail.com, <https://orcid.org/0009-0000-9922-6373>.

Introduction

Understanding the determinants of household savings is important for designing policies that support financial stability and economic growth, particularly in a European context characterised by structural differences between Member States. Research on saving behaviour has long been central to economic theory. Keynes (1936) highlighted the relationship between income, consumption, and savings, while Modigliani and Brumberg's life-cycle hypothesis (1954) suggests that individuals save to smooth consumption over their lifetime. Friedman (1957) emphasised the role of permanent versus temporary income, while Kuznets (1946) observed that rising income may increase the propensity to save. Finally, Duesenberry's relative income hypothesis (1949) links consumption behaviour to social comparisons within society.

Household saving capacity evolves in response to economic, social (Băsu, 2023), political (Aaberge et al., 2017; Li, 2021), and technological factors (Thaariq et al., 2021). Korzeniowska (2023) further shows that saving behaviour changes across economic conditions and crises. Against this background, the present study examines the determinants of household saving across European countries, including the effects associated with the 2008 financial crisis, the COVID-19 pandemic, and the post-2022 energy crisis. Panel data models are combined with economic freedom indicators and gender- and education-specific labour market variables to provide a broader perspective on differences in saving behaviour across European economies.

1. Literature review

1.1. Theoretical framework and hypothesis development

Household economic security has received substantial attention because of its implications for individual welfare and macroeconomic stability. Previous research has identified significant regional differences in the determinants of household saving (Niculescu-Aron & Mihăescu, 2012). In Western Europe, household saving rates were found to be less responsive to economic growth, whereas in Eastern Europe, economic growth was associated with declining saving rates. Similar structural differences between Western European and post-2004 EU economies have been reported by Schrooten and Stephan (2003), Arıç and Siok (2021), and Skoblar (2024).

The structural differences between the EU-15 countries and the post-2004 countries have deep-rooted causes. Financial development varies mainly due

to the different histories of these two groups of countries; Western Europe benefited from decades of capitalism and support for free enterprise following World War II, while Eastern Europe (which includes all post-2004 countries) found itself within the Soviet sphere of influence, marked by forced collectivisation, and the suppression of freedom of expression. Differences are also highlighted in institutional quality, given that the transition period from an authoritarian and undemocratic regime to new democracies was not without challenges related to combating corruption and adapting institutions to Western European standards. Of course, such historical developments have also shaped the propensity to save, the demographic gap, and the migration of citizens from post-2004 countries to the EU-15. Differences between the two groups may reflect distinct historical trajectories (Pollack, 2009; Schimmelfennig, 2008) as well as differences in economic freedom (Osińska et al., 2025). Accordingly, the first hypothesis is formulated as follows:

H1: There are structural differences between EU15 and post-2004 countries in savings decisions.

In this sense, the novelty of the present study lies in highlighting the structural differences in the predisposition of European households towards saving by correlating it with economic freedom variables. The study contributes to the literature by addressing the relatively underexplored relationship between household saving and economic freedom. The potential of the Heritage Foundation's Index of Economic Freedom lies in the fact that the numerous variables in the indicator cover macroeconomic phenomena (e.g., Monetary Freedom tracks inflationary trends, price stability and a strong national currency, while Government Integrity covers corruption problems). Thus, the index provides complementary measures of broader institutional and economic conditions that may not be fully captured by conventional macroeconomic indicators. While previous studies have examined household saving using indicators such as inflation (Mierzejewski & Szczurek, 2025) and unemployment (Delestre & Waters, 2026), the present study adopts the Heritage Index to capture broader institutional and economic conditions. Many studies using the Heritage Index and linear regressions focused on the relationship between economic freedom and economic growth (Brkić et al., 2020; Hung et al., 2024), thereby emphasising how economic freedom is closely and positively correlated with economic growth (Bajrami et al., 2025; Dekkiche & Leila, 2024). Other recent studies focused on the relationship between economic freedom and unemployment (Cervelló-Royo et al., 2023), quality of life (Akinlo & Okunlola, 2022), or foreign direct investment attraction (Štilić et al., 2023). This underexplored relationship defines the study's research gap.

Education is also an important determinant of household saving (Bollinger et al., 2022; Lusardi, 2008; Pham et al., 2024). Beckmann et al. (2013) identify education and income as important predictors of saving, while Fredriksson

and Staal (2021) report a positive relationship between labour market participation and household saving.

On the other hand, different authors have also contextualised the determinants of household savings in the context of crisis. Borowski and Jaworski (2023) concluded that during the COVID-19 pandemic households were forced to save, considering that the volatility of savings depended largely on the intensity of government-imposed restrictions or the number of deaths involving COVID-19. The study by Bohdalová and Pažický (2019) showed that the Global Financial Crisis marked a significant turning point in the saving habits of European households. The analysis highlights that the wealthier a country is, the less its households rely on marginal income to meet consumption needs. In richer countries, households are more likely to allocate additional disposable income toward saving and investment rather than immediate consumption.

Kukk and Staehr (2017) revealed how changes in the macroeconomic environment affect the saving rates in both households and corporate sectors, with some differences in the output gap, the real interest rate, the inflation rate, and the current account balance. Vanlaer et al. (2020), using data from 18 EU countries, showed how confidence in the household financial situation has a greater effect on household saving than confidence in the general economic situation, while Klopocka and Gorska (2021) affirmed that the Consumer Confidence Indicator and most of its component questions reliably predict household saving rates. Šubová et al. (2023) also examined the relationship between household saving and GDP in the V4 countries. Their results highlighted short-run Granger causality from real GDP to household savings rates, and from household savings rates to real GDP, in both the Czech Republic and Hungary. Accordingly, the second hypothesis is formulated as follows:

H2: The influence of education on savings is heterogeneous, being overshadowed by economic constraints in emerging economies.

Recent studies have also proposed alternative approaches to household saving. Ptak-Chmielewska and Grzywińska-Rąpca (2026) used PCA to construct a simplified six-variable consumer confidence indicator related to household saving, while Horioka and Ventura (2025) highlighted cross-country differences in saving motives, including retirement and precautionary saving. The present study retains conventional saving-related variables. Similarly, Mierzejewski and Szczurek (2025) show that saving tends to increase at the onset of crises before subsequently declining, although this pattern varies across countries.

Household saving is shaped by education, economic confidence, age, income, and labour market participation (Bollinger et al., 2022; Fredriksson & Staal, 2021; Horioka & Ventura, 2025; Klopocka & Gorska, 2021; Lusardi, 2008; Vanlaer et al., 2020). Saving behaviour is also affected by crises (Mierzejewski & Szczurek, 2025) and by institutional and historical factors (Kukk & Staehr, 2017; Šubová et al., 2023).

1.2. Variable selection and theoretical justification

Variable selection captures structural differences between EU15 and post-2004 economies beyond conventional income-consumption models. Potential determinants were grouped into three dimensions (institutional/fiscal factors, human capital, and macroeconomic constraints) based on the Life Cycle Hypothesis (Modigliani & Brumberg, 1954) and Buffer-Stock Theory (Carroll, 1997). This multidimensional framework allows saving behaviour to be examined in relation to both short-term economic constraints and longer-term financial planning. The first dimension captures the role of the state through Tax Burden (TAX) and Government Spending (GOVS).

Ricardian equivalence suggests that public spending may affect private saving, while higher taxation can reduce disposable income and saving capacity (Tanzi & Zee, 1998). Government Integrity (GOVI) and Monetary Freedom (MON) are included as proxies for institutional conditions, as stronger institutions may reduce precautionary saving. The second dimension captures human capital through education-related factors.

Following Lusardi (2008), higher educational attainment is expected to be associated with stronger long-term financial planning. Disaggregated employment rates by education level (Tertiary – MT/FT and Lower Secondary – MP/FP) are used to assess whether saving is associated with highly skilled employment or economic necessity among lower-income groups.

To capture immediate economic pressures, indicators of liquidity constraints and living standards are included. Gross Real Income (GIR) and Final Consumption (FC) reflect the household budget constraint, while the At-risk-of-poverty rate (RPR) captures vulnerability in post-2004 economies, where saving often depends on the narrow margin between income and subsistence consumption.

2. Methodology

2.1. Data used

The analysis uses panel data for the 27 EU Member States over 1996–2023, covering three dimensions: institutional framework (government integrity, tax burden, spending efficiency, monetary and trade freedom), financial and poverty indicators (gross income, final consumption, investment, poverty risk), and labour market dynamics (GDP per capita and employment by gender and education). To account for structural heterogeneity, the sample is divided into EU15

economies (Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain and Sweden) and post-2004 members (Bulgaria, Croatia, Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Romania, Slovakia and Slovenia). The panel is unbalanced due to missing observations in the early years (Table 1).

Table 1. Variables utilised

Variable	Abbreviation	Source
Households; non-profit institutions serving households saving rate (percentage)	HSR	Eurostat
Government integrity	GOVI	Heritage
Tax burden	TAX	
Government spending	GOVS	
Monetary freedom	MON	
Trade freedom	TRADE	
Households; non-profit institutions serving households' gross nominal income (percentage change on previous period)	GIN	Eurostat
Households; non-profit institutions serving households' gross real income (percentage change on previous period)	GIR	
Households; non-profit institutions serving households' final consumption (percentage change on previous period)	FC	
Households; non-profit institutions serving households' investment rate (percentage)	HIR	
At risk of poverty rate (cut-off point: 60% of median equivalised income after social transfers)	RPR	
Employment rate: Males less than primary and lower secondary education	MP	
Employment rate: Males upper secondary	MS	
Employment rate: Males tertiary	MT	
Employment rate: Females less than primary and lower secondary education	FP	
Employment rate: Females upper secondary	FS	
Employment rate: Females tertiary	FT	
Household debt including non-profit institutions serving households, consolidated	HDEB	
Median age	MAGE	

Source: own elaboration.

Descriptive statistics focus on two perspectives. Firstly, choropleth maps are constructed for the years 1996, 2004 and 2023, showing the spatial distribution of HSR across European countries. These maps allow visual inspection of regional patterns and long-run changes in saving behaviour. Secondly, the time evolution of HSR is plotted separately for the EU15 group, the post-2004 group and the EU average. Annual group means are computed and displayed in a line chart, which highlights common shocks (such as the 2008–2010 financial crisis and the 2020 COVID-19 pandemic) and persistent differences between developed and emerging economies.

2.2. Variable selection

Given the large number of potential determinants, LASSO (Least Absolute Shrinkage and Selection Operator) linear regression is applied as a preliminary variable selection technique to identify the most relevant predictors of HSR. The procedure is conducted separately for the two country groups and is applied to the pooled data, without explicitly modelling the time dimension. This approach reduces model complexity and limits overfitting while providing a data-driven screening step before fixed-effects estimation.

Let HSR_i denote the household saving rate in country i , and let $x_i = (x_{1,i}, x_{2,i}, \dots, x_{p,i})$ be the vector of p potential explanatory variables (tax burden, income, consumption, employment rates by education, governance indicators, etc.). For each group $g \in \{EU15, Post2004\}$, the linear model with LASSO correction considers the following linear specification:

$$HSR_i = \beta_0 + \sum_{j=1}^p \beta_j \cdot x_{j,i} + \varepsilon \quad (1)$$

Instead of estimating the coefficients by ordinary least squares, LASSO minimises a penalised sum of squares using:

$$\hat{\beta}(\lambda) = \min_{\beta} \left\{ \frac{1}{N} \sum_{i=1}^N (HSR_i - \beta_0 - x_i \beta)^2 + \lambda \sum_{j=1}^p |\beta_j| \right\} \quad (2)$$

where:

- the first term is the mean squared error,
- the second term is an $L1$ penalty that shrinks coefficients,
- $\lambda \geq 0$ controls the strength of penalisation.

For a large λ , some coefficients are forced exactly to zero, giving LASSO its variable selection property.

The LASSO procedure is not intended to produce causal estimates. Instead, it serves as a data-driven mechanism for selecting informative predictors, reducing multicollinearity, and filtering variables before fixed-effects estimation.

tion. For descriptive purposes, relative LASSO weights were calculated from the absolute non-zero penalized coefficients and expressed as percentages of their total absolute value (Caughlin, 2024).

2.3. Fixed-effects panel models

In the second stage, two-way fixed-effects (FE) models are estimated separately for each country group using the selected predictors and GDP per capita. The general specification is:

$$HSR_{it} = \alpha_i + \lambda_t + \beta' X_{it} + u_{it} \quad (3)$$

where:

- HSR_{it} denotes the household saving rate in country i at time t ,
- α_i are country fixed effects capturing time-invariant heterogeneity (institutional structure, culture, long-run preferences),
- λ_t are year fixed effects capturing common shocks (global crises, EU-wide policy changes),
- X_{it} is the vector of selected independent variables,
- u_{it} is the error term.

Models are estimated using the within estimator (plm package in *R*) with country and year fixed effects. The Hausman test (Wooldridge, 2002) consistently supports the fixed-effects specification for both groups, while model fit is assessed the within R^2 (Gao, 2023). Given typical macro-panel issues, residual diagnostics include tests for serial correlation (Breusch–Godfrey / Wooldridge), heteroscedasticity (Breusch–Pagan), and cross-sectional dependence (Pesaran CD). The F -test confirms the joint relevance of two-way fixed effects, and the Shapiro–Wilk test is reported as an indicative check of normality, though less important in large samples.

For both country groups, diagnostics indicate serial correlation, heteroscedasticity, and cross-sectional dependence. To ensure valid inference, all models are re-estimated using Driscoll–Kraay standard errors, which are robust to these issues in large- T panels, while significance is assessed with robust t -statistics and p -values. Finally, the two groups are compared by combining the fixed-effects results into a common dataset and presenting them in a forest plot, which highlights coefficient magnitude, confidence intervals, and structural differences in saving behaviour between mature and emerging economies.

To assess potential endogeneity, Durbin–Wu–Hausman tests (Patrick, 2020) were performed using an instrumental variable framework, where lagged values of final consumption and gross real income were used as instruments for the respective models.

3. Results

3.1. Descriptive results

The evolution of the household saving rate (HSR) in 1996, 2004, and 2023 (Figure 1) reveals clear cross-country differences between EU15 and post-2004 members. In 1996, Central and Northern countries such as Austria, Germany, Finland, and Sweden recorded high saving rates, reflecting institutional stability and mature financial systems, while Southern countries (Greece, Italy, Portugal) showed lower levels, consistent with stronger consumption pressures and structural vulnerabilities, as also noted by Le Blanc et al. (2013). By 2004, enlargement brought a more nuanced picture: several post-2004 countries (Poland, Czech Republic, Hungary) displayed moderate to high saving rates, reflecting prudent behaviour during the economic transition, whereas Southern Europe maintained structurally lower levels. Overall, Northern and Central Europe preserved robust saving patterns throughout the period.

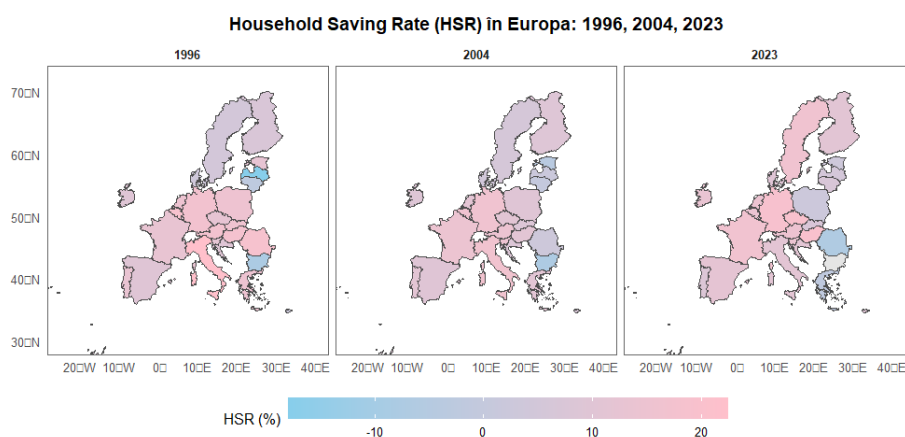


Figure 1. Household saving rate in selected years

Source: own elaboration in RStudio.

In 2023, regional disparities persist. Central European countries (Austria, Germany, Czech Republic, Slovakia) maintain high saving rates, reflecting long-term stability, while Baltic and Eastern states display moderate levels, suggesting gradual post-accession consolidation. In contrast, Southern countries (Greece, Portugal, Spain) remain at the lower end, confirming persistent structural and social constraints on saving capacity (Le Blanc et al., 2013). Overall, saving patterns remain stronger and more stable in Central and Northern Europe, while Southern economies continue to face structural vulnerabilities.

According to Figure 2, EU15 countries, the saving rate remained relatively stable around 10–11%, with slight declines in the 2000s, a temporary rise during the 2008–2010 financial crisis, and a clear peak in 2020 due to forced savings during the COVID-19 pandemic (Borowski & Jaworski, 2023). In contrast, post-2004 countries generally recorded lower rates, often below 7%, with sharper fluctuations, reflecting lower incomes and higher consumption pressures. Although they also experienced a pandemic-related peak in 2020, this was followed by a sharp decline.



Figure 2. Evolution of household saving rate

Source: own elaboration in RStudio.

The EU average follows an intermediate path, influenced by the stability of the EU15 and the volatility of emerging members. Overall, the results confirm a structural polarisation between developed and emerging economies, with the latter displaying lower and more unstable saving patterns (Niculescu-Aron & Mihăescu, 2012).

3.2. Linear regression with Lasso correction

The LASSO penalised regression highlights differences in the determinants of household saving rates between EU15 and post-2004 countries (Figure 3). The method selects relevant predictors through coefficient shrinkage, providing an exploratory overview of the economic, fiscal, and social variables associated with saving behaviour.

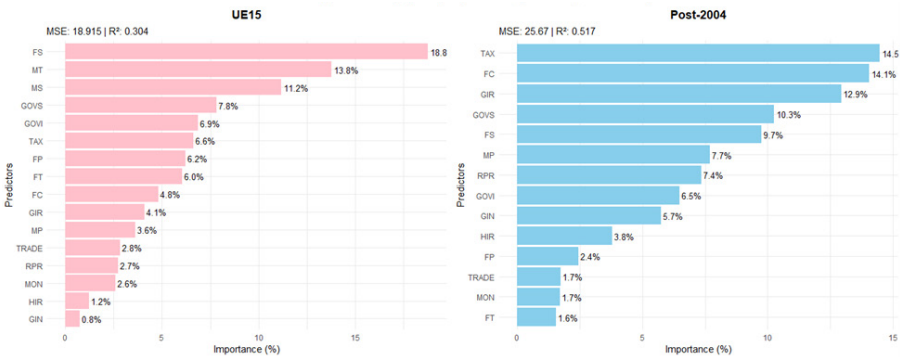


Figure 3. Linear regression analysis results

Note: Variable abbreviations are defined in Table 1.
Source: own elaboration in RStudio.

For mature EU15 economies, the model explains about 30% of the variation in HSR ($R^2 = 0.304$). The predictors with the largest penalised coefficients are FS, MT, and MS, indicating the prominence of medium- and highly educated employment in the exploratory screening, a finding consistent with that of Korzeniowska and Ulman (2023). GOVS, GOVI, and TAX also receive non-zero penalised coefficients, whereas FC, GIR, MP, TRADE, and MON display relatively smaller coefficients. Overall, the exploratory screening suggests greater prominence of structural and occupational variables in the EU15 group.

For post-2004 countries, the LASSO model yields an R^2 of 0.517. TAX, FC, and GIR are among the most prominently selected predictors, with relative weights of approximately 12%–15% (Al Mamun et al., 2025). GOVS and FS show smaller relative penalised coefficients, while RPR (7%) is more prominent in the post-2004 group than in the EU15. Overall, the LASSO screening suggests greater prominence of fiscal and social variables, particularly taxation, income changes, and budgetary conditions (Skoblar, 2024).

The LASSO results indicate different patterns of variable selection across the two groups, with greater prominence of structural and occupational variables in the EU15 and fiscal and social variables in post-2004 economies.

Figure 4 illustrates the direction of the penalised LASSO coefficients. In the EU15, positive coefficients are mainly associated with occupational factors, with FS and MT displaying the largest penalised coefficients, consistent with the relevance of skilled labour market participation for saving behaviour reported by Almudi et al. (2023). GOVS and GIR also show positive penalised coefficients, while TAX, GOVI, and lower-education employment variables (FP, FT, MS) display negative signs, a pattern that is consistent with the potential relevance of fiscal conditions and labour market disparities for household saving (Tanzi & Zee, 1998). In post-2004 countries, the pattern is more strongly associated with fiscal and social variables: GIR, FS, and GOVI display positive

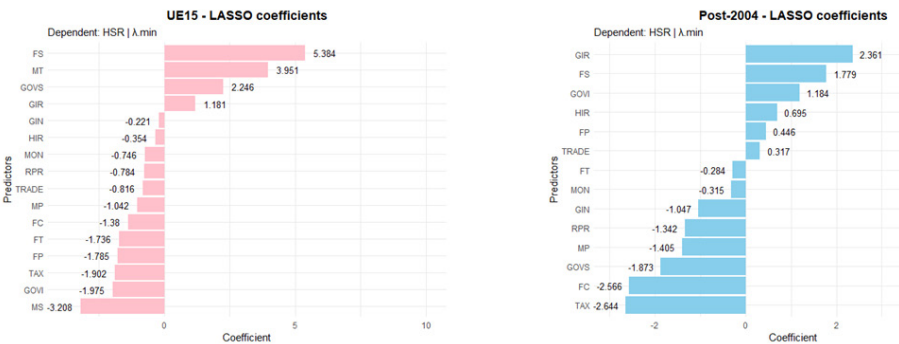


Figure 4. Lasso coefficients by groups

Note: Variable abbreviations are defined in Table 1.
Source: own elaboration in RStudio.

penalised coefficients, consistent with Almudi et al. (2023), whereas TAX, FC, GOVS, RPR, and MP show negative coefficients. Overall, the exploratory LASSO results indicate distinct patterns of variable selection across the two groups, with greater prominence of occupational and institutional variables in the EU15 and fiscal and socio-economic variables in post-2004 economies.

3.3. Fixed effects models

3.3.1. EU15 countries

The variance inflation factor (VIF) results presented in Table 2 indicate that multicollinearity is not a serious concern in the EU15 model. All VIF values remain below the conventional threshold of 10, which suggests that the explanatory variables do not exhibit excessive linear correlation. The highest values are observed for FT (6.16) and FS (5.24), reflecting some expected correlation between labour market indicators related to educational attainment. However, these values remain within acceptable limits and do not compromise the stability of the coefficient estimates (Kim, 2019). Overall, the results confirm that the model does not suffer from problematic multicollinearity and that the estimated relationships can be interpreted reliably.

Table 2. Variance Inflation Factor (VIF) diagnostics – EU15 model

FS	MT	GOVS	TAX	GDP_Capita	FP	FT	FC
5.24	3.27	2.35	1.96	1.52	2.04	6.16	1.12

Note: Variable abbreviations are defined in Table 1.
Source: own calculations in RStudio.

Table 3 presents the two-way fixed effects results for EU15 countries, controlling for country-specific characteristics and common time effects. The model is statistically significant ($F = 40.42$, $p < 0.001$) and explains 48.7% of the within-country variation in HSR (within $R^2 = 0.487$). Employment among highly educated men (MT) has a strong positive effect (0.522 , $p < 0.001$), while GDP per capita (0.00014 , $p < 0.001$) and government efficiency ($GOVS$: 0.103 , $p < 0.001$) also stimulate savings, supporting classical theories that link income growth and macroeconomic stability to higher saving capacity. In contrast, taxation (TAX : -0.107 , $p < 0.01$) and final consumption (FC : -0.389 , $p < 0.001$) significantly reduce savings, consistent with the traditional view that higher fiscal pressure and current expenditure crowd out saving. Female employment with low and medium education (FP : -0.192 , $p < 0.001$; FS : -0.185 , $p < 0.01$) is negatively associated with HSR, while highly educated female employment (FT : 0.179 , $p = 0.07$) shows a positive effect. Overall, in EU15 economies, savings are mainly driven by income, human capital, and institutional quality.

Table 3. Fixed-effects results for the EU15

Variable	Estimate	Standard error	<i>t</i> -value	<i>Pr</i> ($> t $)
FS	-0.18528	0.062404	-2.969	0.0032**
MT	0.522473	0.098644	5.2966	2.12E-07***
GOVS	0.102666	0.017344	5.9193	7.9E-09***
TAX	-0.10749	0.035198	-3.0539	0.002437**
GDP_Capita	0.000143	2.8E-05	5.0967	5.75E-07***
FP	-0.19155	0.046061	-4.1585	4.06E-05***
FT	0.17898	0.099051	1.8069	0.071654
FC	-0.38903	0.077056	-5.0487	7.27E-07***

Note: Variable abbreviations are defined in Table 1.

Source: own elaboration in RStudio.

The results show that both economic and structural factors influence the household savings rate in EU15 economies. Higher education (MT) and government efficiency ($GOVS$) have a positive and significant effect, while taxation (TAX), final consumption (FC), and lower-skilled employment (FP , FS) reduce savings. Overall, in these relatively stable economies, savings are supported by income growth and effective governance but constrained by fiscal pressure and occupational disparities.

Diagnostic tests support the use of the two-way fixed effects model for the EU15 group (Table 4). The Hausman test rejects the random effects specification in favour of fixed effects. The Breusch–Godfrey (1978) and Wooldridge

Table 4. Diagnostic tests for the EU15 model

Test	Statistic	<i>df</i>	<i>p</i> -value
Hausman	$\chi^2 = 50.638$	7	1.083e-08
Breusch–Godfrey	$\chi^2 = 173.11$	27	< 2.2e-16
Wooldridge	$F = 340.02$	1, 373	< 2.2e-16
Breusch–Pagan	$\chi^2 = 1751.1$	1	< 2.2e-16
Pesaran CD Test	$z = -3.5252$	–	0.0004231
<i>F</i> -test for two-way fixed effects	$F = 23.622$	40, 340	< 2.2e-16
Shapiro–Wilk	$W = 0.99342$	–	0.0882

Source: own elaboration in RStudio.

(2002) tests indicate serial autocorrelation, while the Breusch–Pagan (1979) test reveals heteroscedasticity. In addition, the Pesaran CD (2015) test confirms cross-sectional dependence, suggesting that economic shocks in one country affect others within the panel.

The results indicate that the standard fixed effects model violates error structure assumptions, requiring robust standard errors; therefore, Driscoll–Kraay corrections are applied. The *F* test confirms the need for country and year fixed effects to control for unobserved heterogeneity. The Shapiro–Wilk test (1965) does not show serious deviations from residual normality, although this assumption is less relevant in large panels. Overall, the tests justify the fixed effects specification with robust corrections to ensure reliable inference. The robust estimation results for the EU15 group are presented in Table 5. As shown in the Table, both economic and structural factors are significantly associated with the household savings rate in the EU15 group.

Table 5. Robust estimation for the EU15 group

Variable	Estimate	Standard error	<i>t</i> -value	<i>Pr</i> (> <i>t</i>)
FS	–0.18528	0.07006	–2.6446	0.008558 **
MT	0.52247	0.1355	3.856	0.000138 ***
GOVS	0.10267	0.017705	5.7986	1.53E-08 ***
TAX	–0.10749	0.041969	–2.5612	0.010861 *
GDP_Capita	0.000143	4.27E-05	3.3366	0.000942 ***
FP	–0.19155	0.062622	–3.0587	0.002399 **
FT	0.17898	0.12385	1.4452	0.149333
FC	–0.38903	0.10027	–3.8798	0.000126 ***

Note: Variable abbreviations are defined in Table 1.

Source: own elaboration in RStudio.

3.3.2. Countries post-2004 accession

Table 6 presents the variance inflation factor (VIF) values for the explanatory variables included in the post-2004 model. All VIF values are well below the commonly accepted threshold of 10, indicating the absence of problematic multicollinearity among the independent variables.

Table 6. Variance Inflation Factor (VIF) diagnostics – post-2004 model

GIR	TAX	FC	GDP_Capita	FP	MON
2.15	1.27	2.16	1.47	1.19	1.53

Source: own calculations in RStudio.

Table 7 presents the fixed-effects results for post-2004 countries. The model explains approximately 43% of the within-country variation in household saving rates (within $R^2 = 0.434$).

Table 7. Panel results for the post-2004 group

Variable	Estimate	Standard error	t-value	$Pr(> t)$
GIR	0.396591	0.065095	6.0925	3.57E-09 ***
TAX	-0.0963	0.037892	-2.5416	0.01156 *
FC	-0.57335	0.069986	-8.1924	8.54E-15 ***
GDP_Capita	0.000215	0.000127	1.6883	0.09244
FP	0.322646	0.043726	7.3788	1.73E-12 ***
MON	-0.13962	0.028362	-4.9227	1.44E-06 ***

Note: Variable abbreviations are defined in Table 1.

Source: own elaboration in RStudio.

In post-2004 countries, gross real income (GIR) has a strong positive effect (0.3966, $p < 0.001$), indicating high income elasticity of savings: as real income rises, households save more. In contrast, final consumption (FC: -0.573, $p < 0.001$) reduces savings, suggesting that current expenditure still dominates saving formation. Female employment with low education (FP: 0.323, $p < 0.001$) positively influences HSR, reflecting improved labour-market integration and additional household income, a result that differs from the EU15 and can be interpreted in line with Keynesian consumption theory, where a higher income affects both consumption and saving behaviour. Taxation (TAX: -0.096, $p < 0.05$) negatively impacts savings, confirming the direct effect of fiscal pressure on disposable income, while monetary free-

dom ($MON: -0.1396, p < 0.001$) suggests that easier access to credit reduces saving. GDP per capita shows a positive association that is significant at the 10% level, consistent with the income-saving relationship.

Table 8 shows that the two-way fixed effects specification is appropriate for post-2004 countries. The Hausman test favours fixed effects, while the Breusch–Godfrey and Wooldridge tests indicate serial autocorrelation. The Breusch–Pagan tests confirm heteroscedasticity, and the Pesaran CD test reveals significant cross-sectional dependence, suggesting that shocks in one country affect others in the group. The F -test supports the inclusion of both country and year effects to control for unobserved heterogeneity. Although the Shapiro–Wilk test points to slight deviations from normality, this is not important in large panels.

Table 8. Diagnostic tests for the post-2004 model

Test	Statistic	df	p -value
Hausman	$\chi^2 = 73.879$	6	6.528e-14
Breusch–Godfrey	$\chi^2 = 188.46$	22	< 2.2e-16
Wooldridge	$F = 398.83$	1, 318	< 2.2e-16
Breusch–Pagan (studentised)	$BP = 15.581$	6	0.01619
Breusch–Pagan LM (plmtest)	$\chi^2 = 680.59$	1	< 2.2e-16
Pesaran CD	$z = -3.4669$	-	0.0005265
F -test for two-way FE	$F = 12.182$	37, 287	< 2.2e-16
Shapiro–Wilk normality	$W = 0.99138$	-	0.04909

Source: own elaboration in RStudio.

Table 9 reports the coefficient estimates with Driscoll–Kraay standard errors, providing inference robust to the previously identified error dependence.

Table 9. Robust estimation for the post-2004 group

Variable	Estimate	Standard error	t -value	$Pr(> t)$
GIR	0.396591	0.063519	6.2437	1.53E-09 ***
TAX	-0.0963	0.049846	-1.9321	0.05434
FC	-0.57335	0.078845	-7.2719	3.38E-12 ***
GDP_Capita	0.000215	0.000144	1.4964	0.13565
FP	0.322646	0.045796	7.0453	1.38E-11 ***
MON	-0.13962	0.059941	-2.3292	0.02054 *

Note: Variable abbreviations are defined in Table 1.

Source: own elaboration in RStudio.

Figure 5 compares the estimated coefficients for the two country groups. Points represent coefficient estimates, while intervals indicate statistical uncertainty.

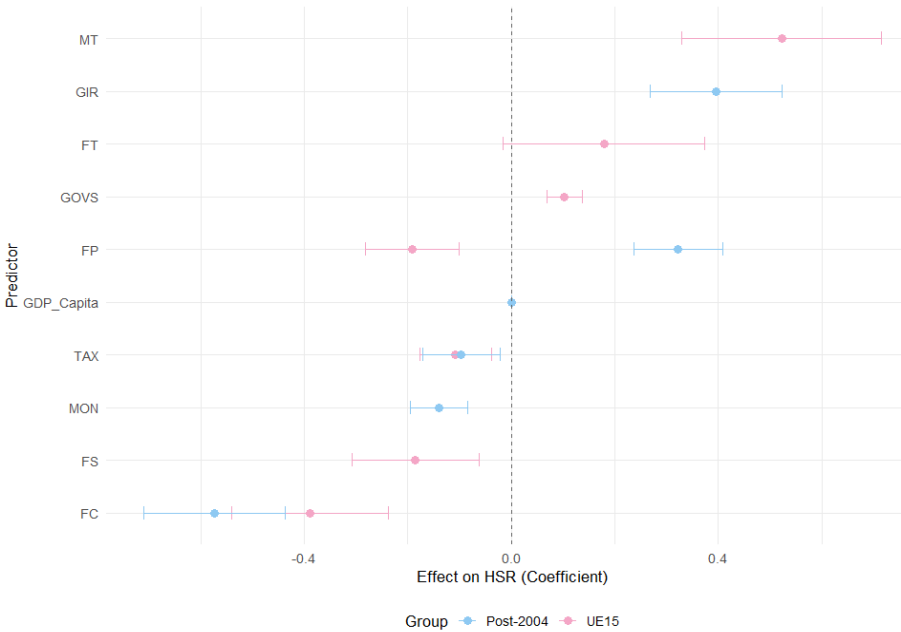


Figure 5. Forest plot comparison

Note: Variable abbreviations are defined in Table 1.
Source: own elaboration in RStudio.

The differences between the two groups are evident. In the EU15, savings are mainly driven by high human capital (MT, FT) and institutional efficiency (GOVS). In post-2004 countries, savings rely more on real income (GIR) and labour market integration, including lower-educated workers (FP). Final consumption (FC) reduces savings in both groups, but more strongly in post-2004 economies. Monetary freedom (MON) is relevant only in post-2004 countries, while taxation negatively affects savings in both groups, with a stronger impact in the EU15. These results show that EU15 countries have a savings profile based on qualifications and institutional stability, while post-2004 countries have an income-oriented profile that is vulnerable to consumption and monetary conditions. Privatisation played a key role in the differences between Central and Eastern European countries, given that social, cultural, and economic legacies played a fundamental role in the transition periods in those countries (Socioliuc (Guriță) et al., 2021).

3.3.3. Assessing potential endogeneity

The results reported in Table 10 indicate different endogeneity patterns across the two country groups. For the EU15 model, the Wu–Hausman test strongly rejects the null hypothesis of exogeneity ($p < 0.001$), thereby indicating that final consumption is endogenous in the saving equation. This finding is consistent with the accounting relationship between consumption and savings in national income identities. In contrast, the same test does not detect endogeneity for gross real income in the post-2004 model ($p = 0.501$), suggesting that income dynamics can be treated as exogenous in this specification. In both models, the Sargan test does not reject the validity of the instruments, while the weak instruments test suggests relatively modest instrument strength. Such differences are due to the different dynamics between the two groups of countries and the resulting correlations.

Table 10. Endogeneity diagnostics for the EU15 and post-2004 models

Test	EU15 (FC instrumented)	Post-2004 (GIR instrumented)
Weak instruments test	5.084 ($p = 0.0067$)	2.997 ($p = 0.0513$)
Wu–Hausman test	16.19 ($p = 0.00007$) ***	0.454 ($p = 0.5007$)
Sargan test	1.177 ($p = 0.278$)	0.100 ($p = 0.752$)

Notes: *** $p < 0.001$. Lagged variables are used as instruments (FC_{t-1} , FC_{t-2} for EU15 and GIR_{t-1} , GIR_{t-2} for Post-2004).

Source: own calculations in RStudio.

The endogeneity diagnostics therefore suggest that caution is required when interpreting the EU15 estimates, particularly the coefficient associated with final consumption. Although a dynamic System GMM estimator could, in principle, provide an alternative framework for addressing endogeneity through internal instruments, it was not adopted as the main estimator in the present study. This choice reflects both the research objective and the structure of the dataset. The primary aim of the analysis is to identify structural differences in the correlates of household saving behaviour between the EU15 and post-2004 countries, rather than to estimate a dynamic adjustment process in household savings. Moreover, the two subsamples contain a relatively small number of cross-sectional units (14 EU15 and 13 post-2004 countries) observed over a comparatively long time period. System GMM estimators are primarily designed for panels characterised by a large number of cross-sectional units and a relatively short time dimension (Roodman, 2009). In the present setting, the limited number of countries would make GMM estimation and instrument-based specification tests potentially sensitive to the choice and number of instruments.

Accordingly, the two-way fixed-effects specification is retained as the main analytical framework because it directly controls for unobserved time-invariant country heterogeneity and common year-specific shocks, while Driscoll–Kraay standard errors provide inference robust to the serial correlation, heteroscedasticity, and cross-sectional dependence identified in the diagnostic tests. Nevertheless, fixed effects do not eliminate simultaneity or reverse causality arising from time-varying endogenous regressors. Therefore, the coefficient estimates, particularly that of final consumption in the EU15 model, should be interpreted as conditional within-country associations rather than strict causal effects. The development of a fully dynamic specification, including lagged household savings and appropriately restricted internal instruments within a System GMM framework, is left for future research.

4. Discussion

The theoretical framework is integrated with the empirical findings, with the two country groups discussed separately. The analysis first considers the EU15 countries and then examines the post-2004 accession countries.

Figure 3 shows that in the exploratory LASSO screening, education-related variables (*FS*, *MT*, *MS*) are among the most prominently selected predictors for EU15 countries, followed by government spending and government integrity. Given the shrinkage imposed by LASSO, these relative coefficient patterns are used only to identify potentially relevant predictors and should not be interpreted as measures of absolute economic effect size.

These results are confirmed in Table 5. *FS* and *FP* show negative associations with savings, while *MT* associations positively, highlighting the role of educational attainment in saving behaviour. In addition, the positive association of *GOVS* and the negative effect of *TAX* support H2. Final consumption (*FC*) is negatively associated with saving, which is consistent with the consumption–saving trade-off (Keynes, 1936). Government spending (*GOVS*) may support saving through public resource management (Feldstein & Elmendorf, 1990; Röhn, 2010), while higher taxation (*TAX*) is associated with lower saving. Conversely, higher government spending may also increase household consumption (Chairassamee et al., 2025).

Figure 3 shows that in post-2004 countries, the exploratory LASSO screening selects a different set of prominent predictors, with *TAX*, *FC*, *GIR*, and *GOVS* receiving relatively larger penalised coefficients than the education-related variables. These patterns indicate differences in variable selection between the two groups, but their magnitudes should not be interpreted as absolute economic effects because LASSO coefficients are subject to shrinkage. The

subsequent fixed-effects models are therefore used for the substantive interpretation of the selected relationships.

The endogeneity diagnostics reveal a structural difference between the two groups of countries. In the EU15 model, the Wu–Hausman test indicates that final consumption is endogenous, suggesting simultaneity between consumption and household saving behaviour. This reflects the close relationship between consumption and savings in more developed economies, where households adjust both decisions simultaneously. In contrast, the post-2004 model does not detect endogeneity for gross real income, thus indicating that income dynamics can be treated as largely exogenous in explaining savings. These findings confirm that household saving behaviour differs structurally between EU-15 and CEE economies, reflecting persistent differences in financial maturity and post-transition institutional legacies.

The findings are broadly consistent with previous research highlighting the relevance of labour market conditions and education for household saving behaviour (Almudi et al., 2023), as well as the role of economic freedom (Bajrami et al., 2025). The negative associations observed for some economic freedom indicators should, however, be interpreted cautiously. Rather than implying a direct adverse effect on saving, they may reflect broader macroeconomic conditions in which stronger economic activity is accompanied by higher household consumption and a lower propensity to save (Brkić et al., 2020). There are also divergent trends in saving within EU countries (Mierzejewski & Szczurek, 2025; Niculescu-Aron & Mihăescu, 2012). The findings are consistent with previous studies reporting divergent saving behaviour across the EU (Ariç & Siok, 2021; Schrooten & Stephan, 2003) and the multidimensional nature of saving determinants (Horioka & Ventura, 2025). Thus, the similarities with other studies are: geographical differences, the role of education in saving decisions, and the classic consumption-saving dichotomy. However, the main differences from other studies stem precisely from the use of economic freedom variables, which have not been used previously. Consequently, this makes these differences difficult to quantify.

Conclusions

Building on classical saving theories, this study examines household saving behaviour across European countries over 1996–2023. To capture persistent structural differences, the sample is divided into EU15 and post-2004 accession countries.

The analysis first examines the evolution of household saving across European countries, revealing substantial cross-country heterogeneity and changes associated with the 2008 financial crisis and the COVID-19 pandem-

ic. Regression results further indicate structural differences between the two groups. In the EU15, saving is more closely associated with occupational and institutional factors, whereas in post-2004 economies, income and fiscal conditions play a stronger role. From an institutional perspective, the EU exhibits distinct patterns of household saving behaviour, with financial maturity and post-transition legacies constituting the primary factors distinguishing the EU-15 from Central and Eastern European (CEE) economies.

The results suggest different policy priorities across the two regions. For EU-15 economies, the positive link between education and savings indicates that policies promoting financial literacy could further strengthen household financial resilience. In contrast, for post-2004 countries, savings remain closely linked to real income growth and taxation, implying that policies reducing the tax burden on labour or stabilising inflation may have a stronger impact on household saving behaviour. The findings support the idea that governments can encourage saving by improving the incentive structure of the private sector, as suggested by Bebczuk et al. (2015). In addition, strengthening precautionary saving mechanisms through institutional design, such as automatic pension enrolment, matched savings accounts, or tax-advantaged long-term deposits, could help households accumulate savings even in more volatile economic environments.

This study has several limitations. First of all, the use of aggregated macroeconomic data may mask within-country household heterogeneity, while the unbalanced panel may affect long-term comparability. Endogeneity is also a concern, particularly for final consumption in the EU15 model; therefore, the estimated coefficients should be interpreted as conditional associations rather than causal effects. The Two-Way Fixed Effects specification was retained because the study focuses on structural within-country differences and the subsamples contain relatively few countries observed over a comparatively long period, whereas System GMM is primarily suited to large- N , small- T panels (Roodman, 2009). Dynamic modelling, including lagged saving rates and System GMM where appropriate, therefore represents an important avenue for future research. Future studies could also incorporate household-level, behavioural, and cultural factors.

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Household debt persistence and its drivers: Evidence from cross-country growth heterogeneity

 Agata Wierzbowska¹

 Renata Karkowska²

 Zbigniew Korzeb³

 Paweł Niedziółka⁴

Abstract

Household indebtedness has been a major policy concern since the 2008 financial crisis. In the current context, understanding the drivers of household debt is a more pressing issue than ever, as they affect economic stability and resilience. The aim of the paper is to examine the determinants of household debt using a comprehensive dataset spanning 36 countries and the period from 2012 to 2022. We employ dynamic panel regression models to explore the drivers of household indebtedness. Our results indicate that the Consumer Confidence Index positively influences household debt across all samples, while the COVID-19 pandemic reduced debt levels. Similarly, bank policies that tighten lending standards reduce household debt, whereas greater credit availability encourages borrowing. On the other

Keywords

- household debt
- consumer confidence
- bank lending policy
- life expectancy
- labour force
- COVID-19

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¹ Graduate School of Economics, Kobe University, Japan, corresponding author: wierzbowska@econ.kobe-u.ac.jp, <https://orcid.org/0000-0001-8641-3217>.

² Faculty of Management, University of Warsaw, Warsaw, Poland, rkarkowska@wz.uw.edu.pl, <https://orcid.org/0000-0002-6335-2973>.

³ Department of Management, Economy and Finance, Białystok University of Technology, Białystok, Poland, z.korzeb@pb.edu.pl, <https://orcid.org/0000-0001-9690-3842>.

⁴ Banking Institute, SGH Warsaw School of Economics, Warsaw, Poland, pniedz@sgh.waw.pl, <https://orcid.org/0000-0002-1659-7310>.

hand, a larger working-age population appears to reduce consumer indebtedness, while life expectancy contributes to its growth. This highlights the complex role of consumption-oriented explanations in shaping borrowing behaviour.

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Introduction

The fierce surge in household debt has been one of the main issues of interest to policymakers, especially after 2008 (Aziz et al., 2024). Household borrowing relative to disposable income between 2000 and 2023 grew substantially in almost all OECD-reporting countries, with Germany the sole exception. The ratio reached a record value in Norway (over 250%), while Lithuania experienced the most rapid expansion at over 1300% (OECD, n.d.). Understanding household financial performance and its determinants is essential for three reasons. Firstly, household debt and the ability to service the obligations affect institutions' profitability, capital and liquidity and, indirectly, financial stability. Indeed, as demonstrated by Ho et al. (2016), the problem of excessive household indebtedness is established to have initiated economic slowdown and financial crises. This is confirmed by Romão and Barradas (2024), who argue that Portuguese households' indebtedness played a crucial role in the recent sovereign debt crisis. Moreover, Barbaglia et al. (2024) conclude that regions in which household leverage increased more rapidly experienced more severe declines in output and employment. Secondly, debt-fuelled consumption affects GDP (Radulescu et al., 2019). Thirdly, as debt servicing consumes an increasing share of household spending, the possibility of achieving the expected standard of living is reduced, which generates adverse social effects and radicalisation of political choices. The problem of dynamic household debt growth impacts both advanced economies and emerging markets (Abd Samad et al., 2020). However, the most highly indebted households are in countries where incomes are typically high, and housing market boom-bust cycles have occurred (Demertzis et al., 2020). For these reasons, and to ensure that over-indebtedness does not escalate (Frigerio et al., 2020), it is important to identify the determinants of household indebtedness. Household financial behaviour and conditions can be predicted using objective criteria (such as macroeconomic fundamentals, societal structural variables, bank credit policy, and the quality of institutions and regulations) and subjective indicators, such as consumer confidence (Kłopocka, 2017).

Our study aims to explore the determinants impacting household indebtedness, emphasising the dichotomy of channels of influence (supply-side or demand-side variables). To fill a research gap identified in the literature, particular attention is paid to the role of the factors that may have most significantly influenced household decisions in recent years, namely consumer confidence approximated by the Consumer Confidence Index (CCI). This is due to the suspicion that escalating geopolitical risks may have distorted the impact of economic sentiment on household debt. Additionally, we analyse the COVID-19 pandemic and consumption-oriented variables related to demographic structure. Therefore, the article aims to verify the relevance and direction of these variables' impact on household debt.

In our view, consumer confidence stands out as one of the most intriguing and pivotal research areas, particularly given its debated role in shaping future economic activity. Consumer confidence is found to be a determinant of consumption (Acuña et al., 2020; Campelo et al., 2020; Mynaříková & Pošta, 2023), GDP (Chua & Tsiaplias, 2009; Matošec & Obuljen Zoričić, 2019), stock returns (Rojo-Suárez & Alonso-Conde, 2020), property investment of households (Khan et al., 2026), housing prices' connectedness (Balcilar et al., 2024), and savings (Kłopocka & Górka, 2021). Demirel and Seyfettin (2017) identify a bidirectional causality relationship between consumer confidence and consumption expenditure, industrial production and inflation, along with a unidirectional relationship between the level of confidence and the unemployment rate.

Our study investigates the determinants of household debt using a comprehensive dataset of 36 countries worldwide from 2012 to 2022. This period covers important economic shifts, including recovery from the post-subprime crisis, the prolonged period of low interest rates and non-standard monetary policy measures (Wierzbowska, 2021), housing market fluctuations, rising income inequality, major policy interventions, and the disruptive effects of the COVID-19 pandemic (Karkowska et al., 2023), followed by an increase in inflation and interest rate hikes. To explore the significance of household indebtedness determinants, we employ dynamic panel regression models using Generalised Method of Moments (GMM) estimators. These allow us to track variable dynamics while accommodating individual heterogeneity and reducing potential estimation biases.

Our approach is novel in taking into account how life expectancy at birth and working participation ratio impact on household debt. It is also the first study to examine COVID-19's influence on the relationship between consumer confidence and household debt, disaggregated by economies with low and high GDP per capita. The results provide new insights into the determinants of household debt. In particular, the COVID-19 period was associated with lower debt levels. Moreover, it was found that the impact of consumer confidence on household debt is relatively greater in countries with comparably higher GDP per capita growth.

The remainder of this article is structured as follows. Section 1 reviews the literature and develops hypotheses. Section 2 describes the data and methodology employed in the empirical research. Section 3 presents and discusses the main results, and Section 4 provides robustness checks. The last section summarises and presents the main conclusions and policy implications.

1. Theoretical background, literature review and hypotheses development

1.1. Household indebtedness and consumption— theoretical framework

In outlining the theoretical background for considering the rationale for household indebtedness, reference should be made to the life-cycle hypothesis developed by Modigliani and Brumberg (1954). It assumes that a household's consumption level exceeds its current income during youth. This gap is filled by consumer credit, the repayment of which is supposed to come from income increasing in the future. Thus, the 'life-cycle' hypothesis (LCH) assumes that people take on credit when they are younger and pay it off as they age (Comelli, 2021). The support for the LCH is Friedman's (1957) permanent income hypothesis (PIH), according to which the consumers make purchasing decisions based not on current but on projected levels of disposable income. In contrast, Ando and Modigliani (1963), referring to an earlier version of the LCH, argue that many people dissave when young, accumulate wealth in middle age, and consume in retirement. The LCH and PIH thus consider indebtedness a tool for smoothing consumption over the household life cycle.

1.2. Taxonomy of household debt determinants

The determinants of the ratio of household debt to GDP, disposable income or net worth, can be classified into demand- and supply-side factors (Coletta et al., 2019). A separate variable that influences households' decisions regarding borrowing (demand-side factor) and lending policy (supply-side factor) is a crisis, particularly a pandemic crisis (Mamatzakis et al., 2023; Yue et al., 2020). Moreover, macroeconomic determinants affect both the demand for and supply of loans granted to households (Dumitrescu et al., 2022).

1.3. Model of state and consumer confidence

A cross-country comparative analysis of household debt reveals how debt levels are influenced by the model of the state (its commitment to social objectives), and also the structure of society. The first theme concerns the impact of consumer confidence on household debt, as shown by Gholipour et al. (2023), who analysed data from 35 OECD countries and established that higher levels of government economic support increased consumer confidence. The functioning of the state and the extent to which the idea of the welfare state is implemented directly impact consumer finance and, indirectly, household indebtedness. The welfare state facilitates rational life planning by stabilising their financial expectations and reducing their risk aversion. Paradoxically, this is why higher indebtedness rates are recorded in Scandinavian countries (OECD, n.d.). In such countries with social-democratic and liberal welfare models, the legal framework affects household debt, which is higher than in conservative and Eastern European welfare states (Coletta et al., 2019). Moreover, Johnston et al. (2020) suggest that states which protect borrowers from income and employment insecurity (which strengthens consumer confidence) are associated with higher household indebtedness. In contrast, liberal economies have comparatively lower household indebtedness. Growth of welfare expenditures affects the increase in household indebtedness, which is confirmed by Aziz et al. (2024), Abd Samad et al. (2023), Coletta et al. (2019), as well as Moore and Stockhammer (2018). Divergence in household debt across countries is a function of the welfare state's orientation toward old-age provisions and the insider/outsider cleavage in the labour market (Comelli, 2021).

The opposite relationship is indicated by Hu (2024), who identifies financial welfare retrenchment as a key factor affecting an upsurge in household leverage, echoing Moore and Stockhammer (2018), who suggest that the rolling back of the welfare state drives household indebtedness. Pan (2023) examines the effects of populism on household debt in 30 countries and documents how left-wing populism diminishes household debt by reducing household consumption while right-wing populism diminishes household debt by increasing public debt. Both types of populism decrease household debt by reducing lenders' willingness to lend.

1.4. Consumer confidence among demand-driven factors of household interest in borrowing

Gric et al. (2022) differentiate between rational (driven by macroeconomic fundamentals), and irrational (excessive) consumer sentiment, which re-

flects households' optimism or pessimism in addition to rationally derived beliefs. Household indebtedness is influenced by the extent to which changes in rational factors translate into current and future, strictly subjective, households' perceptions of their ability to service debt. Nowzohour and Stracca (2017) state that economic sentiment may be used to describe how economic agents view future economic developments. Economic sentiment covers two opposing dimensions, i.e. confidence and uncertainty (van der Wielen & Barrios, 2021).

Empirical studies indicate that economic sentiment and, in particular, consumer confidence have a significant impact on household debt. Analysing data from 15 European countries over the period 2003–2019, Gric et al. (2022) demonstrate a significantly positive role of sentiment as a determinant of household debt on top of the economic fundamentals. Rubaszek and Serwa (2014) document how the household credit-to-GDP ratio depends on both individual income uncertainty and persistence. Referring to the Polish market, Kłopocka (2017) highlights the predictive power of both composite and component consumer confidence indexes for household saving and borrowing, while Lamdin (2008) links changes in consumer sentiment to subsequent changes in revolving credit utilisation. Consumer confidence impacts not only the level of household debt but also the quality of debt servicing; Wadud et al. (2020) demonstrate how improved current consumer sentiment significantly induces lower mortgage, credit card and automobile loan defaults.

Higher certainty regarding the amount and stability of income strengthens consumer confidence, which in turn expands household debt. This leads us to hypothesise that:

H1: A higher consumer confidence index leads to increased household borrowing.

1.5. Structural and social determinants of the demand on household borrowing

Referring to LCH and PIH, it can be argued that the dynamics and size of household indebtedness depend on the structure of the population, its income and age stratification, and the level of financial education.

Among the structural factors, income inequality comes to the fore. It positively correlates with household debt (Iacoviello, 2008; Moore & Stockhammer, 2018; Rutendo & Marozva, 2023; Stockhammer & Wildauer, 2017). Focusing on the Portuguese market, Romão and Barradas (2024) demonstrate the importance of consumption-oriented variables, including the degree of personal income inequality, households' labour income, and the fraction of the work-

ing-age population. These factors are highly interrelated. For instance, a relatively large working-age population renders the labour market more competitive, thereby suppressing households' labour income and, in turn, credit-worthiness. Conversely, non-working young people are debt-free due to strict credit constraints, while the non-working elderly population tend to spend their savings (Moore & Stockhammer, 2018). In turn, baby boomers exhibit a relatively relaxed attitude toward indebtedness, especially compared with other generations (Cynamon & Fazzari, 2008). Furthermore, while a larger working population exerts a positive and significant influence on household debt (Aziz et al., 2024), this effect reverses if it is accompanied by rising unemployment, which typically leads to a decline in household debt (Dumitrescu et al., 2022; Meng et al., 2013). Assuming *ceteris paribus* that an expanding labour force may result in pressure to reduce income or an increase in unemployment, the following hypothesis is tested:

H2: An increase in the fraction of the working-age population is accompanied by a decrease in household debt.

An analysis of consumer credit across 23 EU countries for 1997–2014 (Borowski et al., 2017) indicates the population share of young people and the level of society's education as variables positively associated with household indebtedness. The importance of the population's age structure is also highlighted by Moore and Stockhammer (2018), while Ho et al. (2016) reveal that working and retirement populations in the total population affect household leverage. This corresponds with the findings of Piovarci (2021), who emphasises the negative impact of age on debt, noting how an ageing population coincides with a contraction in debt. This conclusion confirms earlier studies by Farinha (2003) and Kim (2025), who note that young people mainly incur debt in connection with the purchase of a home.

Long and Feng (2024) challenge this consensus, arguing that there is a negative correlation between a decline in the dependency ratio, a deterioration in household solvency, and an overall decline in the real income of older people. These empirical discrepancies often result from differences in the samples used; for example, in countries with welfare-state characteristics, the impact of age on debt is weak or non-existent (Dumitrescu et al., 2022). Higher life expectancy leads to a greater propensity to take on debt, which should be linked to a change in creditworthiness assessment standards (taking into account a longer repayment period), greater borrower optimism about the possibility of stretching debt repayment over a relatively longer period, as well as debt-financed investments aimed at ensuring a certain standard of living after retirement. Considering the above, we assume that:

H3: Life expectancy at birth is positively associated with household indebtedness.

1.6. Factors determining the supply of credit to households

The supply of credit to households is positively correlated with financial development, which indicates the level of competition of the financial sector (Abd Samad et al., 2020; Aziz et al., 2024). Romão and Barradas (2024) conclude that a process of financialisation that is associated with financial development contributes to the growth of households' indebtedness. The multiplicity of lending institutions and intensifying competition among them leads to looser requirements being placed on borrowers, which contributes to the growth of debt. A similar effect is produced by the relaxing of regulatory standards (Abd Samad et al., 2023) and banking supervision frameworks Borowski et al. (2017). Credit volumes are relatively lower in countries with supervision integrated into the central bank. This means that the political independence of the supervisory authority restricts access to consumer credit. The degree of competition is impacted by concentration, which indirectly affects the supply of credit to households, as (Borowski et al., 2017). Based on the above findings, we assume that:

H4: Bank policies that tighten lending standards reduce household debt, while greater credit availability encourages borrowing.

1.7. COVID-19 and household indebtedness

Household demand for debt is procyclical and subject to macroeconomic trends (Borowski et al., 2017). Nofsinger (2012), by examining household behaviour before, during, and immediately after the subprime crisis, argues that this demand exacerbates the boom/bust economic cycle. In boom times, households increase indebtedness and decrease savings, while in bust times, households repay debt and save more, which drags on an already sluggish economy. Taylor and McNabb (2007) provide evidence of the procyclicality of consumer confidence and its role in predicting downturns. Debt depends not only on life cycles and business cycles, but it is also shaped (through changes in consumer confidence) by pandemic threats and the geopolitical situation. Teresiene et al. (2021) show that the COVID-19 pandemic did not affect the consumer confidence index in the Eurozone, whereas in the United States and China, the impact was negative. At the same time, Guo et al. (2022) document increased household borrowing behaviours during COVID-19, while Yue et al. (2020) suggest the opposite trend. Based on a survey among Polish citizens during the COVID-19 pandemic, Kurowski and Malinowska-Misiąg (2024) conclude that financial literacy significantly

increases households' borrowing intentions. Since data horizon is too short to assess the impact of geopolitical phenomena, we test only the hypothesis relating to the impact of COVID-19:

H5: COVID-19 decreases household borrowing.

1.8. The impact of macroeconomic variables on household debt

As mentioned, macroeconomic variables affect both demand and supply of household debt. The effect of interest rates on debt levels is not clear-cut. While Aziz et al. (2024) and Dumitrescu et al. (2022) demonstrate the positive effect of interest rates for household debt, Abd Samad et al. (2023) and Moore and Stockhammer (2018) suggest the opposite effect. Emiris and Koulischer (2023) document that less constrained and wealthier households increase their borrowing most when interest rates fall, while Rubaszek and Serwa (2014) show that the household credit to GDP ratio depends on the lending-deposit interest rate spread. Interest rates are most often a function of inflation, with increases resulting in suppressed household indebtedness, as shown by Aziz et al. (2024), Dumitrescu et al. (2022), Abd Samad et al. (2020), and Coletta et al. (2019).

Among the variables identified in empirical studies as affecting household indebtedness, unemployment and housing prices are relatively frequently mentioned. Unemployment is associated with a decline in satisfactory creditworthiness and is usually compounded by reduced disposable income. For this reason, it leads to lower household debt (Abd Samad et al., 2020; Aziz et al., 2024; Coletta et al., 2019; Dumitrescu et al., 2022). In turn, the rise of residential property prices results in growth of household debt (Abd Samad et al., 2020; Aziz et al., 2024; Coletta et al., 2019; Dumitrescu et al., 2022; Moore & Stockhammer, 2018; Romão & Barradas, 2024; Stockhammer & Wildauer, 2017). This is due to the need to take on increasing amounts of debt to buy a home, allocate more to debt servicing, and supplement current income with consumer loans. Marire (2024) proves that the coexistence of a 'house price boom' and the 'low policy rate' explains the substantial increase in household leverage.

The impact of residential property prices on household debt is also distorted by different models of residential property use in individual countries in terms of share of owned and rented flats (Augustyniak et al., 2013), differences in national housing policies based on support for long-term rentals or mortgage subsidies (Podlińska & Bogusz, 2025), as well as varying degrees of quantita-

tive restrictions on mortgage markets (Eerola et al., 2022), and the growing influence of institutional investors on housing prices (Banti & Phylaktis, 2025).

Both Coletta et al. (2019) and Borowski et al. (2017) point to a positive impact of economic growth on household debt, while Moore and Stockhammer (2018) conclude that growth leads to a reduction in household debt. Dumitrescu et al.'s study (2022) used a sample comprising 26 OECD countries for the period of 2002q1–2020q4, and demonstrates how economic growth leads to lower household debt, although this effect decreases as the level of household debt increases.

Despite the ambiguous effect of GDP on household indebtedness, the strong consensus that consumer confidence is positively associated with household indebtedness leads us to test the hypothesis:

H6: The impact of the consumer confidence index on household borrowing is more pronounced in countries with higher GDP per capita growth.

2. Data and methodology

This study investigates the determinants of household debt using a dataset of 36 countries worldwide from 2012 to 2022. This period is crucial for studying household borrowing because it encompasses significant economic shifts, including post-2008 crisis recovery, the debt crisis across the Mediterranean countries, prolonged low interest rates, housing market changes, and technological advancements in financial services. The decade in question also saw growing income inequality, major policy interventions, and the disruptive effects of the COVID-19 pandemic, followed by a surge in inflation and interest rate hikes. These events provide a unique context for understanding how households respond to economic cycles, financial innovations, and regulatory changes, offering valuable insights into borrowing behaviour and financial stability.

Table 1 summarises the composition of the research sample and reports country-level averages for three key variables: household debt as a share of net disposable income (DEBTH), gross domestic savings to GDP (DOMSAVINGS), and labour force participation (LABOURFORCE). The sample displays substantial cross-country heterogeneity in household indebtedness. Debt levels are particularly high in several advanced economies, most notably Denmark (262%) and the Netherlands (261%), followed by Norway (235%), Switzerland (216%), and Australia (206%), while markedly lower values are observed in emerging economies such as Mexico (22%), Russia (31%), Colombia (46%), and Brazil (48%).

Table 1. Descriptive statistics by country (averages for 2012–2022)

Countries	Debth	Domsavings	Labourforce
Australia	206.3	26.26	67.47
Austria	91.46	27.91	56.38
Belgium	112.87	25.09	29.96
Brazil	48.95	17.37	55.46
Canada	182.09	22.52	64.86
Chile	69.6	24.38	33.53
Colombia	46.76	15.51	48.90
Czechia	70.7	32.96	30.30
Denmark	262.48	28.98	60.03
Estonia	81.12	29.67	42.16
Finland	138.49	22.89	52.52
France	123.35	22.29	35.50
Germany	96.21	27.36	50.77
Greece	109.94	10.17	24.67
Hungary	48.32	29.74	30.39
Ireland	171.53	53.75	48.50
Italy	88.16	20.95	26.22
Japan	114.23	24.29	45.58
Korea	168.75	35.05	27.12
Latvia	47.15	21.39	38.02
Lithuania	50.79	22.24	34.75
Luxembourg	177.61	50.63	31.58
Mexico	22.91	19.59	44.64
Netherlands	261.9	30.79	70.84
New Zealand	117.65	23.12	62.34
Norway	235.95	36.64	56.68
Poland	58.54	23.04	33.45
Portugal	130.66	17.45	33.43
Russia	31.01	30.28	35.53
Slovak Republic	73.9	24.15	30.30
Slovenia	56.29	27.1	35.09
Spain	113.66	22.41	34.00
Sweden	183.06	28.8	54.48
Switzerland	216.04	36.32	67.24
United Kingdom	151.53	16.65	55.93
United States	109.66	18.12	55.15

Source: own elaboration.

Savings rates also vary widely, ranging from relatively low levels in countries such as Greece (10.1%) to very high levels in Ireland (53.7%) and Luxembourg (50.6%), suggesting differences in domestic funding capacity and household balance-sheet behaviour. Labour force participation is highest in the Netherlands (70.8%), Australia (67.4%), and Switzerland (67.2%), whereas it is notably lower in several European countries (e.g., Italy 26.2%, Belgium 29.9%). Overall, Table 1 highlights strong between-country variation in the outcome variable (DEBTH) and in potential explanatory factors, providing a useful backdrop for the subsequent empirical analysis of the determinants of household indebtedness. Table 2 with descriptive statistics shows substantial heterogeneity in the panel. Household indebtedness (DEBTH) varies widely, indicating that some country-year observations are highly leveraged relative to disposable income. By contrast, consumer sentiment (CCI) is tightly clustered around its mean, suggesting relatively limited variation in confidence over the sample. Bank solvency conditions, proxied by BANKCAP, implies meaningful differences in capitalisation across banking systems. CREDIT displays one of the widest ranges, consistent with large differences in financial depth and private-sector leverage across countries. Within this, domestic credit to the private sector is included as a macro-financial control capturing the overall depth of financial intermediation and credit availability in the economy. Although household debt constitutes one component of private-sector credit, the variable is broader in scope, as it also includes credit extended to firms and other private-sector entities. Its inclusion therefore allows us to control for the general credit environment in which household indebtedness evolves. Domestic savings (DOMSAVINGS) also show notable dispersion, pointing to heterogeneity in domestic funding capacity. LABOURFORCE varies considerably, while LIFEEXPECTANCY is comparatively stable but still heterogeneous across countries.

Table 2. Descriptive statistics

Variable	Observations	Mean	Standard deviation	Min	Max
DEBTH	396	4.63	0.6	2.92	5.69
CCI	362	4.6	0.02	4.51	4.65
BANKCAP	351	7.45	2.09	4	15.05
CREDIT	365	94.73	44.86	24.93	221.13
DOMSAVINGS	384	26.35	8.89	6.72	64.1
LABOURFORCE	384	44.38	13.6	20.72	81.76
LIFEEXPECTANCY	384	79.94	3.16	69.75	84.56
GDPGROWTH	384	2	3.3	-11.17	24.48

Source: own elaboration.

Table 3 reports pairwise correlations (with p-values in parentheses) between household indebtedness and the main explanatory variables. DEBTH is strongly and positively correlated with CREDIT (0.66) and LIFEEXPECTANCY (0.67), and also shows a sizeable positive association with LABOURFORCE (0.57). These patterns suggest that higher household debt tends to coincide with deeper credit markets, stronger labour market participation, and higher levels of socioeconomic development, as measured by life expectancy. DEBTH is also moderately positively correlated with DOMSAVINGS (0.36), indicating that more indebted economies in the sample are not necessarily low-saving economies, consistent with cross-country heterogeneity in financial structures and balance sheets.

Table 3. Correlation matrix

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(1) DEBTH	1.000							
(2) CCI	−0.016 (0.766)	1.000						
(3) BANKCAP	−0.485 (0.000)	0.194 (0.000)	1.000					
(4) CREDIT	0.659 (0.000)	−0.100 (0.035)	−0.501 (0.000)	1.000				
(5) DOMSAVINGS	0.362 (0.000)	0.191 (0.000)	0.142 (0.003)	0.005 (0.918)	1.000			
(6) LABOURFORCE	0.570 (0.000)	0.035 (0.464)	−0.183 (0.000)	0.375 (0.000)	0.093 (0.047)	1.000		
(7) LIFEEXPECTANCY	0.669 (0.000)	0.000 (0.994)	−0.414 (0.000)	0.424 (0.000)	0.139 (0.002)	0.315 (0.000)	1.000	
(8) GDPGROWTH	0.006 (0.908)	0.307 (0.000)	0.232 (0.000)	−0.171 (0.000)	0.323 (0.000)	0.044 (0.346)	−0.108 (0.019)	1.000

Notes: *p*-values in parentheses.

Source: own elaboration.

Based on the review of the theory and previous empirical evidence (Abd Samad et al., 2020; Dumitrescu et al., 2022), we estimate a dynamic specification to account for the strong persistence observed in household indebtedness. The baseline model is as Equation (1):

$$DEBTH_{i,t} = \beta_0 DEBTH_{i,t-1} + \beta' X_{i,t} + \delta_2 COVID_t + \lambda_i + \varepsilon_{i,t} \quad (1)$$

where $DEBTH_{i,t}$ denotes household debt as a percentage of household and NPISH net disposable income in country i and year t . $DEBTH_{i,t-1}$ is the lagged dependent variable, included to capture the persistence of household indebtedness. $X_{i,t}$ is a vector of control variables, including CCI, BANKCAP, CREDIT, DOMSAVINGS, LABOURFORCE, LIFEEXPECTANCY, and GDPGROWTH. Accordingly, β denotes the vector of coefficients associated with these control variables. $COVID_t$ is a dummy variable equal to 1 for the pandemic period and 0 otherwise. In the baseline specification, the COVID-related dummy equals 1 for 2019–2022 and 0 otherwise. We use this broader window not to suggest that the pandemic started in 2019 in economic terms, but to capture the full pandemic-related disturbance period, including the pre-pandemic year immediately preceding the shock and the subsequent years of economic disruption. The year 2019 is therefore treated as part of the transition window rather than as a pandemic year per se. This broader definition allows us to account for anticipatory changes, early uncertainty, and adjustment processes in household indebtedness around the COVID-19 shock. λ_i denotes country fixed effects, which control for unobserved time-invariant country-specific heterogeneity, while $\varepsilon_{i,t}$ is the idiosyncratic error term. The definitions, calculation methods and data sources for all variables used in the empirical analysis are summarised in the Appendix. To account for the dynamic nature of household indebtedness and potential endogeneity concerns, we employ dynamic panel Generalised Method of Moments (GMM) estimators following Arellano and Bond (1991) and the system-GMM extensions developed by Arellano and Bover (1995) and Blundell and Bond (1998). In this framework, the model is estimated using internally generated instruments: lagged levels of endogenous (or pre-determined) variables serve as instruments for the equation in first differences, and lagged first differences serve as instruments for the equation in levels (system GMM). This approach mitigates endogeneity, controls for unobserved heterogeneity, and improves efficiency when variables are persistent. Robust (heteroskedasticity-consistent) standard errors are reported.

Instrument validity and model diagnostics are assessed using standard GMM post-estimation tests. The Hansen test of overidentifying restrictions evaluates the joint validity of the instrument set; failure to reject the null supports instrument exogeneity (as reflected by the reported p-values). We also report the Arellano–Bond tests for serial correlation in the differenced residuals. As expected in dynamic differenced models, AR(1) is typically present, while the key requirement for consistency is the absence of a second-order serial correlation. Accordingly, the AR(2) test results (insignificant p-values) support the assumption of no second-order autocorrelation in the differenced errors, implying no serial correlation in the level error term and hence consistent GMM estimates.

3. Results

Our study analyses the determinants of household indebtedness by examining the factors that influence it through both supply-side and demand-side channels. To provide a deeper and more nuanced understanding, we further refine the analysis by categorising these determinants into distinct groups, thereby shedding light on the various forces shaping household debt. Table 4 presents four nested specifications. Column (1) includes persistence (lagged DEBTH) and CCI. Column (2) adds banking- and macro-variables (BANKCAP, CREDIT, DOMSAVINGS). Column (3) further augments the model with labour market participation and demographic development (LABOURFORCE, LIFEEXPECTANCY). Column (4) introduces the COVID dummy to capture the pandemic-period shift in household debt dynamics. The validity of the dynamic system GMM estimations is assessed using standard post-estimation diagnostic tests. Firstly, the Arellano–Bond tests indicate statistically significant first-order serial correlation in the differenced residuals (AR(1)), which is expected in dynamic panel models after first-differencing. Importantly, the test for second-order serial correlation (AR(2)) is insignificant across all specifications, supporting the use of lagged levels as valid instruments. Secondly, the Hansen test of over-identifying restrictions does not reject the null hypothesis of instrument validity in any specification, suggesting that the instrument set is jointly exogenous. Overall, these diagnostics support the consistency of the estimators and the appropriateness of the chosen instrument set.

First, lagged household debt strongly impacts the current level of household debt. The lagged coefficients range between 0.8 and 0.9, and are statistically significant at the 1% level, confirming the strong persistence of the household debt and the inherent difficulties in reducing it rapidly. The Consumer Confidence Index also positively influences household debt across all samples. The result confirms observations from previous literature (e.g., Gric et al., 2022; Kłopocka, 2017) and our first hypothesis (H1), suggesting that when consumers feel optimistic about the economy, they are more likely to take on debt, possibly to finance consumption or investments.

A higher bank capital-to-asset ratio is associated with lower household debt levels. In contrast, a higher level of domestic credit to the private sector as a percentage of GDP generally means higher household debt, thus confirming our fourth hypothesis (H4), that bank policies that tighten lending standards reduce household debt while greater credit availability encourages borrowing. Higher bank capital ratios typically signal lower credit availability, and often reflect restrictive regulatory or supervisory policies that limit debt. These findings align with those obtained by Abd Samad et al. (2023) and Borowski et al. (2017). On the other hand, domestic credit to the private sector indicates the overall availability of credit in the economy, which can facilitate household borrowing.

Table 4. Regression results of determinants of household debt

Variables	(1) Debth	(2) Debth	(3) Debth	(4) Debth
DEBTH (−1)	0.917*** (0.002)	0.850*** (0.003)	0.815*** (0.010)	0.792*** (0.015)
CCI	0.063*** (0.002)	0.104*** (0.003)	0.031*** (0.008)	0.012 (0.011)
BANKCAP		−0.004*** (0.001)	−0.005*** (0.001)	−0.006*** (0.001)
CREDIT		0.002*** (0.000)	0.002*** (0.000)	0.002*** (0.000)
DOMSAVINGS		0.001*** (0.000)	0.001 (0.001)	0.001 (0.001)
LABOURFORCE			0.000 (0.000)	−0.000 (0.000)
LIFEEXPECTANCY			0.006*** (0.001)	0.009*** (0.001)
GDPGROWTH				0.000 (0.000)
COVID				−0.005*** (0.001)
Observations	327	327	327	327
Number of countries	36	36	36	36
Hansen statistic	33.40	30.62	26.90	23.73
p-value	0.638	0.634	0.723	0.784
AR test statistic	−2.416	−2.231	−2.172	−2.086
p-value	0.0157	0.0257	0.0299	0.0370
AR(2) test statistic	−1.176	−1.150	−1.199	−1.360
p-value	0.240	0.250	0.230	0.174

Note: Standard errors are in parentheses *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Source: own elaboration.

Higher gross domestic savings affect household debt positively. This suggests that higher credit availability and lower vulnerability to economic shocks that stem from higher savings in the economy are important determinants of household indebtedness. Regarding demographics, the labour force participation rate does not influence household debt significantly, whereas

longer life expectancy is statistically significantly associated with higher debt. Consequently, while we do not find confirmation for our second hypothesis (H2), the third hypothesis—relating to life expectancy at birth positively contributing to household indebtedness—is confirmed. The absence of a significant effect of the labour force participation rate suggests that the size of the active labour force alone does not necessarily translate into higher household borrowing. This aligns with studies indicating that labour-market expansion may be offset by factors such as income pressure, unemployment risk, or credit constraints (Dumitrescu et al., 2022; Meng et al., 2013). In contrast, the positive and statistically significant relationship between life expectancy and household debt supports the life-cycle perspective: longer expected lifetimes extend the potential repayment horizon, improve perceived creditworthiness, and encourage borrowing to smooth consumption and finance investments aimed at maintaining living standards in retirement.

Finally, the COVID-19 dummy is negative and statistically significant in equation (4), confirming our fifth hypothesis (H5). It seems that during the pandemic, crisis households actively prioritised reducing debt. This observation is consistent with the literature stating that debt tends to increase in boom periods and decrease in bust periods (e.g., Nofsinger, 2012).

The result indicating the negative impact of COVID-19 on household debt is also in line with explanations given by the behavioural dimension: capacity to decide, perception of value, and relations to others (Biddle, 2021). The pandemic affects the capacity to decide due to complexity and uncertainty that intensify loss aversion. Consequently, heightened risk aversion naturally deterred individuals from increasing debt. The pandemic also strengthened the influence of other consumers' behaviour and the perception of reality on consumer decisions, often at the expense of individualism and rationality in the decision-making process. Furthermore, fear of the pandemic caused a significant shift in consumer spending patterns towards increased consumption of necessities at the expense of non-necessities. The magnitude of this shift depended heavily on personality traits, perceived economic stability, and self-justifications for purchasing (Cannito et al., 2021; Di Crosta et al., 2021). Moreover, job insecurity and life uncertainty prevented consumers from purchasing goods whose value exceeds their current payment capabilities (Chirumbolo et al., 2021). Our results on a negative impact of COVID-19 on household debt are consistent with this trend, as debt is mainly used to finance non-necessities. This is corroborated by Nigatu et al. (2022), who indicate that during the pandemic, only 17.5% of respondents experienced an increase in debt, with a significant determinant of this increase being the deterioration in their mental health.

Table 5 reports dynamic system GMM estimates for two GDP-per-capita-growth sub-samples: Panel A includes observations with above-average GDP per capita growth, while Panel B includes observations with GDP per capita

Table 5. Household debt: high- vs. low-GDP-growth countries

	Panel A: High GPD per capita growth				Panel B: Low GPD per capita growth			
Variables	(1) Debth	(2) Debth	(3) Debth	(4) Debth	(1) Debth	(2) Debth	(3) Debth	(4) Debth
DEBTH (-1)	0.943*** (0.001)	0.871*** (0.006)	0.865*** (0.017)	0.840*** (0.024)	1.004*** (0.003)	0.921*** (0.009)	0.790*** (0.033)	0.804*** (0.033)
CCI	0.041*** (0.000)	0.119*** (0.005)	0.067*** (0.017)	0.056* (0.030)	0.010*** (0.002)	0.054*** (0.006)	-0.085*** (0.019)	-0.065 (0.045)
BANKCAP		-0.015*** (0.001)	-0.011*** (0.002)	-0.017*** (0.002)		-0.008*** (0.001)	-0.001 (0.001)	-0.001 (0.001)
CREDIT		0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)		0.002*** (0.000)	0.003*** (0.000)	0.003*** (0.000)
DOMSAVINGS		0.002*** (0.000)	0.001 (0.001)	0.001* (0.001)		0.001** (0.000)	0.002 (0.001)	0.002 (0.002)
LABOURFORCE			-0.003** (0.001)	-0.003 (0.002)			-0.003*** (0.001)	-0.002*** (0.001)
LIFEEXPECTANCY			0.005*** (0.001)	0.008** (0.004)			0.015*** (0.002)	0.012*** (0.004)

	Panel A: High GPD per capita growth				Panel B: Low GPD per capita growth			
Variables	(1) Debth	(2) Debth	(3) Debth	(4) Debth	(1) Debth	(2) Debth	(3) Debth	(4) Debth
GDPGROWTH				−0.000 (0.000)				−0.000 (0.000)
COVID				−0.011*** (0.003)				−0.008*** (0.001)
Observations	133	127	127	127	194	175	175	175
Number of countries	33	33	33	33	33	33	33	33
Hansen statistic	31.73	24.30	25.51	19.91	33.31	27.03	25.33	23.93
<i>p</i> -value	0.579	0.798	0.651	0.834	0.501	0.670	0.661	0.634
AR test statistic	−1.748	−1.619	−1.732	−1.769	−1.447	−1.287	−1.281	−1.288
<i>p</i> -value	0.0805	0.105	0.0834	0.0769	0.148	0.198	0.200	0.198
AR(2) test statistic	0.769	0.482	0.623	0.587	−1.496	−1.566	−1.537	−1.559
<i>p</i> -value	0.442	0.630	0.533	0.557	0.135	0.117	0.124	0.119

Note: Standard errors are in parentheses *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Source: own elaboration.

growth at or below the sample average. Within each panel, columns (1)–(4) present progressively augmented specifications: column (1) includes the lagged dependent variable and CCI; column (2) adds BANKCAP, CREDIT, and DOMSAVINGS; column (3) further adds LABOURFORCE and LIFEEXPECTANCY; and column (4) additionally controls for the COVID dummy. Diagnostic tests support the validity of the GMM specifications. The Hansen test does not reject the hypothesis of instrument validity in any model, and the AR(2) test is consistently insignificant, indicating no evidence of second-order serial correlation in the differenced residuals.

In all cases, debt exhibits strong persistence. The consumer confidence index has a positive impact on household debt in most models, but its strength differs markedly between the subsamples. Consumer confidence affects debt more in countries with higher GDP per capita growth, confirming our hypothesis H6. Given the positive impact of GDP growth on household debt found in some studies (e.g., Coletta et al., 2019; Borowski et al., 2017) and results that consumer confidence is positively associated with household indebtedness, CCI might affect the debt more when GDP grows faster. GDP growth fuels consumer confidence in an optimistic outlook, which might strengthen the positive impact of confidence on debt.

Furthermore, in low-growth countries, the CCI coefficient turns negative in models (3) and (4), where labour force participation and life expectancy are added. This change should be interpreted with caution, as the additional controls may absorb some of the macroeconomic and life-cycle channels previously captured by consumer confidence. In particular, consumer confidence is likely to be correlated with labour-market conditions, income security, and demographic structure. In a low-growth environment, this residual confidence effect does not necessarily translate into higher borrowing; instead, households may remain cautious, face income constraints, or prefer balance-sheet adjustment despite improved sentiment. Thus, the negative coefficient may indicate that the positive debt-enhancing effect of confidence operates mainly through labour-market and demographic channels, rather than through consumer sentiment alone.

In both panels, GDPGROWTH is close to zero and statistically insignificant in model (4). This result may indicate that household debt dynamics are driven more strongly by structural financial conditions and the stock-adjustment process than by contemporaneous GDP growth. The finding is consistent across both high- and low-growth country groups, suggesting that the direct effect of current macroeconomic growth on household indebtedness is limited in the dynamic specification.

4. Robustness check

In the last step, we conduct robustness checks to verify whether the base-line findings are stable when the model is estimated using alternative specifications and estimation techniques. This helps mitigate concerns that the main results are driven by a particular estimator, instrument choice, or func-

Table 6. Robustness check: system GMM with time fixed effects

Variables	(1) Debth	(2) Debth
DEBTH (-1)	0.866*** (0.015)	0.772*** (0.028)
CCI	0.408* (0.246)	0.785** (0.328)
BANKCAP	-0.012*** (0.003)	-0.013*** (0.003)
CREDIT	0.001*** (0.000)	0.001*** (0.000)
DOMSAVINGS	0.003*** (0.001)	0.003*** (0.001)
LABOURFORCE		0.003*** (0.001)
LIFEEXPECTANCY		0.018*** (0.003)
Time Fixed Effects	YES	YES
Observations	302	302
Number of countries	33	33
Hansen statistic	15.33	16.28
<i>p</i> -value	0.999	0.754
AR test statistic	-2.311	-2.267
<i>p</i> -value	0.0208	0.0234
AR(2) test statistic	-1.295	-1.471
<i>p</i> -value	0.195	0.141

Note: Standard errors are in parentheses *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Source: own elaboration.

tional form, and increases confidence in the inferred relationships between the determinants and household debt. The robustness checks in Tables 6 and 7 provide additional validation for the baseline findings by assessing alternative specifications and estimators while controlling for time fixed effects. Table 6 re-estimates the dynamic model using system GMM with year fixed effects. Table 7 complements this approach by estimating a conventional panel fixed-effects model with year fixed effects.

The results broadly confirm the observations made in the previous section. Household debt is highly persistent, consumer confidence is positively related with debt levels. Bank capitalisation lowers debt (though the relationship is not statistically significant in the case of fixed-effects model in Table 7), whereas domestic credit to private sector is positively associated with household debt. Gross domestic savings to GDP exhibit a positive correlation in Table 6 but become negative in Table 7. Longer life expectancy increases debt and an increase in the labour force participation rate also becomes positive when time fixed effects are included in GMM estimation.

Table 7. Robustness check: two-way panel fixed effects model

Variables	(1) Debth	(2) Debth
CCI	0.840*** (0.261)	0.935*** (0.260)
BANKCAP	-0.002 (0.004)	-0.003 (0.004)
CREDIT	0.006*** (0.000)	0.006*** (0.000)
DOMSAVINGS	-0.006** (0.002)	-0.004* (0.002)
LABOURFORCE		-0.006*** (0.002)
LIFEEXPECTANCY		0.005 (0.008)
Time Fixed Effects	YES	YES
Observations	332	332
Number of countries	33	33
R-squared	0.522	0.536
F-statistic	22.27	20.42

Note: Standard errors are in parentheses *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Source: own elaboration.

Conclusions

This article studies the determinants of household indebtedness in 36 countries worldwide over the period 2012–2022, with a focus on the role of consumer confidence. We examine the overall relationship and pay special attention to the impact of the COVID-19 pandemic and consumption-oriented demographic variables in shaping the link between consumer confidence and household debt. For the analysis, we employ dynamic panel regression models using GMM estimators, and we additionally conduct robustness checks using alternative model specifications and estimators, including fixed-effects panel regressions with time effects, to confirm that the main findings are not driven by a particular empirical approach.

Our results provide novel evidence on the determinants of household indebtedness. Consumer confidence positively influences household debt, suggesting that an optimistic outlook on the economy makes households more likely to take on debt, for instance, to finance consumption or investments. At the same time, the COVID-19 pandemic lowered the debt levels in line with the literature claiming that debt decreases during significant downturns (e.g., Nofsinger, 2012).

The positive impact of consumer confidence on household indebtedness is also confirmed in regressions where we divide countries based on GDP per capita growth rate. This impact is stronger in countries with higher GDP per capita growth. The findings highlight the contextual nature of the consumer confidence-household indebtedness relationship, emphasising the importance of macroeconomic factors such as growth in shaping borrowing behaviour. Consequently, these insights can inform policymakers seeking to balance economic growth and financial stability, as the drivers and effects of consumer confidence on debt accumulation vary across different economic contexts.

Household debt is highly persistent, with past debt levels significantly influencing present levels. The high degree of persistence indicates that past borrowing strongly influences current debt levels, reflecting the long-term nature of financial commitments. Continuous monitoring of debt level trends is essential to safeguard financial stability and ensure resilience in the post-pandemic recovery period.

Household indebtedness is also affected by sectoral, macroeconomic and demographic variables. Expanded domestic credit to the private sector as a percentage of GDP drives household debt upwards, while a higher bank capital-to-asset ratio lowers household debt levels. Higher domestic savings, indicating higher credit availability are also key determinant of household indebtedness. The results for labour force participation are less robust and should therefore be interpreted with caution, as the coefficient is not statistically significant in the main model. By contrast, life expectancy at birth

is more consistently associated with higher household indebtedness, which suggests that demographic and life-cycle factors may play a role in shaping household borrowing.

The empirical results provide a few important implications. Firstly, consumer confidence may serve as an important predictor of household borrowing behaviour alongside economic fundamentals and thus should be considered by policymakers for forecasting indebtedness and predicting policy effects.

Secondly, the persistence of household indebtedness indicates that debt is difficult to reduce in a short period of time and thus policymakers should carry out prudent policies, closely monitoring the situation and intervening early when signs of rapid deterioration appear. However, this task might be complicated by unpredictable events such as the COVID-19 pandemic, which cause sudden changes in debt levels. Such a possibility reinforces the imperative for prudent policies in 'normal' times.

This study has several limitations. Firstly, the analysis focuses on a dataset of 36 countries, which, despite its breadth, may not fully capture the diverse economic, cultural, and institutional factors influencing household debt in other regions. Secondly, the study primarily examines aggregate household debt, which may obscure heterogeneity across income groups, age cohorts, or other demographic factors. Thirdly, while the dataset accounts for major global events like the COVID-19 pandemic and inflation surges, it may not adequately capture country-specific shocks or policy responses. Lastly, data constraints may affect the precision and completeness of the analysis, particularly regarding informal borrowing and unregulated financial activities. These limitations highlight the need for further research to validate and extend the findings across broader contexts and datasets.

Possible future studies could include expanding the possible determinants of household indebtedness to include ones related to implementing new technologies in lending. Furthermore, detailed research on the channels through which the COVID-19 pandemic affected how consumer confidence and some macroeconomic variables impact on household debt would bring more insight into debt dynamics, and in turn, might help in policy preparation for future crises.

Appendix

Variables and data sources

Variable abbreviation	Variable name	Definition	Role in the model	Data source
DEBTH	Household debt	Household debt expressed as a percentage of household and non-profit institutions serving households (NPISH) net disposable income.	Dependent variable	OECD
CCI	Consumer Confidence Index	Index measuring consumers' expectations and perceptions regarding the general economic situation, household financial conditions, unemployment, and savings capacity.	Control variable	OECD
BANKCAP	Bank capital to assets ratio	Ratio of bank capital to total bank assets.	Control variable	World Bank Global Financial Development Database
CREDIT	Domestic credit to private sector	Domestic credit provided to the private sector, expressed as a percentage of GDP.	Control variable	World Bank World Development Indicators
DOMSAVINGS	Gross domestic savings	A share of national income not used for final consumption expenditure as percentage of GDP.	Control variable	World Bank World Development Indicators
LABOUR-FORCE	Labour force participation rate	The percentage of economically active population in the total population aged 15 and above.	Control variable	World Bank World Development Indicators
LIFE-EXPECTANCY	Life expectancy at birth	Average number of years a newborn is expected to live.	Control variable	World Bank World Development Indicators
GDPGROWTH	GDP growth	Annual percentage growth rate of gross domestic product.	Control variable	World Bank World Development Indicators
COVID	Pandemic-related adjustment window	Dummy variable equal to 1 for the years 2019–2022 and 0 otherwise.	Period dummy	Authors' construction

Source: own elaboration.

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How environmental media narratives shape the sustainability premium

 Attila Zoltán Nagy¹

 Beatrix Steiner²

 Vivien Csapi³

Abstract

This paper examines whether environmental narratives constitute an independent and state-dependent pricing channel in equity markets beyond conventional ESG scores and aggregate climate risk measures. Using more than 220 million US news articles, we construct indicators of environmental narrative sentiment and thematic intensity and analyse their effects on equal-weighted and value-weighted ESG portfolio premia. The empirical framework augments the Fama–French five-factor model with explicit climate risk and macroeconomic uncertainty controls and allows for delayed pricing effects. We find that environmental narratives, particularly attention-based measures, exert economically relevant effects on the equal-weighted sustainability premium, even after controlling for standard asset-pricing factors and climate-related risk indices, whereas the corresponding effects are substantially weaker in value-weighted portfolios. In contrast, aggregate ESG and climate risk measures display

Keywords

- sustainability premium
- ESG
- environmental narratives
- investor sentiment
- media attention
- factor models
- climate risk
- asset pricing

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¹ Department of Finance and Accounting, Faculty of Business and Economics, University of Pécs, 7622 Pécs, Rákóczi út 80, Hungary, nagy.attila.zoltan@tkk.pte.hu, <https://orcid.org/0009-0007-3261-249X>.

² Department of Finance and Accounting, Faculty of Business and Economics, University of Pécs, 7622 Pécs, Rákóczi út 80, Hungary, steiner.beatrix@tkk.pte.hu, <https://orcid.org/0009-0008-4849-531X>.

³ Department of Finance and Accounting, Faculty of Business and Economics, University of Pécs, 7622 Pécs, Rákóczi út 80, Hungary, csapiv@tkk.pte.hu, <https://orcid.org/0000-0003-1996-091X>.

weak and unstable explanatory power once narratives are accounted for. The effects differ substantially across portfolio weighting schemes, while the lagged specifications provide more limited evidence of persistent delayed effects.

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Introduction

Empirical evidence on ESG-related asset pricing remains mixed, unstable over time, and often contradictory. A prominent theoretical explanation for negative sustainability premia is provided by Pástor et al. (2021), who show that strong investor preferences for green assets can lower their expected returns, leading to negative abnormal performance for high-ESG portfolios. Consistent with this mechanism, existing studies document weak, heterogeneous, or vanishing ESG premia (Alessi et al., 2021; Alves et al., 2025; Bolton & Kacperczyk, 2021).

These findings suggest that sustainability-related pricing effects cannot be adequately captured by static ESG scores alone. While ESG metrics reflect slowly evolving firm characteristics, climate-related risk is inherently dynamic and shaped by information flows and investor attention, implying that sustainability-related pricing effects are state-dependent rather than continuous.

Behavioural finance theories provide an additional explanation for why sustainability-related pricing effects may vary over time and across informational environments. Under conditions of limited investor attention and heuristic information processing, environmental narratives may influence asset prices not only through their informational content but also through their salience and visibility in the media environment. In this context, investor attention and investor sentiment represent conceptually distinct transmission mechanisms. Attention-based effects reflect the relative prominence and visibility of environmental narratives, whereas sentiment-based effects capture the emotional tone and valence of environmental news coverage. This distinction is particularly relevant in ESG-related asset pricing, where investors are exposed to complex, uncertain, and highly narrative-driven information flows (Chen, 2017; Choi & Choi, 2019; Mangee, 2021).

This view is consistent with attention-based asset pricing and equilibrium models of sustainable investing. In the context of climate risk, equilibrium forces imply that sustainability-related pricing effects are inherently time-varying. Periods of heightened climate concern may trigger short-lived repricing, even if long-run expected returns ultimately reflect lower risk premia for green assets (Pástor et al., 2021).

Importantly, this equilibrium-based explanation is not inconsistent with evidence of short-term positive price reactions to ESG-related news. A large body of sentiment-based studies documents that favourable ESG news and media coverage generate temporary increases in investor optimism and short-run price appreciation, particularly when investor attention is high (López-Cabarcos et al., 2019; Naughton et al., 2019; Xu et al., 2022). These effects are often asymmetric and transitory, displaying limited persistence once sentiment fades and prices revert toward fundamentals (Serafeim, 2020; Yousaf et al., 2024). As a result, narrative-driven demand may temporarily push high-ESG assets above their fundamental values, while in the long run, equilibrium forces dominate, leading to lower expected returns and negative sustainability premia.

Despite these insights, the existing empirical literature remains largely focused on aggregate ESG ratings or climate risk indices, paying limited attention to the role of specific environmental narratives and their temporal dynamics. In particular, three gaps remain: the lack of thematic differentiation across environmental narratives, the limited distinction between sentiment- and attention-based narrative channels, and the insufficient empirical separation of narrative-based information from explicit climate and macroeconomic risk indicators.

This study addresses these gaps by examining how environmental narratives embedded in media coverage are associated with sustainability premia in equity markets, and whether these effects persist after controlling for standard asset pricing factors and explicit climate- and macroeconomic risk measures. Using more than 220 million US news articles from the GDELT database, the analysis constructs narrative-based indicators capturing both sentiment and thematic intensity, and evaluates their impact on equal-weighted and value-weighted ESG portfolios within a Fama–French five-factor framework augmented with lag structures and risk controls.

The results show that environmental narrative measures retain robust and economically meaningful explanatory power for sustainability premia beyond traditional market factors and aggregate risk indices. Moreover, narrative effects differ systematically between equal-weighted and value-weighted portfolios, highlighting portfolio-weighting-related heterogeneity in narrative-driven repricing. Overall, the findings indicate that static ESG scores and aggregate climate-risk measures capture only part of the information relevant for sustainability-related asset pricing. Environmental narratives appear to provide additional information beyond these traditional measures.

This paper contributes to the literature in three important ways. Firstly, rather than treating environmental narratives as auxiliary sentiment controls or sources of noise, we conceptualise them as a time-varying conditioning information channel that may influence when and how ESG-related information becomes relevant for asset prices. Secondly, we explicitly disentangle narrative-based environmental indicators from conventional ESG scores and climate-risk measures, allowing us to assess their independent and joint roles in asset pricing. Thirdly, by focusing on the informational environment in which sustainability-related premia emerge, our approach helps reconcile the mixed empirical evidence on ESG premia by shifting the question from whether such premia exist to when they are priced. More specifically, our framework distinguishes between attention-driven narrative salience and sentiment-driven narrative tone, thereby allowing us to evaluate which informational channel is more relevant for sustainability-related asset pricing dynamics.

The remainder of the paper is organised as follows. Section 1 reviews the related literature. Section 2 describes the data and variables, including the construction of the sustainability premium and the environmental narrative indicators. Section 3 presents the empirical methodology. Section 4 reports the empirical results. The final sections discuss the findings, implications, limitations, and conclude.

1. Literature review

The sustainable-investing equilibrium framework of Pástor et al. (2021) predicts that strong investor demand for green assets may reduce their expected returns, providing a theoretical explanation for the frequently documented negative or unstable sustainability premium. The empirical evidence supports this mechanism, as studies document negative, weak, or unstable ESG premia across markets, including evidence of higher returns for carbon-intensive firms and substantial cross-sectional heterogeneity (Alessi et al., 2021 ; Alves et al., 2025; Bolton and Kacperczyk, 2021; Ciciretti et al., 2023).

Beyond their direct impact on asset prices, climate-related narratives influence financial markets through institutional settings, information asymmetries, and investor belief formation. Accordingly, narratives act as endogenous risk drivers whose relevance varies across time, market regimes, and institutional environments (Bhargava et al., 2023; Mangee, 2021).

Fahmy (2025) shows that climate policy announcements often trigger immediate market reactions that are later reversed once investors reassess their credibility. This pattern suggests that markets initially respond to narrative

salience rather than to verifiable changes in expected cash flows. Similar dynamics are observed in ESG disclosures, where aspirational statements often dominate investor perceptions despite weak alignment with realised sustainability performance (Cesarone et al., 2024; Ferro et al., 2025).

Climate-related news coverage significantly affects investor behaviour, with capital reallocations driven by media attention rather than fundamentals and stronger responses to negative coverage, particularly for high-emission firms facing reputational risk (Andreu et al., 2026; Guastella et al., 2022). Extensive literature shows that limited investor attention amplifies the impact of salient narratives and media signals, strengthening short-term price reactions, increasing return comovement, and weakening informational efficiency during periods of heightened uncertainty (Chen, 2017; Choi & Choi, 2019; Dong & Ni, 2014; Gao et al., 2018). These findings are also consistent with behavioural-finance theories emphasising limited investor attention, salience-driven information processing, and heuristic-based decision-making in financial markets (Da et al., 2011; Tetlock, 2007). In environments characterised by information overload and elevated uncertainty, investors may react more strongly to highly visible and widely disseminated narratives than to fundamental information itself. As a result, environmental narratives may affect asset prices not only through their informational content, but also through their ability to attract investor attention and shape short-term belief formation (Chen, 2017; Choi & Choi, 2019; Mangee, 2021).

Das and Yaghoubi (2025) show that negative climate sentiment reduces stock liquidity, particularly for firms exposed to regulatory risk or operating in information-opaque environments. This suggests that narratives affect not only prices but also trading conditions, increasing transaction costs and reinforcing market frictions. Dierckx et al. (2021) similarly show that narrative intensity extracted from news predicts fluctuations in market volatility, indicating that narratives serve as a transmission channel through which uncertainty propagates.

Ongan et al. (2025) demonstrate that ESG-related uncertainty differs from conventional macroeconomic uncertainty, reflecting ambiguity around regulation, disclosure standards, and policy credibility. This distinction is critical, as ESG uncertainty cannot be fully captured by traditional risk proxies. Instead, it represents a narrative-based uncertainty channel that interacts with investor expectations and policy credibility.

Baker et al. (2016) and Caldara and Iacoviello (2022), in turn, show that elevated economic policy and geopolitical uncertainty significantly alter market responses to news. Under such conditions, investors rely more heavily on heuristics and narratives, amplifying the pricing impact of climate-related information. Gaies (2025) further documents that climate news has time-varying predictive power for financial instability, with stronger effects during periods of macroeconomic stress.

Climate finance research further refines this view by distinguishing between physical and transition climate risks. Bua et al. (2024) and Salisu et al. (2023) show that transition risk—linked to regulation, policy uncertainty, and decarbonisation narratives—induces sharper and more short-lived price reactions than physical risk. Zhou and Ma (2025) and Li and Zhou (2026) similarly document asymmetric effects, where physical risks affect returns gradually, while transition risks generate episodic volatility driven by expectations and sentiment.

Beyond these contributions, the literature also emphasises limitations in ESG measurement. ESG ratings exhibit substantial disagreement across providers, reflecting differences in methodology, weighting schemes, and reliance on forward-looking disclosures (Cesarone et al., 2024; Ferro et al., 2025; Wołczek, 2025). This measurement noise further strengthens the role of narratives, as investors are forced to rely on imperfect signals when forming expectations about firms' sustainability profiles.

This equilibrium-based explanation is consistent with evidence of short-term positive price reactions to ESG-related news. Sentiment-based studies show that favourable ESG news and media coverage generate temporary increases in investor optimism and short-run price appreciation, particularly when investor attention is high (López-Cabarcos et al., 2019; Naughton et al., 2019; Xu et al., 2022). However, these effects are often asymmetric and transitory, with limited persistence once sentiment fades and prices revert toward fundamentals (Serafeim, 2020; Yousaf et al., 2024). As a result, narrative- and sentiment-driven demand may temporarily push high-ESG assets above their fundamental values. Climate and ESG risks affect asset prices through multiple channels, including physical and transition risks, narrative-driven belief updates, and amplification via uncertainty and attention constraints, which increase perceived risk even without new fundamental information. Importantly, investor sentiment and investor attention should not be treated as interchangeable concepts. Sentiment reflects the emotional tone and valence of information, whereas attention captures the relative salience and visibility of narratives within the broader informational environment. While sentiment-driven reactions may influence short-term optimism or pessimism, attention-based mechanisms determine which narratives become pricing-relevant for investors in the first place. This distinction is particularly important in ESG-related asset pricing, where media salience and information diffusion may amplify the pricing impact of environmental narratives independently of their emotional tone (Chen, 2017; Choi & Choi, 2019).

Accordingly, the emerging literature suggests that climate risk pricing cannot be adequately captured by static factor models. Instead, it requires an integrated framework that accounts for narrative diffusion, investor attention, and uncertainty dynamics. Combining physical and transition risk indicators with ESG-related uncertainty and macro-financial risk measures allows em-

pirical analyses to map the time-varying and narrative-driven nature of climate risk pricing.

Despite these advances, existing studies largely treat environmental narratives, media attention, and ESG-related information as either interchangeable proxies or additive explanatory variables. In contrast, we depart from this approach by treating environmental narratives as a conditioning information channel that shapes the pricing relevance of ESG characteristics and climate-related risks, rather than as standalone determinants of returns. In particular, relatively limited attention has been devoted to whether attention-based narrative salience or sentiment-based narrative tone constitutes the more relevant transmission channel in ESG-related asset pricing. Our framework addresses this gap by explicitly separating the investor-attention and investor-sentiment dimensions of environmental narratives within a unified empirical setting.

2. Data and variables

2.1. The sustainability premium

In this study, we examine the evolution of the sustainability premium between 2014 and 2025 for firms with a market capitalisation exceeding USD 1 billion. Our analysis is based on monthly data for 2,859 US companies obtained from the LSEG database. The dataset includes monthly closing prices, ESG ratings, and the number of shares outstanding, which allows for the computation of market capitalisation.

Following the methodology of Azevedo et al. (2021), we define the sustainability premium by applying a 180-day lag and ranking firms each month according to their ESG scores. Firms are sorted into portfolios based on the top 30% (High ESG) and bottom 30% (Low ESG) of the ESG score distribution. The sustainability premium is constructed as a long-short portfolio that is long in High ESG firms and short in Low ESG firms (firms without ESG ratings are excluded). Portfolios are formed using both equal-weighted and value-weighted methods and are rebalanced on a monthly basis. In the value-weighted portfolios, portfolio weights are proportional to firms' market capitalisations at the portfolio formation date.

The average equal-weighted sustainability premium is -0.56% , while the value-weighted premium amounts to -0.54% (see Figure 1). The estimated premiums exhibit substantial dispersion. Specifically, the equal-weighted premium ranges from -15.7% to 12.6% , whereas the value-weighted premium is confined to a narrower interval between -7.1% and 5.1% .

For the equal-weighted premium, the test statistic equals $t = -3.68$ ($p < 0.001$), while for the value-weighted premium, $t = -2.32$ ($p = 0.0215$). The results of the t -tests indicate a statistically significant negative mean in both cases (see Table 1).

Table 1. Descriptive statistics and significance tests of the sustainability premium

Statistic	Equally-weighted sustainability premium	Value-weighted sustainability premium
Mean	-0.5573	-0.5425
Median	-0.5848	-0.6522
Minimum	-15.69	-7.095
Maximum	12.59	5.067
Standard deviation	3.187	1.955
Skewness	-0.4058	-0.032
Excess kurtosis	3.823	0.6528
t -statistic	-3.680	-2.319
p -value	0.0003	0.0215
95% CI lower bound	-0.8334	-1.0315
95% CI upper bound	-0.2515	-0.0831

Note: The table reports descriptive statistics for the monthly equal-weighted and value-weighted sustainability premium, as well as the results of one-sample t -tests, for the period 2014–2025. All values are expressed in percentage terms. The null hypothesis of the t -tests is that the mean premium equals zero. Reported p -values correspond to two-sided tests.

Source: authors’ calculations.

The equal-weighted sustainability premium exhibits a negative Jensen’s alpha in the CAPM framework ($\alpha = -0.38$), which is statistically significant at the 10% level. Within the Fama–French three-factor model, the alpha remains negative ($\alpha = -0.56$) and becomes significant at the 1% level, while in the five-factor specification the magnitude of underperformance further increases ($\alpha = -0.65$; $p < 0.01$). These findings indicate that for equal-weighted portfolios, the sustainability premium remains persistently negative even after controlling for standard risk factors. For the equal-weighted High ESG portfolio, no statistically significant alpha is observed in any of the model specifications. In contrast, the Low ESG portfolio displays a positive and highly significant alpha in both the three-factor and five-factor models (FF3: $\alpha = 0.52$; FF5: $\alpha = 0.57$; $p < 0.01$). This pattern suggests that the equal-weighted sustainability premium is primarily driven by the systematic outperformance of firms with low ESG ratings.

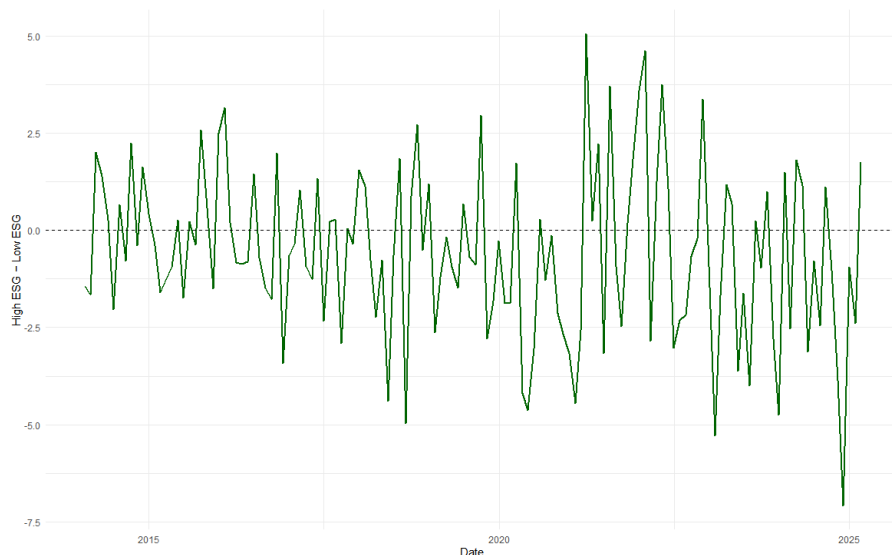


Figure 1. Time series of the value-weighted sustainability premium

Note: The figure shows the monthly evolution of the value-weighted sustainability premium between 2014 and 2025.

Source: authors' calculations.

For value-weighted portfolios, the results are qualitatively similar but less pronounced. The value-weighted low ESG portfolios exhibit positive alphas across all model specifications, which are statistically significant in the three- and five-factor models (FF3: $\alpha = 0.66$; $p < 0.10$; FF5: $\alpha = 0.76$; $p < 0.05$). By contrast, the value-weighted High ESG portfolios do not display statistically significant alphas in any of the models. Nevertheless, the value-weighted sustainability premium remains negative and statistically significant in the augmented factor models (FF3: $\alpha = -0.55$; $p < 0.10$; FF5: $\alpha = -0.7$; $p < 0.05$), indicating that the negative sign of the sustainability premium persists among larger-cap firms, albeit with weaker statistical power.

Figure 2 indicates that the sustainability premium did not generate persistently positive cumulative returns over the sample period. Both the equal-weighted and value-weighted long–short portfolios exhibited a declining cumulative performance, although the value-weighted premium displayed noticeably higher volatility, particularly during the 2020–2021 period. Overall, the results suggest that ESG-related excess returns were unstable and sensitive to changing market conditions.

Overall, the results indicate that the negative sustainability premium is mainly attributable to the positive alpha of low-ESG firms and remains robust to the inclusion of Fama–French risk factors for both equal-weighted and value-weighted portfolios (see Table 2).

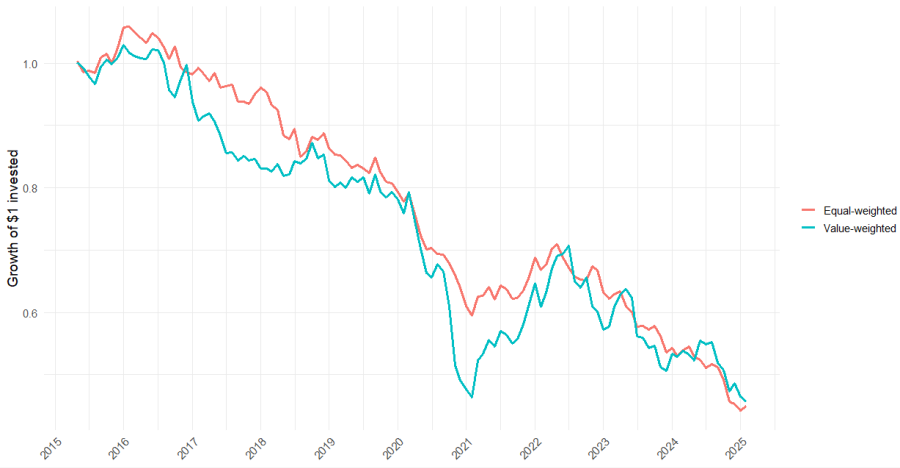


Figure 2. Cumulative performance of the equal-weighted and value-weighted sustainability premium portfolios

Note: The figure reports the cumulative performance of the equal-weighted and value-weighted sustainability premium portfolios between 2015 and 2025. The portfolios are constructed as long-short portfolios that are long in high-ESG firms and short in low-ESG firms, with monthly rebalancing.

Source: authors’ calculations.

Table 2. Factor alphas of ESG portfolios			
Portfolio	Jensen’s Alpha	FF3 Alpha	FF5 Alpha
eq_High_ESG	−0.1441	−0.0366	−0.0821
eq_Low_ESG	0.2377	0.5196***	0.5693***
eq_sus_prem	−0.3818*	−0.5562***	−0.6514***
vw_High_ESG	0.1706	0.1049	0.0625
vw_Low_ESG	0.5337*	0.6559*	0.7562**
vw_sus_prem	−0.3631	−0.5510*	−0.6937**

Note: The table reports alphas for equal-weighted (eq_) and value-weighted (vw_) sustainability premiums estimated using Jensen’s CAPM as well as the Fama–French three- and five-factor models. The reported values are based on monthly excess returns over the period 2014–2025. p-values are derived from two-sided statistical tests, with the null hypothesis that $\alpha = 0$ (* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$).

Source: authors’ calculations.

2.2. Environmental news variables

The environmental news variables are derived from the GDELT (Global Database of Events, Language, and Tone) database. In our analysis, we pro-

cess approximately 220 million news articles related to the United States and identify coverage linked to 22 distinct environmental (ENV) topics, including climate change, fossil fuels, renewable energy sources, and biodiversity-related issues. For each environmental topic, we construct two complementary indicators, resulting in a total of 44 environmental news variables.

The environmental narrative variables are constructed from monthly article-level observations extracted from the GDELT Global Knowledge Graph database. We first restrict the sample to US-related news items by requiring the LOCATIONS field to contain “United States”. For each month, we compute the total number of US-related articles, which serves as the denominator for the TopicShare measure. Environmental news items are identified using GDELT theme codes, where a news article is assigned to a given ENV topic if the corresponding theme appears in the THEMES field as a complete semi-colon-separated entry.

For each environmental topic and month, we calculate two indicators. First, AvgTone is defined as the monthly average of GDELT’s Tone metric for US-related news items associated with the given topic. This measure captures the average sentiment of environmental news coverage. Positive values indicate more favourable or constructive framing, whereas negative values reflect more alarming, adverse, or conflict-oriented coverage.

Second, TopicShare measures the relative media prominence of each environmental topic. It is calculated as the number of US-related articles associated with a given ENV topic divided by the total number of US-related news articles in the same month. TopicShare therefore proxies the intensity of media and investor attention devoted to a specific environmental narrative, independently of the sentiment conveyed in the news.

The data are compiled at a monthly frequency and cover the period from 1 December 2014 to 30 April 2025. The joint use of the two indicators allows us to separately examine the sentiment-driven and attention-based channels through which environmental news may affect financial variables. Descriptive statistics for the AvgTone and TopicShare variables are reported in Appendix Tables A1 and A2.

We additionally examine the correlation structure of the ENV variables to assess potential multicollinearity and identify broader thematic narrative clusters. The AvgTone variables generally exhibit weak-to-moderate correlations, suggesting that sentiment dynamics contain substantial topic-specific information. At the same time, several economically meaningful clusters emerge, particularly among fossil fuel narratives (e.g., COAL, NATURALGAS, OIL), climate-related narratives (e.g., CLIMATECHANGE, DEFORESTATION, FORESTRY), and renewable-energy narratives (e.g., SOLAR, WINDPOWER). TopicShare variables display stronger correlations overall, indicating that media attention cycles tend to jointly amplify the salience of related environmental topics. The strongest correlations are primarily observed within

conceptually related narrative groups, such as climate-transition themes and fossil-fuel-related coverage.

To reduce dimensionality and improve the economic interpretability of the environmental narrative variables, we construct five broader thematic narrative categories based on the correlation structure and conceptual similarity of the underlying GDELT topics. Rather than relying on purely statistical dimension-reduction techniques such as principal component analysis (PCA), we aggregate the variables using simple arithmetic averages in order to preserve the economic meaning and interpretability of the resulting indicators.

The five aggregated narrative categories are constructed based on the conceptual similarity and empirical correlation structure of the underlying environmental topics. The fossil fuel and traditional energy category includes narratives related to coal, natural gas, and oil (ENV_COAL, ENV_NATURALGAS, ENV_OIL). The renewable and transition-technology category captures narratives associated with wind power, solar energy, biofuels, geothermal energy, hydropower, green-transition topics, and carbon-capture technologies (ENV_WINDPOWER, ENV_SOLAR, ENV_BIOFUEL, ENV_GEOTHERMAL, ENV_HYDRO, ENV_GREEN, ENV CARBONCAPTURE). The climate-risk category consists of narratives related to climate change, deforestation, and forestry (ENV_CLIMATECHANGE, ENV_DEFORESTATION, ENV_FORESTRY). The resource-extraction category includes mining- and metals-related narratives (ENV_MINING, ENV_METALS), while the biodiversity and ecological-damage category captures narratives associated with endangered species, species extinction, poaching, overfishing, fishery-related issues, and waterways (ENV_SPECIESENDANGERED, ENV_SPECIESEXTINCT, ENV_POACHING, ENV_OVERFISH, ENV_FISHERY, ENV_WATERWAYS).

We first examine the within-block correlation structure of the underlying environmental narratives. The results indicate that correlations are generally stronger within thematic groups than across groups, supporting the conceptual validity of the aggregated narrative blocks. The strongest and most coherent within-block correlations appear in the fossil-fuel, climate-risk, and resource-extraction categories, suggesting that these narratives are characterised by relatively stable common informational dynamics.

For the AvgTone variables, the fossil-fuel narratives (ENV_COAL_AvgTone, ENV_NATURALGAS_AvgTone, ENV_OIL_AvgTone) display moderate-to-strong positive correlations ($\rho \approx 0.50\text{--}0.54$), indicating that media sentiment regarding fossil-fuel-related topics tends to move together over time. Similarly, climate-risk narratives related to climate change, deforestation, and forestry exhibit moderate correlations ($\rho \approx 0.37\text{--}0.54$), suggesting the presence of a broader environmental-degradation sentiment factor. Resource-extraction narratives (ENV_MINING_AvgTone and ENV_METALS_AvgTone) also show relatively strong correlation ($\rho \approx 0.56$).

In contrast, renewable-energy and biodiversity-related AvgTone narratives appear to be substantially more heterogeneous. Although some renewable-energy narratives, such as wind and solar energy, exhibit moderate positive correlations, many thematic pairs display weak or even negative relationships. Biodiversity-related narratives show particularly weak internal correlations, implying that these topics do not form a unified media-sentiment cluster.

The TopicShare variables display a noticeably more coherent correlation structure than the AvgTone variables. This suggests that media attention cycles tend to move more consistently together within environmental narrative groups than media sentiment itself. Stronger within-block correlations are particularly evident in the renewable-transition narratives, fossil-fuel narratives, and resource-extraction narratives. For example, the correlation between ENV_MINING_TopicShare and ENV_METALS_TopicShare reaches approximately $\rho \approx 0.68$, while climate-transition-related narratives such as ENV_GREEN_TopicShare, ENV_WINDPOWER_TopicShare, and ENV CARBONCAPTURE_TopicShare also exhibit relatively strong positive correlations.

After constructing the five aggregated narrative dimensions, we further examine the correlation structure of the aggregated TopicShare and AvgTone indicators. The correlations between the aggregated TopicShare blocks are generally moderate and economically interpretable, while remaining below levels typically associated with severe multicollinearity. The strongest relationships emerge between renewable and climate-risk narratives, as well as between resource-extraction and biodiversity narratives, reflecting economically meaningful thematic overlap.

The aggregated AvgTone indicators display substantially weaker cross-block correlations, suggesting that sentiment dynamics remain relatively topic-specific even after aggregation. This finding indicates that the AvgTone variables capture differentiated narrative sentiment channels rather than a single underlying environmental-sentiment factor.

Finally, we examine the stationarity properties of the aggregated narrative variables using Augmented Dickey–Fuller (ADF) tests with AIC-based lag selection. All aggregated TopicShare variables are found to be stationary at the 5% significance level. Among the aggregated AvgTone variables, the Fossil, Renewable, ClimateRisk, and Biodiversity blocks are also stationary, while the ResourceExtraction_AvgTone variable appears non-stationary. Consequently, this variable is included in first-difference form in the subsequent regression analyses.

3. Methodology

The empirical analysis is based on monthly data covering the period from December 2014 to April 2025. The dependent variables are the equal-weighted and value-weighted sustainability premiums, denoted by eq_sus_prem and vw_sus_prem , respectively. The explanatory variables are GDELT-based environmental narrative indicators aggregated into five economically interpretable thematic blocks. For each block, we construct both TopicShare and AvgTone indicators. TopicShare captures the relative intensity of media attention, while AvgTone measures the average sentiment of news coverage.

Prior to estimation, the time-series properties of the variables are examined using Augmented Dickey–Fuller (ADF) tests with AIC-based lag selection. All aggregated TopicShare variables are stationary in levels. Among the aggregated AvgTone indicators, Fossil_AvgTone, Renewable_AvgTone, ClimateRisk_AvgTone, and Biodiversity_AvgTone are stationary in levels, while ResourceExtraction_AvgTone is non-stationary and is therefore included in first differences. Non-stationary macroeconomic risk variables are also included in first differences.

The empirical analysis proceeds in three steps. First, we estimate regressions using the five aggregated environmental narrative blocks separately for TopicShare and AvgTone measures. In order to distinguish delayed and immediate pricing effects, the models are estimated using both one-month lagged and contemporaneous narrative variables. Second, we augment the baseline specifications with Fama–French three-factor and five-factor controls. Third, we extend the FF5 specification by adding climate-specific, ESG-uncertainty, and macroeconomic risk controls.

For the aggregated narrative-block models, the baseline specification is:

$$sus_prem_t^{(k)} = \alpha^{(k)} + \delta^{(k)'} NB_{t-h} + \varepsilon_t^{(k)} \quad (1)$$

where $sus_prem_t^{(k)}$ denotes the sustainability premium, with $k = eq$ for the equal-weighted portfolio and $k = vw$ for the value-weighted portfolio. NB_{t-h} is the vector of the five aggregated environmental narrative blocks, where $h = 0$ refers to contemporaneous effects and $h = 1$ refers to one-month lagged effects.

The FF3-augmented specification is:

$$sus_prem_t^{(k)} = \alpha^{(k)} + \beta^{(k)'} FF3_t + \delta^{(k)'} NB_{t-h} + \varepsilon_t^{(k)} \quad (2)$$

where $FF3_t$ includes Mkt_RF_t , SMB_t , and HML_t .

The FF5-augmented specification is:

$$sus_prem_t^{(k)} = \alpha^{(k)} + \beta^{(k)'} FF5_t + \delta^{(k)'} NB_{t-h} + \varepsilon_t^{(k)} \quad (3)$$

where $FF5_t$ includes Mkt_RF_t , SMB_t , HML_t , RMW_t , and CMA_t .

The vector NB consists of the five thematic environmental narrative blocks: Fossil, Renewable, ClimateRisk, ResourceExtraction, and Biodiversity. The models are estimated separately for TopicShare and AvgTone indicators. In the AvgTone specifications, ResourceExtraction_AvgTone is included in first-difference form because it is non-stationary in levels.

The FF3 and FF5 frameworks are employed because they represent standard benchmark asset-pricing models capable of controlling for broad systematic risk exposures related to market, size, value, profitability, and investment factors. Augmenting these benchmark specifications with environmental narrative variables allows us to assess whether narrative effects contain incremental explanatory power beyond conventional risk-factor structures.

We explicitly assess the robustness of the effects of environmental narratives on sustainability premiums by controlling for climate-related and macroeconomic risk factors. The objective is to test whether the estimated effects of the narrative variables persist after accounting for broader risk channels that may potentially influence the dynamics of sustainability premiums.

We capture the risk dimension using indicators grouped into three categories. The first group relates to climate-specific risks and includes a measure of transition climate risk, the Transition Risk Indicator (*TRI*), and a proxy for physical climate risk, the Physical Risk Indicator (*PRI*) (Bua et al., 2024). The second group captures ESG-related uncertainty and is represented by the U.S. ESG Uncertainty Index (*ESGUI*) (Ongan et al., 2025). The third group encompasses macroeconomic and geopolitical uncertainty, measured by economic policy uncertainty (*EPU*) (Baker et al., 2016), financial market volatility (*VIX*), and the geopolitical risk indicator (*GPR*) (Caldara and Iacoviello, 2022). The stationarity of the risk-related time series is examined using Augmented Dickey–Fuller (*ADF*) tests. The results indicate that several variables (specifically *EPU*, *VIX*, and *GPR*) are non-stationary in levels; therefore, these variables are included in the regressions in first differences. Accordingly, the subsequent analysis employs ΔEPU , ΔVIX , and ΔGPR . To ensure comparability across the different risk indicators, all explanatory variables are standardised. The time series are transformed using z-score normalisation, so that coefficients reflect one-standard-deviation changes. The model with climate-risk controls is specified as:

$$sus_prem_t^{(k)} = \alpha^{(k)} + \beta^{(k)'} FF5_t + \delta^{(k)'} NB_t + \gamma_1^{(k)} TRI_t^z + \gamma_2^{(k)} PRI_t^z + \varepsilon_t^{(k)} \quad (4)$$

The model with ESG uncertainty is:

$$sus_prem_t^{(k)} = \alpha^{(k)} + \beta^{(k)'} FF5_t + \delta^{(k)'} NB_t + \gamma_1^{(k)} ESGUI_t^z + \varepsilon_t^{(k)} \quad (5)$$

The model with macroeconomic and geopolitical risk controls is:

$$sus_prem_t^{(k)} = \alpha^{(k)} + \beta^{(k)'} FF5_t + \delta^{(k)'} NB_t + \gamma_1^{(k)} \Delta EPU_t^z + \gamma_2^{(k)} \Delta VIX_t^z + \gamma_3^{(k)} \Delta GPR_t^z + \varepsilon_t^{(k)} \tag{6}$$

where x^z denotes the standardised form of variable x , and Δ denotes the first-difference operator.

All regressions are estimated using OLS. Residual diagnostics indicated no evidence of severe multicollinearity in the multivariate narrative specifications, as assessed using variance inflation factors (VIFs). Given the monthly frequency of the data and the potential presence of heteroskedasticity and low-order autocorrelation, Newey–West heteroskedasticity- and autocorrelation-consistent standard errors are used throughout, with a lag length of one month.

4. Results

The empirical results indicate that environmental narratives are associated with sustainability premia in a heterogeneous manner, with substantial differ-

Table 3. Contemporaneous topicshare narratives and the equal-weighted sustainability premium

Variable	Base Model	FF3 + Narratives	FF5 + Narratives
Fossil narratives	146.93** (60.76)	128.14*** (34.22)	108.51*** (32.72)
Renewable narratives	339.33 (347.58)	273.96 (169.66)	297.91** (142.91)
Climate-risk narratives	−35.44 (99.25)	−125.42* (69.37)	−136.69** (54.18)
Resource-extraction narratives	−47.17 (317.01)	−343.09** (154.51)	−276.92* (161.67)
Biodiversity narratives	−433.98 (1340.57)	1084.29 (838.21)	1149.35 (774.12)

Note: The table reports OLS regression results for the equal-weighted sustainability premium. Environmental narratives are measured using aggregated TopicShare indicators. Standard errors in parentheses are Newey–West heteroskedasticity- and autocorrelation-consistent with one lag. FF3 and FF5 refer to the Fama–French three-factor and five-factor models, respectively. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels.

Source: authors’ calculations.

ences across narrative categories and between attention-based (TopicShare) and sentiment-based (AvgTone) indicators. Table 3 reports the contemporaneous effects of aggregated TopicShare narrative blocks on the equal-weighted sustainability premium.

The most robust result emerges for fossil-fuel-related narratives. The Fossil TopicShare variable exhibits a positive and statistically significant relationship across all model specifications, including the FF3 and FF5 frameworks. The coefficient remains economically large and statistically strong even after controlling for standard asset-pricing factors, suggesting that increased media attention devoted to fossil-fuel-related environmental narratives is associated with higher contemporaneous sustainability premia.

The largest spikes in fossil-fuel narrative intensity coincide with major energy and climate-related events. The December 2015 spike coincides with the adoption of the Paris Agreement, while the exceptionally large March 2022 spike and the subsequent April 2022 peak coincide with Russia's invasion of Ukraine, the resulting European energy-security debate, and the EU's decision to prohibit Russian coal imports. The January 2016 spike also coincides with the US announcement of a moratorium on new coal leases on federal lands. Figure 3 illustrates these episodes using the standardised monthly Fossil TopicShare series.

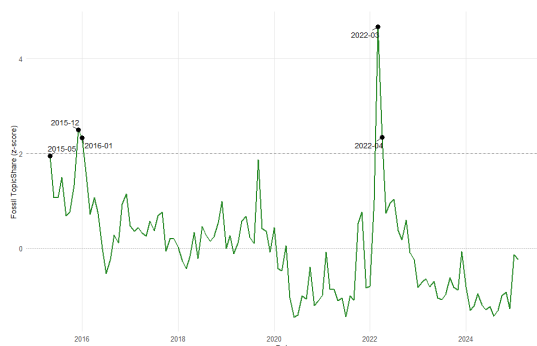


Figure 3. Standardised Fossil–Fuel narrative intensity and major spikes

Note: The figure shows the standardised monthly Fossil TopicShare series. Labels identify the five largest monthly observations over the sample period. The dashed horizontal line indicates a z-score of 2.

Source: authors' calculations based on GDELT data.

Renewable-energy narratives display a weaker and less consistent relationship. While the baseline and FF3 specifications do not yield statistically significant coefficients, the FF5 specification produces a positive and significant coefficient at the 5% level. This result suggests that renewable-energy-related media attention may contain incremental explanatory power once profitability and investment-related risk factors are controlled for.

In contrast, climate-risk narratives are negatively associated with the sustainability premium in the factor-controlled models. The coefficients become statistically significant in both the FF3 and FF5 specifications, indicating that increases in media attention devoted to climate-risk-related narratives are associated with lower contemporaneous sustainability premia. A similar negative relationship is observed for resource-extraction narratives, particularly in the FF3 model. These findings suggest that different environmental narratives are associated with sustainability premia in markedly different ways, with fossil-fuel-related narratives exhibiting positive effects and climate-risk and resource-extraction narratives exhibiting negative effects.

By comparison, biodiversity-related narratives do not exhibit robust explanatory power in the equal-weighted specifications. Although the estimated coefficients vary substantially across models, they remain statistically insignificant, suggesting that biodiversity-related media attention does not exhibit an independent statistical association with contemporaneous sustainability-premium dynamics in these specifications.

Table 4 presents the corresponding results for aggregated AvgTone narrative blocks. Overall, the sentiment-based indicators exhibit weaker and less consistent explanatory power than the TopicShare measures. This pattern is

Table 4. Contemporaneous AvgTone narratives and the equal-weighted sustainability premium

Variable	Base Model	FF3 + Narratives	FF5 + Narratives
Fossil narratives	-1.14 (0.77)	-0.34 (0.46)	-0.02 (0.43)
Renewable narratives	2.37 (2.03)	-0.23 (0.82)	-0.28 (0.77)
Climate-risk narratives	0.20 (0.61)	0.53* (0.31)	0.16 (0.24)
Resource-extraction narratives	0.74 (0.66)	0.84* (0.43)	0.64* (0.37)
Biodiversity narratives	-1.06 (1.04)	-1.59*** (0.51)	-1.06** (0.47)

Note: The table reports OLS regression results for the equal-weighted sustainability premium. Environmental narratives are measured using aggregated AvgTone indicators. Resource-extraction sentiment is included in first differences due to non-stationarity in levels. Standard errors in parentheses are Newey–West heteroskedasticity- and autocorrelation-consistent with one lag. FF3 and FF5 refer to the Fama–French three-factor and five-factor models, respectively. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels.

Source: authors' calculations.

consistent with media attention intensity being more closely associated with sustainability premia than the tone of environmental coverage itself.

Among the AvgTone variables, the strongest and most robust effect is observed for biodiversity-related narratives. The Biodiversity AvgTone coefficient is negative and statistically significant in both the FF3 and FF5 specifications, implying that increasingly negative biodiversity-related media sentiment is associated with higher sustainability premia. Resource-extraction sentiment also exhibits weak positive effects in the factor-controlled specifications, although the statistical significance remains only marginal. Climate-risk sentiment is weakly significant only in the FF3 specification, while fossil-fuel and renewable-energy sentiment indicators do not display robust explanatory power across the models.

Overall, the results indicate that aggregated TopicShare variables provide substantially stronger and more stable explanatory power for sustainability premia than AvgTone indicators. This pattern is consistent with the possibility that media salience and investor attention are more closely associated with sustainability premia than the emotional tone of environmental news coverage. However, the analysis does not directly identify investor attention as the mechanism underlying these associations.

The corresponding value-weighted portfolio results are reported in Appendix Tables A3 and A4. Overall, the value-weighted specifications provide little evidence that environmental narratives systematically affect sustainability premia once conventional risk factors are taken into account. In the TopicShare regressions (Appendix Table A4), most narrative blocks lose statistical significance once FF controls are introduced. Similarly, the AvgTone regressions (Appendix Table A3) produce no consistently significant coefficients across specifications. Overall, environmental narrative effects are substantially stronger in equal-weighted than in value-weighted portfolios.

To examine this difference more directly, we analyzed the spread between the equal- and value-weighted sustainability premia and additionally tested whether the relationship between environmental narratives and the EW-VW spread varies with the Fama–French SMB factor. The narrative variables do not significantly explain the EW-VW spread directly, and SMB itself does not show a robust direct relationship with the spread. However, the interaction analysis reveals significant effects for fossil-fuel TopicShare ($\beta = -102.02$, $p = 0.007$) and resource-extraction TopicShare ($\beta = -256.10$, $p = 0.025$), while the renewable-energy TopicShare interaction is marginally significant ($\beta = -284.34$, $p = 0.052$). The resource-extraction AvgTone interaction is also marginally significant ($\beta = -0.82$, $p = 0.084$). These results provide evidence that the difference between equal- and value-weighted portfolios may vary with size-related market conditions, although the pattern is not systematic across all narrative measures. Since SMB is a market-level size factor rather than a direct measure of firm size, these findings should be interpreted as

supplementary evidence of size-related heterogeneity rather than as direct identification of firm size as the underlying mechanism. Detailed results are reported in Appendix Table A6.

Additional lagged specifications were estimated to examine whether environmental narratives affect sustainability premia with delayed dynamics. Overall, the lagged effects proved substantially weaker and less robust than the contemporaneous relationships. Only fossil-fuel-related TopicShare narratives retained some explanatory power for the equal-weighted sustainability premium, while most other lagged TopicShare and AvgTone variables lost statistical significance once FF controls were included. These findings indicate that the observed association between environmental narratives and sustainability premia is concentrated in the contemporaneous period rather than in persistent delayed adjustments. This pattern is consistent with relatively rapid incorporation of narrative-related information, although the underlying information-diffusion mechanism is not directly tested.

Robustness tests were conducted by augmenting the FF5 specifications with climate-related and macroeconomic risk indicators, including transition climate risk (TRI), physical climate risk (PRI), ESG-related uncertainty (ESGUI), and macroeconomic uncertainty measures (ΔEPU , ΔVIX , ΔGPR). The results are reported in Table 5.

Overall, the explanatory power of the additional risk-control variables remained limited once the aggregated environmental narrative variables and FF5 factors were included simultaneously in the models. Importantly, however, the estimated effects of the environmental narrative variables remained relatively stable across the alternative specifications for the equal-weighted sustainability premium. Fossil-fuel-related narratives retained positive and statistically significant coefficients across all risk-control models, while climate-risk narratives continued to display negative and economically meaningful effects with marginal or near-conventional levels of statistical significance. These findings suggest that the explanatory power of environmental narratives is not subsumed by broader climate-related or macroeconomic risk conditions.

By contrast, the additional risk indicators themselves exhibited only weak and inconsistent effects. Neither transition climate risk (TRI) nor physical climate risk (PRI) demonstrated robust statistical significance in the equal-weighted specifications. ESG-related uncertainty (ESGUI) displayed at most weak marginal significance, while the macroeconomic uncertainty variables remained statistically insignificant throughout the specifications.

The value-weighted specifications yielded substantially weaker and statistically insignificant narrative effects once the additional risk controls were introduced.

The results indicate that aggregated environmental narratives retain incremental explanatory power for ESG-related asset pricing beyond broader climate-risk, ESG-uncertainty, and macroeconomic-risk measures.

Table 5. Robustness of environmental narrative effects with climate and macroeconomic risk controls

Variable	FF5 + TRI/PRI	FF5 + ESGUI	FF5 + Macro risk
Fossil narratives	72.53*	76.23**	72.63*
	(40.22)	(38.27)	(37.89)
Climate-risk narratives	−113.06*	−117.25*	−108.43*
	(59.51)	(59.75)	(63.72)
TRI_z	0.084		
	(0.090)		
PRI_z	−0.002		
	(0.146)		
ESGUI_z		−0.144*	
		(0.077)	
ΔEPU_z			0.020
			(0.086)
ΔVIX_z			−0.155
			(0.173)
ΔGPR_z			−0.086
			(0.074)
Narrative controls	Yes	Yes	Yes
FF5 factors	Yes	Yes	Yes

Note: The table reports robustness regressions for the equal-weighted sustainability premium. All specifications include the Fama–French five-factor model and aggregated environmental narrative variables. Additional controls include transition climate risk (TRI), physical climate risk (PRI), ESG-related uncertainty (ESGUI), and macroeconomic and geopolitical uncertainty measures (ΔEPU , ΔVIX , ΔGPR). Standard errors in parentheses are Newey–West heteroskedasticity- and autocorrelation-consistent with one lag. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels.

Source: authors' calculations.

To further examine the differences between the FF3 and FF5 specifications, we re-estimated the models by adding the profitability (RMW) and investment (CMA) factors separately to the FF3 specification. The results indicate that the differences between FF3 and FF5 cannot be attributed uniformly to either additional factor. For the equal-weighted TopicShare specifications, the fossil-fuel narrative effect remains positive and statistically significant after adding either RMW or CMA separately, supporting the robustness of this result. The climate-risk effect becomes significant when RMW is added, while the resource-extraction effect remains significant with RMW but weakens after the inclusion of CMA. For AvgTone, the negative biodiversity effect re-

mains significant in both decomposed specifications. Overall, the decomposition suggests that the main narrative effects are not mechanically driven by the additional profitability and investment factors included in FF5, although individual narrative coefficients exhibit some sensitivity to these controls. Detailed results are reported in Appendix Table A5.

The differences observed across model specifications indicate that the association between environmental narratives and sustainability premia varies across portfolio weighting schemes, factor controls, and time horizons. Firstly, TopicShare variables generally exhibit stronger and more stable associations with the sustainability premium than AvgTone indicators. This pattern is consistent with the possibility that media salience and investor attention are more closely related to sustainability-premium dynamics than the emotional tone of environmental coverage, although the present analysis does not directly identify attention as the underlying mechanism. Secondly, the stronger effects observed in equal-weighted portfolios indicate heterogeneity across portfolio weighting schemes. Although the SMB interaction results provide supplementary evidence of size-related heterogeneity, they do not allow us to identify firm size or investor attention as the underlying mechanism. Thirdly, the weakening of several coefficients after introducing FF controls suggests that part of the narrative effects overlaps with conventional systematic risk exposures, although several environmental narrative variables retain incremental explanatory power beyond standard factor structures. Finally, the relatively weak lagged effects indicate that the observed relationships are concentrated in the contemporaneous period rather than in persistent delayed adjustments. This pattern is consistent with relatively rapid incorporation of narrative-related information, but the underlying information-diffusion mechanism is not directly tested.

5. Discussion

Our results suggest that environmental narratives are associated with sustainability premia beyond conventional ESG scores and climate-risk measures. While equilibrium-based models predict lower expected returns for high-ESG assets due to investor preferences (Pástor et al., 2021), our results show that environmental narrative variables retain explanatory power for sustainability premia even after controlling for standard risk factors and explicit climate and macroeconomic uncertainty measures.

A particularly important finding is that attention-based environmental narrative measures exhibit stronger and more stable explanatory power than sentiment-based indicators. While AvgTone variables produce weaker and less

robust effects across specifications, TopicShare-based measures remain economically and statistically relevant after controlling for standard asset-pricing factors and broader climate-risk indicators. This pattern is consistent with the possibility that media salience and investor attention are more closely associated with sustainability-related pricing than the emotional tone of environmental coverage itself. However, the present analysis does not directly test the underlying attention or information-processing mechanism.

The pricing associations also differ substantially across environmental topics. The strongest effects are observed for fossil-fuel, climate-risk, and resource-extraction narratives, while broader environmental themes display weaker and less consistent relationships. The positive association observed for fossil-fuel-related narratives may reflect heightened investor awareness of future transition costs, regulatory pressures, and decarbonisation risks, which may be reflected in differences in the relative pricing of high- and low-ESG firms. This pattern suggests that narratives with more direct implications for future cash flows, risk perceptions, and firm valuations may be more relevant for sustainability-related pricing.

These findings are broadly consistent with prior studies documenting that climate-related news, investor attention, and ESG-related media salience affect financial-market dynamics beyond traditional risk factors (Andreu et al., 2026; López-Cabarcos et al., 2019; Naughton et al., 2019; Vu et al., 2025; Xu et al., 2022). They extend this literature by indicating that environmental narratives do not operate as a homogeneous information channel. Instead, pricing associations differ across thematic categories and between attention-based and sentiment-based measures. The stronger results for narrative salience suggest that the visibility of environmental information may be relevant for understanding when sustainability-related information becomes reflected in equity-market pricing, although this interpretation remains consistent with an attention-based explanation rather than a directly identified mechanism.

The stronger effects observed in equal-weighted portfolios indicate heterogeneity across portfolio weighting schemes. Additional interactions between SMB and selected TopicShare narratives provide supplementary evidence of size-related heterogeneity, although SMB is a market-level factor rather than a direct measure of firm size and therefore does not identify firm size as the underlying mechanism. The relatively weak lagged effects further indicate that the observed associations are concentrated in the contemporaneous period rather than in persistent delayed adjustments. This pattern is consistent with relatively rapid incorporation of narrative-related information, although the underlying information-diffusion mechanism is not directly tested.

Taken together, the findings suggest that environmental narratives may provide a time-varying conditioning dimension in the relationship between sustainability-related information and asset prices, rather than representing an independently identified unconditional risk factor.

Several practical implications emerge from the results. Sustainability-related pricing dynamics appear sensitive to changes in narrative salience and media attention, with the strength of these associations varying across portfolio weighting schemes and market conditions. This suggests that observed ESG-related investment performance may be associated not only with firm-level sustainability characteristics but also with the intensity and visibility of environmental narratives within the broader informational environment (Andreu et al., 2026; Vu et al., 2025).

For firms, environmental communication and media exposure may be associated with market valuation beyond underlying ESG fundamentals, highlighting the importance of credible and transparent sustainability-related disclosure practices. Firms operating in transition-sensitive or environmentally controversial industries may be particularly exposed to narrative-driven re-pricing dynamics (Ferro et al., 2025; Guastella et al., 2022).

From a policy perspective, the findings highlight the relevance of information quality, disclosure consistency, and climate-related reporting standards. If the observed associations between sustainability premia and narrative salience reflect differences in the information environment, unstable or highly fragmented information environments may amplify pricing volatility, increase uncertainty surrounding ESG investments, and strengthen greenwashing-related concerns in financial markets (Baker et al., 2016; Caldara & Iacoviello, 2022; Ongan et al., 2025).

The analysis relies on media-based narrative measures and focuses on US large- and mid-cap firms at monthly frequency, which may limit the generalisability of the findings across markets, frequencies, and institutional environments. In addition, the analysis does not directly measure investor attention, information diffusion, or belief formation. These mechanisms should therefore be regarded as plausible interpretations of the observed relationships rather than directly identified channels. Future research could employ firm-level measures of attention and narrative exposure, higher-frequency data, and cross-country comparative analyses to distinguish among these possible mechanisms.

Conclusions

This study examined whether environmental narratives are associated with sustainability premia beyond conventional ESG scores and climate-risk measures. Using GDELT-based environmental narrative indicators and ESG long-short portfolios, the analysis shows that environmental narrative measures retain economically meaningful explanatory power for sustainability premia

after controlling for standard asset-pricing factors and broader climate-related uncertainty measures.

The findings indicate that the prominence of environmental narratives in the media is more consistently associated with sustainability premia than the emotional tone of environmental coverage. This pattern is consistent with a potentially important role for media salience and investor attention in sustainability-related pricing, although the analysis does not directly identify these factors as causal mechanisms. The stronger effects observed in equal-weighted portfolios further indicate heterogeneity across portfolio weighting schemes, while the additional analysis provides supplementary evidence of size-related heterogeneity without directly identifying firm size as the underlying mechanism.

Overall, the results suggest that variation in ESG premia is related not only to conventional risk factors and sustainability characteristics, but also to the broader information environment in which environmental information becomes relevant to investors. The pricing associations vary substantially across environmental topics, with the strongest effects observed for fossil-fuel-related narratives, while broader climate-risk proxies exhibit comparatively weak explanatory power. The relatively weak lagged effects indicate that the observed relationships are concentrated in the contemporaneous period rather than in persistent delayed adjustments.

Several limitations remain. The analysis relies on aggregated media-based indicators and focuses on US large- and mid-cap firms at monthly frequency, which may limit the generalisability of the findings across markets and institutional settings. In addition, the analysis does not directly measure investor attention, information diffusion, or belief formation. Future research could therefore employ firm-level measures of attention and narrative exposure, higher-frequency data, and cross-country comparative analyses to distinguish among these possible mechanisms.

Appendix. Supplementary tables

Table A1. Descriptive statistics of media tone (AvgTone) by environmental topic

Variable (AvgTone)	Mean	SD	Min	Max	N
BIOFUEL	0.277859	0.27236	−0.64025	0.966986	125
CARBONCAPTURE	0.521524	0.328584	−0.35599	1.227313	125
CLIMATECHANGE	−1.06547	0.309518	−1.98022	−0.38311	125
COAL	−1.0229	0.300368	−2.71234	−0.42557	125
DEFORESTATION	−1.55497	0.497425	−3.53382	−0.68679	125
FISHERY	−0.86626	0.242074	−1.49961	−0.20357	125
FORESTRY	−1.07709	0.870944	−3.70404	0.333634	125
GEO THERMAL	0.526514	0.575297	−4.05352	1.751084	125
GREEN	0.528565	0.191479	−0.02945	0.964831	125
HYDRO	−0.47723	0.525926	−3.12989	0.437174	125
METALS	0.010142	0.316993	−1.56227	0.559663	125
MINING	−0.5702	0.274331	−1.50737	−0.07183	125
NATURALGAS	−0.37912	0.398247	−1.83706	0.354406	125
NUCLEARPOWER	−0.73074	0.515131	−2.5962	0.442739	125
OIL	−1.38563	0.357681	−2.58583	−0.72408	125
OVERFISH	−1.42053	0.421036	−2.80872	−0.07415	125
POACHING	−1.64476	0.58581	−3.35957	−0.05778	125
SOLAR	0.301545	0.192308	−0.29584	0.744045	125
SPECIESENDANGERED	−1.59414	0.319018	−2.72157	−0.67672	125
SPECIESEXINCT	−0.89119	0.615602	−3.27505	1.423234	125
WATERWAYS	−1.43688	0.534402	−3.80831	−0.20087	125
WINDPOWER	0.042181	0.350237	−1.89947	0.634095	125

Source: authors' calculations.

Table A2. Descriptive statistics of topic share by environmental topic

Variable (TopicShare)	Mean	SD	Min	Max	N
BIOFUEL	0.001627	0.000382	0.000912	0.003028	125
CARBONCAPTURE	0.00083	0.000607	4.8×10^{-5}	0.002436	125
CLIMATECHANGE	0.023786	0.008074	0.011115	0.047596	125
COAL	0.0074	0.001725	0.004028	0.013296	125
DEFORESTATION	0.000839	0.000451	0.000394	0.003716	125
FISHERY	0.002507	0.000352	0.001628	0.003301	125
FORESTRY	0.002182	0.000945	0.001073	0.005872	125
GEOHERMAL	0.000737	0.000274	0.000297	0.003073	125
GREEN	0.008289	0.00208	0.004413	0.017641	125
HYDRO	0.001398	0.000339	0.000693	0.002884	125
METALS	0.00452	0.000697	0.002967	0.007956	125
MINING	0.009685	0.001438	0.006046	0.014585	125
NATURALGAS	0.01007	0.002279	0.005312	0.021024	125
NUCLEARPOWER	0.001069	0.000341	0.000488	0.002111	125
OIL	0.033909	0.00796	0.022463	0.066929	125
OVERFISH	0.000288	0.000106	0.000136	0.000814	125
POACHING	0.000823	0.000442	0.000387	0.003359	125
SOLAR	0.009749	0.002706	0.005463	0.026673	125
SPECIESENDANGERED	0.001818	0.000334	0.001115	0.003004	125
SPECIESEXTINCT	8.4×10^{-5}	4.5×10^{-5}	3.5×10^{-5}	0.00028	125
WATERWAYS	0.003146	0.000833	0.001585	0.007237	125
WINDPOWER	0.002334	0.000544	0.001206	0.005331	125

Source: authors' calculations.

Table A3. Contemporaneous AvgTone narratives and the value-weighted sustainability premium

Variable	Base Model	FF3 + Narratives	FF5 + Narratives
Fossil narratives	−1.61 (1.28)	−0.68 (1.01)	−0.56 (1.02)
Renewable narratives	2.05 (2.69)	−0.60 (1.72)	−0.20 (1.58)
Climate-risk narratives	0.65 (0.92)	0.98 (0.76)	0.53 (0.62)
Resource-extraction narratives	0.68 (1.07)	1.00 (0.84)	0.46 (0.92)
Biodiversity narratives	−0.80 (2.04)	−1.32 (1.47)	−0.53 (1.37)

Note: The table reports OLS regression results for the value-weighted sustainability premium. Environmental narratives are measured using aggregated AvgTone indicators. Resource-extraction sentiment is included in first differences due to non-stationarity in levels. Standard errors in parentheses are Newey–West heteroskedasticity- and autocorrelation-consistent with one lag. FF3 and FF5 refer to the Fama–French three-factor and five-factor models, respectively. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels.

Source: authors' calculations.

Table A4. Contemporaneous TopicShare narratives and the value-weighted sustainability premium

Variable	Base Model	FF3 + Narratives	FF5 + Narratives
Fossil narratives	187.82* (110.30)	167.97 (113.84)	173.57 (120.37)
Renewable narratives	542.88 (638.01)	461.21 (614.53)	492.61 (621.03)
Climate-risk narratives	−73.72 (183.24)	−146.63 (186.05)	−180.02 (172.18)
Resource-extraction narratives	−17.93 (559.13)	−298.15 (536.55)	−308.12 (510.75)
Biodiversity narratives	−894.88 (2017.69)	381.24 (2120.16)	263.96 (1985.83)

Note: The table reports OLS regression results for the value-weighted sustainability premium. Environmental narratives are measured using aggregated TopicShare indicators. Standard errors in parentheses are Newey–West heteroskedasticity- and autocorrelation-consistent with one lag. FF3 and FF5 refer to the Fama–French three-factor and five-factor models, respectively. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels.

Source: authors' calculations.

Table A5. Decomposition of narrative effects across FF3, FF3 + RMW, FF3 + CMA, and FF5 specifications

Portfolio	Narrative	Variable	FF3	FF3 + RMW	FF3 + CMA	FF5
Equal-weighted	TopicShare	Fossil	128.14***	139.66***	92.82**	108.51***
Equal-weighted	TopicShare	Renewable	273.96	286.74*	287.44*	297.91**
Equal-weighted	TopicShare	Climate-risk	−125.42*	−144.49**	−117.35*	−136.69**
Equal-weighted	TopicShare	Resource-extraction	−343.09**	−375.68**	−230.95	−276.92*
Equal-weighted	TopicShare	Biodiversity	1084.29	976.82	1277.77	1149.35
Value-weighted	TopicShare	Fossil	167.97	190.73*	141.60	173.57
Value-weighted	TopicShare	Renewable	461.21	486.46	471.26	492.61
Value-weighted	TopicShare	Climate-risk	−146.63	−184.32	−140.61	−180.02
Value-weighted	TopicShare	Resource-extraction	−298.15	−362.54	−214.44	−308.12
Value-weighted	TopicShare	Biodiversity	381.24	168.90	525.66	263.96
Equal-weighted	AvgTone	Fossil	−0.34	−0.38	0.03	−0.02
Equal-weighted	AvgTone	Renewable	−0.23	0.05	−0.57	−0.28
Equal-weighted	AvgTone	Climate-risk	0.53*	0.38	0.30	0.16
Equal-weighted	AvgTone	Resource-extraction	0.84*	0.56	0.91**	0.64*
Equal-weighted	AvgTone	Biodiversity	−1.59***	−1.28***	−1.36***	−1.06**
Value-weighted	AvgTone	Fossil	−0.68	−0.77	−0.43	−0.56
Value-weighted	AvgTone	Renewable	−0.60	−0.01	−0.82	−0.20
Value-weighted	AvgTone	Climate-risk	0.98	0.66	0.83	0.53
Value-weighted	AvgTone	Resource-extraction	1.00	0.41	1.05	0.46
Value-weighted	AvgTone	Biodiversity	−1.32	−0.66	−1.17	−0.53

Note: The table reports OLS regression results for the equal-weighted and value-weighted sustainability premia. Environmental narratives are measured using aggregated TopicShare and AvgTone indicators. Statistical inference is based on Newey–West heteroskedasticity- and autocorrelation-consistent standard errors with one lag. FF3 and FF5 refer to the Fama–French three-factor and five-factor models, respectively. FF3 + RMW and FF3 + CMA augment the FF3 specification separately with the profitability (RMW) and investment (CMA) factors. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Source: authors' calculations.

Table A6. Environmental narratives and the equal-weighted versus value-weighted sustainability premium spread

Panel A. Direct narrative effects

Narrative	TopicShare β	p -value	AvgTone β	p -value
Fossil	−53.699	0.578	0.243	0.774
Renewable	−70.884	0.852	−0.087	0.955
Climate risk	26.144	0.835	−0.303	0.610
Resource extraction	−73.218	0.827	0.021	0.980
Biodiversity	317.482	0.818	−0.414	0.734

Panel B. SMB × narrative interaction effects

Narrative	TopicShare × SMB β	p -value	AvgTone × SMB β	p -value
Fossil	−102.023***	0.007	−0.261	0.364
Renewable	−284.343*	0.052	0.438	0.487
Climate risk	45.515	0.391	0.334	0.213
Resource extraction	−256.097**	0.025	−0.821*	0.084
Biodiversity	−322.589	0.611	−0.409	0.267

Note: The dependent variable is the difference between the equal-weighted and value-weighted sustainability premia (EW-VW spread). Panel A reports the coefficients of the environmental narrative variables from regressions including the Fama–French five factors (Mkt-RF, SMB, HML, RMW, and CMA) as controls. Panel B reports the interaction coefficients between SMB and the respective environmental narrative variable. Models are estimated using OLS with Newey–West heteroskedasticity- and autocorrelation-consistent standard errors with one lag. N = 118 in all specifications. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Source: authors’ calculations.

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Accounting-based CAPM: Symmetrical and downside risk approaches

 Lesław Markowski¹

 Przemysław Garsztka²

 Jacek Mizerka³

 Anna Rutkowska-Miczka⁴

Abstract

The complexity of asset return variability justifies supplementing the standard Capital Asset Pricing Model (CAPM) formula with market risk measures based on firms' fundamental analysis. Moreover, a key area of investigation involves the approach to downside pricing. The main objective of this study is to test non-standard CAPM extensions that incorporate accounting information. The results for the Frankfurt Stock Exchange indicate that profitability ratios constitute a significant source of systematic risk and generate a positive premium related to a company's financial condition. Furthermore, in the case of large firms, sensitivity measures based on downside accounting betas demonstrate a clear advantage over their conventional counterparts.

Keywords

- CAPM
- profitability ratios
- accounting beta
- downside risk
- downside accounting beta

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¹ Institute of Economics and Finance, University of Warmia and Mazury in Olsztyn, ul. M. Oczapowskiego 2, 10-719 Olsztyn, Poland, leszekm@uwm.edu.pl, <https://orcid.org/0000-0001-6238-1724>.

² Department of Econometrics, Poznań University of Economics and Business, Al. Niepodległości 10, 61-875 Poznań, Poland, przemyslaw.garsztka@ue.poznan.pl, <https://orcid.org/0000-0002-9877-5634>.

³ Department of Corporate Finance, Poznań University of Economics and Business, Al. Niepodległości 10, 61-875 Poznań, Poland, jacek.mizerka@ue.poznan.pl, <https://orcid.org/0000-0001-5862-7162>.

⁴ Institute of Economics and Finance, University of Warmia and Mazury in Olsztyn, ul. M. Oczapowskiego 2, 10-719 Olsztyn, Poland, corresponding author: anna.rm@uwm.edu.pl, <https://orcid.org/0000-0001-6073-3386>.

Introduction

The research presented in this paper is situated within the stream of studies on capital asset pricing that incorporate risk asymmetry and selected information derived from financial statements. Early contributions in this area include the works of Kim and Zumwalt (1979) and Kim and Ismail (1998), followed by more recent studies such as Konchitchki et al. (2016), Luo et al. (2021), W. Huang et al. (2022), and Rutkowska-Ziarko et al. (2024). These studies differ both in their approaches to modelling downside risk and in the types of financial statement information employed.

This paper makes a novel contribution to the literature on asset pricing and risk measurement in several crucial ways. Firstly, it advances the development of downside Capital Asset Pricing Model (CAPM) approaches by incorporating empirically observed features of financial returns, such as skewness and asymmetric volatility, which are often neglected in traditional models. This perspective aligns with behavioural finance insights and utility-based theories that emphasise loss aversion and asymmetric risk preferences (Kahneman & Tversky, 1979). Secondly, the study explores the viability of profitability-based measures as risk indicators, offering an alternative to purely market-derived metrics. The use of accounting betas constructed from firm-level profitability ratios serves as a practical and potentially more informative tool for capturing firm-specific exposure to systematic risk, especially in contexts where market data is limited or distorted. The integration of these two research streams provides the basis for the development of a Downside Accounting Capital Asset Pricing Model (DA-CAPM), in which the primary measure of systematic risk is the downside accounting beta (DAB). Motivated by the limitations inherent in traditional market-based approaches to risk assessment, this study investigates the incorporation of average profitability ratios and accounting-based betas as integral components in evaluating systematic risk. By embedding these accounting-derived metrics into the asset pricing framework, we aim to construct a more holistic representation of firm-specific risk exposures, particularly under heterogeneous financial conditions across listed firms. This novel integration addresses the shortcomings of conventional models grounded in symmetric variance, which often fail to capture the asymmetric behaviour of asset returns and the differential risk preferences exhibited by investors, especially in the presence of downside volatility.

The aim of this study is to examine the explanatory power of the classical Capital Asset Pricing Model (CAPM) with respect to stock returns and to assess the impact of incorporating accounting variables into the model framework. In particular, the study focuses on extending the standard CAPM specification by including corporate profitability indicators and accounting betas in order

to determine whether fundamental variables provide additional information relevant to risk pricing and the determination of expected stock returns.

Furthermore, the study investigates the importance of an asymmetric approach to risk by incorporating its downside dimension. In this context, it attempts to assess whether risk measures based solely on unfavourable return deviations are more effective in explaining the cross-sectional variation in stock returns than traditional measures based on total return variability. Therefore, the study seeks to determine whether the integration of accounting information and downside risk measures enhances the explanatory power of the extended CAPM framework.

The novelty of this study stems from the simultaneous incorporation of accounting profitability measures, accounting betas, and downside risk into the traditional CAPM framework. While prior studies have typically examined these factors separately, this research investigates their joint effect on explaining stock returns, thereby offering a more comprehensive approach to asset pricing and risk assessment.

A statistically significant pricing based on the DAB was obtained for assets listed on the New York Stock Exchange (NYSE) (Rutkowska-Ziarko et al., 2024). A key element in achieving this objective is the collection and analysis of quarterly financial statements. The choice of the Frankfurt Stock Exchange (FSE) is motivated by the availability of standardised quarterly financial reports, in contrast to other exchanges such as the London Stock Exchange (LSE), as well as by the fact that the German market is the largest market in the European Union in terms of national market capitalisation.

The literature provides a number of studies addressing asset pricing in the German market. Notably, significant cross-sectional regression analyses employing accounting data for firms listed on the German capital market, including financial factors, were conducted by Amel-Zadeh (2011) and Artmann et al. (2012). However, these studies do not incorporate a downside approach to risk, which is explicitly addressed in the present paper. The application of downside risk measures to accounting-based variables therefore constitutes a novel contribution to the existing literature, which has predominantly relied on symmetric measures in risk evaluation.

The methodological framework of our study incorporates accounting-based factors, such as profitability ratios and accounting beta coefficients. Moreover, these adaptations are tested under both symmetrical risk assumptions, which rely on the variance of returns, and under downside risk specifications, which account for return asymmetry and investors' heightened sensitivity to negative outcomes. Specifically, it employs lower partial moments (LPM), such as semi-variance, which are theoretically consistent with utility functions exhibiting decreasing absolute risk aversion (Bawa, 1975). Semi-variance captures deviations below the mean return and is widely recognized as a suitable metric for assessing systematic risk under asymmetry. Moreover, partial

moments in their general formulation (both lower and upper) exhibit lower estimation errors than the traditional mean–variance framework and should be considered a preferred initial choice of risk measures, particularly when return distributions deviate from normality (Nawrocki & Viole, 2024). Semi-covariance, an asymmetric co-LPM, has been employed in prior research to estimate downside betas (Ang et al., 2006; Bawa & Lindenberg, 1977; Harlow & Rao, 1989; Hogan & Warren, 1974; Levi & Welch, 2020).

The empirical methodology is inspired by the two-step Fama–MacBeth procedure. Owing to the limited time-series dimension of the quarterly data, a full implementation of the original approach was not feasible. Accordingly, the estimation strategy represents an adaptation of the Fama–MacBeth framework to the characteristics of the available sample. The empirical procedure corresponds more closely to that proposed by Black et al. (1972).

Our empirical evidence suggests that profitability ratios, along with accounting betas, most notably within the downside risk framework, constitute significant determinants of the cross-sectional variation in stock returns. In doing so, it extends the applicability of the CAPM through models that reflect both the distributional asymmetries of returns and the informational value embedded in firm-level accounting performance. The development of these extended CAPM variants represents a significant advancement toward a unified framework that blends accounting fundamentals with behavioural dimensions of risk perception. Our approach contributes to the existing literature by bridging the gap between market-driven and accounting-based perspectives on risk. Moreover, this synthesis offers a more nuanced and robust approach to asset pricing, with practical implications for both academic research and financial decision-making.

This paper is organised as follows. Section 1 briefly reviews the literature on testing the CAPM considering the downside framework to risk. Section 2 explains methodology as well as the hypotheses of cross-sectional standard and accounting regressions and Section 3 describes the dataset. Section 4 presents the research findings and discussion. The last section offers several conclusions and suggests areas for future research.

1. Literature review

The Capital Asset Pricing Model (CAPM) has a long and influential history, serving as a foundational framework for understanding the relationship between risk and expected return. Over time, researchers have proposed and rigorously tested numerous alternative pricing models, among which the Arbitrage Pricing Theory (APT) and the Fama–French multifactor models are

particularly prominent. Despite these advancements, the literature continues to report conflicting evidence. On one hand, several studies document persistent anomalies in risk pricing and return variability, but on the other, subsequent research has often challenged or even refuted these findings. Consequently, the question of how effectively asset pricing models explain the variation in returns remains both timely and relevant. In this context, Cho and Polk (2024) conducted an empirical investigation focusing on firms listed on the New York Stock Exchange (NYSE). Their study assessed the extent to which CAPM accounts for price-level variation associated with nine additional firm characteristics that are widely recognised as influencing the cross-sectional distribution of average returns. These characteristics include net issuance, investment, accruals, beta, size, momentum, and profitability. By integrating insights from asset pricing and corporate finance, their analysis revealed that portfolios constructed on the basis of adjusted value metrics incorporating market-to-book ratio, return on equity (ROE), and Sharpe beta exhibit substantial variation in abnormal pricing. These findings underscore the limitations of the traditional CAPM in capturing the complexity of return determinants and highlight the need for more comprehensive modelling approaches.

A growing body of literature suggests that economic fundamentals, particularly profitability indicators and accounting-based beta coefficients, can complement the traditional CAPM beta in estimating the cost of equity capital (Cohen et al., 2009; Nekrasov & Shroff, 2009). Barberis et al. (2021) show that firms with higher return on assets (ROA) tend to deliver higher returns in capital markets on average.

In addition to the risk associated with the firm's accounting profitability, the second major dimension of risk examined in this study relates to the downside risk framework. Unlike traditional risk measures such as variance or standard deviation that treat positive and negative return deviations from the mean as equally significant, the downside risk approach concentrates exclusively on returns that fall below a predetermined threshold, typically a benchmark or minimum acceptable return. This focus on negative tail outcomes is particularly pertinent in asset pricing models, as exemplified by the Downside Capital Asset Pricing Model (D-CAPM), which captures systematic risk by considering only negative market excess returns in its estimation (Nurjannah et al., 2012).

An associated methodological advancement is the two-beta market model, which facilitates the decomposition of asset return sensitivities under asymmetric market conditions, specifically during upward (upside) and downward (downside) market movements. This framework enables the downside accounting beta coefficients to be estimated, thereby allowing for a more targeted assessment of downside risk exposure. The conceptual distinction between positive and negative betas, originally introduced by Fabozzi and Francis (1977), was operationalised in empirical research by Kim and Ismail (1998),

who documented a positive and statistically significant pricing of downside risk for equities listed on the New York Stock Exchange (NYSE). These results are consistent with theoretical models of risk-averse investor behaviour, which posit that compensation is required for bearing downside volatility.

Nevertheless, despite robust empirical support for downside risk measures, a segment of the literature challenges their predictive efficacy relative to conventional risk metrics. For example, Levi and Welch (2020) argue that downside beta lacks superior explanatory power in cross-sectional return regressions when compared to the traditional CAPM beta. Their findings indicate that stocks with historically low downside betas do not systematically outperform during subsequent market downturns, calling into question the incremental value of downside beta in asset pricing applications.

It has been demonstrated by numerous studies that downside risk measures are more accurate reflections of investors' perceptions of equity risk, particularly in circumstances of market asymmetry (Ang et al., 2006; Menon et al., 2023). Traditional risk measures, such as variance and standard deviation, treat all deviations from the mean positive and negative as equally relevant. However, this assumption contradicts observed investor behaviour, which is predominantly risk-averse and more sensitive to losses than to equivalent gains. The downside risk framework addresses this limitation by focusing exclusively on returns that fall below a specified threshold, typically a risk-free rate or a minimum acceptable return. In this framework, positive deviations are viewed as desirable outcomes rather than sources of risk. This asymmetrical approach has gained wide acceptance in asset pricing and portfolio optimisation due to its conceptual alignment with investor preferences and its computational simplicity (Harlow, 1991).

Within this context, downside beta defined as the sensitivity of an asset's return to negative market movements has been increasingly employed as a refinement of traditional beta in Capital Asset Pricing Model (CAPM) extensions. Ang et al. (2006) provided empirical evidence that risk-averse investors demand a premium for bearing downside market risk, a relationship that is captured more effectively by downside beta than by its conventional counterpart. They found that stocks with higher downside betas tend to yield higher average returns, suggesting that investors seek compensation specifically for exposure to unfavourable market conditions. This finding aligns with broader theories of asymmetric risk pricing and has spurred a growing body of empirical research on the role of downside risk in asset valuation.

Further supporting this line of inquiry, positive and statistically significant premiums associated with downside beta have been observed in various asset pricing contexts. These premiums often appear in conjunction with other known risk factors such as co-skewness, illiquidity, and firm size. Estrada (2002, 2007) made a significant contribution to this literature by introducing a modified version of downside beta, which not only aligns more closely with inves-

tor loss aversion but also demonstrates superior explanatory power for return volatility. His work provides both a theoretical rationale and empirical validation for incorporating downside risk into mainstream asset pricing models.

The robustness of downside risk measures has also been tested across different market environments. For instance, empirical studies by Chen et al. (2009), Ali (2019), F. Huang (2019), and Atilgan et al. (2021) have all found a significant positive association between downside risk measures and expected returns in both developed and emerging markets. These findings suggest that the pricing of downside risk is a pervasive phenomenon not limited to specific geographies or market structures.

Despite this broad empirical support, the literature remains divided. Some researchers have challenged the predictive superiority of downside risk measures relative to conventional metrics. For example, Levi and Welch (2020) argue that downside beta does not consistently outperform the traditional CAPM beta in explaining cross-sectional variations in returns. Their analysis indicates that stocks with historically low downside betas do not necessarily deliver better performance during future market downturns. In turn, Atilgan et al. (2019) investigated the relationships between several downside risk measures such as lower partial moment, value-at-risk, expected shortfall, and subsequent returns, demonstrating that these relationships consistently exhibit a negative direction. This critique highlights the ongoing debate within the finance literature regarding the incremental value of downside risk metrics in asset pricing models.

In summary, while downside risk measures, particularly downside beta, have demonstrated substantial theoretical and empirical relevance in capturing investor preferences and return dynamics, their practical superiority over traditional risk metrics remains a topic of active research. Continued exploration is needed to reconcile these mixed findings and to refine models that more accurately reflect investor behaviour under asymmetric market conditions.

This study employs both accounting-based and market-based sensitivity measures to assess systematic risk. The accounting beta, first introduced by Hill and Stone (1980), quantifies the sensitivity of a firm's accounting returns such as return on assets (ROA) and return on equity ROE to changes in market or sector returns, following the one-factor Sharpe model (1964). In this research, accounting betas are calculated using accounting performance metrics (ROA and ROE), while market betas are derived from stock price data. Beyond these, other accounting measures, such as earnings, cash flow-based metrics (Kim & Ismail, 1998), return on sales (Rutkowska-Ziarko & Pyke, 2017), book value of equity and measures of the income statement (Sarmiento et al., 2021), have also been used to estimate accounting betas. For investors, accessing timely and reliable financial and non-financial information is essential. The comprehensive audit process plays a crucial role in this regard by significantly reducing the potential for inaccuracies in financial reporting.

A notable contribution demonstrating the use of earnings measures to explain stock returns is provided by Ellahie (2021). He finds that realised ROA and ROE betas are poor predictors of future returns, whereas earnings betas calculated as unexpected changes to earnings forecasts perform relatively well. In particular, Ellahie shows that earnings-based betas outperform the market beta, and that betas constructed from earnings changes exhibit superior performance relative to those based on earnings levels.

The present study centres on downside risk and, accordingly, utilises the downside accounting beta (DAB), a measure initially introduced by Rutkowska-Ziarko and Pyke (2017) and subsequently refined by Rutkowska-Ziarko (2023). This metric builds on the concept of risk asymmetry in accounting-based CAPM frameworks, originally advanced by Kim and Ismail (1998). They conceptualised risk asymmetry as a condition in which the accounting metric for the market portfolio in a given period declines relative to the previous period. In their approach, accounting betas based on earnings and cash flows were estimated using the arithmetic mean as a proxy for the market index, with up-market and down-market conditions delineated by whether the accounting variable (e.g., earnings or cash flows) increased or decreased compared to the prior quarter.

Importantly, this framework diverges from traditional downside risk metrics such as semi-variance or lower partial moments (LPM), as it leverages accounting information rather than market-based returns to characterise risk. Kim and Ismail (1998) found that accounting betas, whether based on earnings or cash flows, are significantly associated with return volatility, and that risk premiums vary substantially between rising and declining markets. Moreover, their findings suggest that the use of accounting data yields improved model performance compared to models relying solely on market prices, offering a compelling case for incorporating fundamental financial indicators into risk assessment models. Konchitchki et al. (2016) introduced a novel downside risk measure termed accounting-based downside risk (ABDR), which quantifies asymmetry in firm performance by calculating the ratio of the square root of the lower partial moments (LPM) of return on assets (ROA) to the square root of the upper partial moments (UPM) of ROA. Their findings provide empirical evidence supporting the linkage between accounting-based performance measures and asset pricing models, highlighting the potential of financial statement data in capturing downside risk.

Building on this framework, Alam et al. (2021) refined the ABDR metric by developing the cash flow downside risk (CFDR) measure, which applies a similar methodology using cash flow data instead of ROA. Their study revealed a positive relationship between CFDR and future credit spreads, suggesting that downside risk in cash flows may serve as a leading indicator of firms' creditworthiness. Separately, W. Huang et al. (2022) and Luo et al. (2021) applied the ABDR measure in the context of the Chinese equity market, demonstrating

a negative association between ABDR values and the likelihood of future stock price crashes, thus underlining its predictive utility for downside tail events.

It is important to note that the ABDR and CFDR approaches represent alternative methodologies for incorporating accounting data into downside risk assessment. These differ conceptually and methodologically from the downside accounting beta (DAB) framework employed in the present study, offering complementary perspectives on the use of financial statement information in risk modelling. While Alam et al. (2021) examine accounting-based downside risk measures primarily in the context of credit spreads, our work shifts the analytical lens toward the development and empirical testing of novel CAPM extensions that explicitly integrate accounting information with downside risk considerations. In particular, our approach emphasises the role of average profitability ratios and accounting betas as potential determinants of systematic risk, an area not addressed in Alam et al.'s framework. By incorporating these accounting-based proxies into both traditional and asymmetric CAPM specifications, our analysis offers a fundamentally different perspective on the pricing of risk in capital markets. Thus, our contribution lies in proposing an innovative fusion of accounting metrics and market-based factors to refine the asset pricing model, extending the literature beyond the scope of credit market dynamics and toward a more comprehensive understanding of equity valuation.

Similarly, the study by Luo et al. (2021) centres on the Chinese A-share stock market, with a specific emphasis on the pricing implications of accounting-based downside risk within that localised context. In contrast, our research extends the investigation of downside risk to a broader international setting, utilising data from the Frankfurt Stock Exchange. We develop and empirically test novel CAPM frameworks that are not constrained by regional market characteristics or the particular downside risk measures employed by Luo et al. Our models incorporate accounting-derived variables, specifically average profitability ratios and accounting betas, into both conventional and downside risk CAPM specifications, offering a more generalised and comprehensive framework for understanding systematic risk across diverse market environments. Moreover, while W. Huang et al. (2022) focus on the linkage between accounting-based downside risk and stock price crash risk in the Chinese market, our study adopts a fundamentally different angle. Rather than examining tail risk events in isolation, we integrate accounting information into asset pricing models to explore how such variables influence expected returns and the broader risk-return relationship. This approach moves beyond the domain of crash risk analysis, contributing to the literature by highlighting the role of downside risk in shaping asset prices more generally. By extending the scope of analysis beyond idiosyncratic crash risk to systematic pricing dynamics, our research offers a more holistic perspective on the integration of accounting variables into capital market valuation frameworks.

2. Downside and accounting CAPM

Conventional risk metrics like beta coefficient rely on the variance of returns as the primary indicator of the total risk associated with a given security. However, if risk is instead conceptualised as the deviation of returns falling below a specified threshold, then an alternative risk metric, the semi-variance of returns, becomes more appropriate. This measure belongs to the broader class of risk metrics known as lower partial moments (LPM). Specifically, semi-variance represents a lower partial moment of order 2. In general, lower partial moments can be defined as follows:

$$LPM_i^n = E\left[\min(R_{it} - \tau; 0)\right]^n, \quad (1)$$

where τ represents the threshold rate of return, which serves as the foundation for differentiating between various methodologies regarding the final formulation of downside sensitivity coefficients for securities' returns under adverse market conditions. In the classical framework, this threshold corresponds to the risk-free rate (Bawa & Lindenberg, 1977; Hogan & Warren, 1974). By contrast, the generalised LPM approach allows investors to adopt any chosen acceptable rate of return. One such alternative is to set the average rate of return as the threshold (Harlow & Rao, 1989). Under this formulation, the downside beta coefficient, as derived from the Harlow–Rao model, takes the following form:

$$\beta_i^{HR} = \frac{E\left[(R_{it} - E(R_i))\min(R_{Mt} - E(R_M); 0)\right]}{E\left[\min(R_{Mt} - E(R_M); 0)\right]^2} \quad (t = 1, 2, \dots, T). \quad (2)$$

where $E(R_i)$ denotes the expected return of the i -th security; $E(R_M)$ is the expected return of the market portfolio; T represents the length of the observed time series. In this study, systematic downside accounting risk will be defined by the above formula.

Based on the accounting data of individual entities and treating the financial condition of all analysed companies as a systematic source of return volatility, this study introduces a generalised measure of market (or sector) profitability. On this basis, accounting betas were constructed, which, alongside the average values of accounting ratios, serve as risk factors in non-standard versions of the CAPM model. The accounting beta for the i -th entity with respect to the return on assets indicator ($\beta_i(ROA)$) is determined using the formula proposed by Hill and Stone (1980):

$$\beta_i(ROA) = \frac{E\left[(ROA_{it} - \overline{ROA_i}) \cdot (ROA_{Mt} - \overline{ROA_M})\right]}{E\left[ROA_{Mt} - \overline{ROA_M}\right]^2}, \quad (3)$$

where ROA_{it} , $\overline{ROA}_i = \frac{1}{T} \sum_{t=1}^T ROA_{it}$ denote the return on assets for the entity in period t and its average level, respectively, while ROA_{Mt} , $\overline{ROA}_M = \frac{1}{T} \sum_{t=1}^T ROA_{Mt}$ represent the mean return on assets for the market (sector) in t period and its average long-term level. The values of ROA_{Mt} , which is the index (portfolio) of the market according to this return ratio, were determined as the weighted average market capitalisation of the return ratios of the entities included in this index, which is written as follows:

$$ROA_{Mt} = \sum_{i=1}^N ROA_{it} \cdot \frac{MV_i}{\sum_{i=1}^N MV_i}, \quad (4)$$

where MV_i is the market capitalisation value of the share capital of the i -th entity.

For the downside approach, the Harlow and Rao (1989) formula was used to determine the downside accounting beta (DAB) for ROA ($\beta_i^{HR}(ROA)$), as in equation (2), replacing the rates of return with the ROA values:

$$\beta_i^{HR}(ROA) = \frac{E\left[\left(ROA_{it} - \overline{ROA}_i\right) \cdot \min\left(ROA_{Mt} - \overline{ROA}_M; 0\right)\right]}{E\left[\min\left(ROA_{Mt} - \overline{ROA}_M; 0\right)^2\right]}. \quad (5)$$

The measures of profitability and risk related to return on equity (ROE) were determined using the methodology outlined above and defined by equations (3–5).

Following the classical procedure outlined by Fama and MacBeth (1973), the CAPM model is tested in two distinct stages. During the first stage, systematic risk measures, both market, and accounting, are estimated. Next, market or financial risk premiums are estimated. The standard and accounting CAPM cross-sectional regression equations in conventional and downside frameworks are presented in Table 1 as follows:

According to the equilibrium model, investors are rewarded for accepting systematic risk, expressed by the beta coefficient. Furthermore, profitable firms with high expected future profitability ratios ROA and ROE tend to exhibit faster dividend growth as a larger portion of earnings per book value share is efficiently utilised. Consequently, stocks that are low-priced yet remain profitable and financially stable are likely to be undervalued by the market (Cho & Polk, 2024).

In line with the main research question outlined above, the study examines whether profitability ratios and accounting-based beta coefficients generate a positive and statistically significant risk premium associated with

Table 1. The standard and accounting CAPM

Symmetrical	Downside
Standard versions of the CAPM	
$\bar{R}_i = \lambda_0 + \lambda_1 \hat{\beta}_i + \eta_i$	$\bar{R}_i = \lambda_0 + \lambda_1 \hat{\beta}_i^{HR} + \eta_i$
Nonstandard (accounting) versions of the CAPM	
$\bar{R}_i = \lambda_0 + \lambda_1 \overline{ROA}_i + \eta_i$ $\bar{R}_i = \lambda_0 + \lambda_1 \overline{ROE}_i + \eta_i$	–
Extended versions of the CAPM	
$\bar{R}_i = \lambda_0 + \lambda_1 \hat{\beta}_i (ROA) + \eta_i$ $\bar{R}_i = \lambda_0 + \lambda_1 \hat{\beta}_i (ROE) + \eta_i$	$\bar{R}_i = \lambda_0 + \lambda_1 \hat{\beta}_i^{HR} (ROA) + \eta_i$ $\bar{R}_i = \lambda_0 + \lambda_1 \hat{\beta}_i^{HR} (ROE) + \eta_i$
$\bar{R}_i = \lambda_0 + \lambda_1 \hat{\beta}_i + \lambda_2 \overline{ROA}_i + \eta_i$ $\bar{R}_i = \lambda_0 + \lambda_1 \hat{\beta}_i + \lambda_2 \overline{ROE}_i + \eta_i$	$\bar{R}_i = \lambda_0 + \lambda_1 \hat{\beta}_i^{HR} + \lambda_2 \overline{ROA}_i + \eta_i$ $\bar{R}_i = \lambda_0 + \lambda_1 \hat{\beta}_i^{HR} + \lambda_2 \overline{ROE}_i + \eta_i$
$\bar{R}_i = \lambda_0 + \lambda_1 \hat{\beta}_i + \lambda_2 \hat{\beta}_i (ROA) + \eta_i$ $\bar{R}_i = \lambda_0 + \lambda_1 \hat{\beta}_i + \lambda_2 \hat{\beta}_i (ROE) + \eta_i$	$\bar{R}_i = \lambda_0 + \lambda_1 \hat{\beta}_i^{HR} + \lambda_2 \hat{\beta}_i^{HR} (ROA) + \eta_i$ $\bar{R}_i = \lambda_0 + \lambda_1 \hat{\beta}_i^{HR} + \lambda_2 \hat{\beta}_i^{HR} (ROE) + \eta_i$

Note: $\bar{R}_i$ – the mean return of the i -th security or portfolio; $\hat{\beta}_i, \hat{\beta}_i^{HR}$ – estimates of conventional and downside beta coefficients; ROA_i, ROE_i – mean of ROA and ROE ratios; $\hat{\beta}_i(ROA), \hat{\beta}_i(ROE), \hat{\beta}_i^{HR}(ROA), \hat{\beta}_i^{HR}(ROE)$ – estimates of accounting beta coefficients in conventional and downside framework; η_i – the random error term of the equation for ($i = 1, \dots, N$), where N is the number of securities or portfolios.

Source: own elaboration.

a firm’s financial condition. Formally, the expected values of the parameters for the standard and accounting-based specifications of the CAPM are presented in Table 2.

Table 2. Hypotheses for parameters of standard and accounting CAPM

Factors	The null hypothesis	The alternative hypothesis
Constant term	$H_0: E(\lambda_0) = 0$	$H_1: E(\lambda_0) \neq 0$
β_p, β_i^{HR} $\overline{ROA}_i, \overline{ROE}_i$ $\beta_i(ROA), \beta_i(ROE)$ $\beta_i^{HR}(ROA), \beta_i^{HR}(ROE)$	$H_0: E(\lambda_1) = 0$ $H_0: E(\lambda_2) = 0$	$H_1: E(\lambda_1) > 0$ $H_1: E(\lambda_1) > 0$

Source: own elaboration.

Positive relationships between expected returns and accounting-based risk factors should hold irrespective of the adopted risk approach (symmetrical or downside) and the number of variables included in the model.

3. Data

The empirical analysis was limited to companies listed on the stock exchange. This restriction arises from the fact that, for non-listed firms, it is not feasible to derive a reliable comparison between the accounting beta and the CAPM-based beta. In the absence of such a comparison, the proposed approach would lack a necessary benchmark against which its validity could be assessed. By focusing on publicly traded companies, the study ensures both the availability of consistent data and the methodological soundness required for evaluating the quality of the proposed framework. This study investigates a sample of firms listed on the Frankfurt Stock Exchange (Deutsche Börse), comprising constituents of the DAX40, MDAX, and SDAX indices. The CDAX index was employed as a proxy for the market portfolio. The research period spans ten years, from 2015 to 2024, selected as a balanced compromise between the availability of reliable financial and market data and the desirable length of the time series. The final sample includes 25 large-cap firms from the DAX40, 24 mid-cap firms from the MDAX, and 25 small-cap firms from the SDAX indices. Accordingly, the sole criterion for sample inclusion was the availability of complete data rather than the firm's continued existence, which substantially mitigates concerns regarding potential survivorship bias. The models proposed in this study were estimated for the full sample of 74 firms, as well as for three subsamples comprising companies included in the DAX 40, MDAX, and SDAX indices, in order to examine the models' sensitivity to firm size. Some studies suggest that firms exhibiting higher current profitability growth are expected to earn higher future returns; however, the positive relation between profitability growth and stock returns tends to diminish with firm size (Lim et al., 2024).

It should be noted that a distinctive feature of the German equity market is the substantial concentration of market capitalisation among large-cap firms included in the DAX 40 index. These firms account for approximately 82% of the aggregate market capitalisation of all companies included in the DAX 40, MDAX, and SDAX indices. In the present study, large-cap firms accounted for nearly 90% of the total market capitalisation of the 74 firms included in the sample. The firms included in the analysis, in aggregate, account for 66% of the total market capitalisation of the three selected indices. Additionally, Table 3 presents the distribution of the sample firms across economic sectors, together with their respective shares of total market capitalisation and their shares of the aggregate market capitalisation of the firms included in the study. The largest number of studied companies belongs to the Industrials and Materials sector. However, in terms of market capitalisation, companies from the Automotive & Transportation and Technology & Telecommunications sectors account for the largest share of the study.

Table 3. Distribution of the sample firms across economic sectors

Sector	Financials & real estate	Technology & telecommunications	Health-care & pharmaceuticals	Industrials & materials	Automotive & transportation	Energy, consumer & services
Number of companies	8	14	8	23	8	13
Share of the sample firms in total market capitalisation (%)	5	17	7	12	19	6
Share of the sample firms in the sample's total market capitalisation (%)	7	26	11	18	29	9

Source: based on information from Thomson Reuters Refinitiv Eikon database.

The dataset consists of daily closing stock prices and quarterly accounting-based profitability indicators, specifically return on assets (ROA) and return on equity (ROE). In constructing the accounting-based factors, particularly the accounting beta, lagged profitability ratios were incorporated, reflecting the notion that investors’ reactions are driven by previously released accounting information. All data were obtained from the Thomson Reuters Refinitiv Eikon database. The three-month rate of return was computed on the basis of daily price observations, while financial ratios were derived from quarterly financial statements.

In addition to individual securities, the study analyses equally weighted portfolios in which each constituent has an identical percentage share of the total, regardless of the firm’s market capitalisation and stock price. Securities were ranked in ascending order based on their average returns, and portfolios consisting of five securities each were constructed using a rolling window approach. This procedure, applied to the full set of 74 firms, resulted in 70 distinct portfolios.

Two methodologies were employed for estimating systematic risk (beta). The first follows the classical Sharpe model (1964), which defines risk in terms of return variance. The second applies the downside beta framework developed by Harlow and Rao (1989), which considers downside deviation as a more relevant risk measure in certain investment contexts.

4. Empirical results and discussion

The preliminary results section outlines the distribution parameters for systematic risk measures derived from both market and accounting data (Table 4). The findings suggest that across all companies, there is greater variability in risk metrics and profitability indicators compared to large firms alone, highlighting a higher heterogeneity in the broader market. Interestingly, certain ROE results deviate from this trend, with values being markedly higher in large companies, possibly reflecting their superior financial stability. Furthermore, the mean beta coefficients based on ROA substantially exceed those derived from ROE in both the conventional and downside frameworks. The pronounced skewness and kurtosis observed in the distributions of ROE-based coefficients, with the exception of small firms, suggest the presence of outliers and fat-tailed behaviour that deviate from the assumption of normality. It may imply that ROE captures risk dynamics more sensitively. Finally, the larger divergences between conventional and downside measures in the large-company group could point to structural differences in how these firms respond to downside risk relative to the overall sample.

The empirical analysis began with the standard specification of the CAPM. As indicated by the estimates for the full sample of firms presented in Table 5, asset pricing on the Frankfurt Stock Exchange (FSE) does not support the model's equilibrium assumptions. In particular, over the sample period, investors did not receive compensation in the form of a positive and statistically significant market risk premium, regardless of whether risk was measured using conventional beta or downside beta.

To examine the potential impact of firm size, the estimated models were evaluated across firms with different levels of market capitalisation. As a robustness criterion, both the classical CAPM and, subsequently, the accounting-based CAPM were estimated separately for different firm-size categories. The results based on individual securities are consistent with those obtained for the full sample. However, portfolio-level analysis revealed significant relationships for medium-sized and small firms. For medium-sized firms, the downside CAPM performed significantly better, whereas for small firms, the conventional CAPM provided a better fit. Nevertheless, these models appear insufficient to adequately explain return variations, underscoring the need to consider extended versions of asset pricing models.

Table 4. Descriptive statistics

Statistics	$\hat{\beta}_i$	$\hat{\beta}_i^{HR}$	ROA_i	ROE_i	$\hat{\beta}_i(ROA)$	$\hat{\beta}_i(ROE)$	$\hat{\beta}_i^{HR}(ROA)$	$\hat{\beta}_i^{HR}(ROE)$
All companies								
Minimum	0.045	-0.194	-1.173	-23.175	-1.728	-0.865	-2.777	-1.148
Maximum	2.551	2.221	5.937	37.907	4.424	7.130	6.104	8.067
Mean	1.021	1.007	1.065	10.619	1.036	0.675	1.092	0.670
Median	1.024	1.074	1.021	10.659	0.731	0.363	0.723	0.302
Stdev	0.460	0.473	1.061	10.611	1.167	1.262	1.554	1.422
Skewness	0.133	-0.316	1.900	-0.133	0.924	3.645	1.140	3.812
Kurtosis	0.357	-0.272	7.043	1.539	0.844	15.166	1.870	16.562
DAX40 companies								
Minimum	0.265	0.165	0.010	-8.551	-0.127	-0.047	-0.847	-0.792
Maximum	1.527	1.590	1.941	36.172	3.957	6.861	5.051	7.814
Mean	0.971	0.937	0.918	11.527	0.876	0.740	0.831	0.645
Median	1.025	1.059	0.910	13.067	0.648	0.221	0.418	0.163
Stdev	0.370	0.409	0.572	8.540	0.920	1.485	1.210	1.608
Skewness	-0.228	-0.352	0.148	0.372	1.698	3.230	1.905	3.749
Kurtosis	-1.187	-1.104	-0.842	1.847	3.227	10.116	4.090	14.218

Statistics	$\hat{\beta}_i$	$\hat{\beta}_i^{HR}$	ROA_i	ROE_i	$\hat{\beta}_i(ROA)$	$\hat{\beta}_i(ROE)$	$\hat{\beta}_i^{HR}(ROA)$	$\hat{\beta}_i^{HR}(ROE)$
MDAX companies								
Minimum	0.045	0.082	−0.609	−23.175	−1.729	−0.865	−2.777	−1.148
Maximum	1.598	1.737	5.937	33.201	4.425	7.130	5.504	8.067
Mean	1.022	1.057	1.281	12.237	1.019	0.780	1.145	0.862
Median	1.022	1.107	1.139	12.129	0.798	0.406	0.829	0.461
Stdev	0.418	0.421	1.279	13.042	1.217	1.569	1.688	1.846
Skewness	−0.481	−0.655	2.027	−0.687	0.727	2.951	0.551	2.761
Kurtosis	−0.562	−0.273	5.777	1.020	1.657	9.460	1.092	8.040
SDAX companies								
Minimum	0.052	−0.195	−1.173	−12.981	−0.773	−0.386	−1.071	−0.494
Maximum	2.551	2.221	4.985	37.907	3.801	1.411	6.104	1.413
Mean	1.071	1.029	1.003	8.158	1.211	0.508	1.302	0.510
Median	1.174	1.088	0.958	9.794	0.758	0.472	0.985	0.514
Stdev	0.578	0.578	1.207	9.838	1.349	0.484	1.742	0.487
Skewness	0.284	−0.230	1.302	0.492	0.596	0.092	1.148	−0.076
Kurtosis	0.076	−0.423	3.398	2.292	−0.740	−0.653	1.148	−0.608

Note: $\hat{\beta}_i, \hat{\beta}_i^{HR}$ – estimates of conventional and downside beta coefficients; ROA_i, ROE_i – ROA and ROE ratios; $\hat{\beta}_i(ROA), \hat{\beta}_i(ROE), \hat{\beta}_i^{HR}(ROA), \hat{\beta}_i^{HR}(ROE)$ – estimates of accounting beta coefficients in conventional and downside framework.

Source: own elaboration.

Table 5. Estimates of standard CAPM in symmetrical and downside approaches.

Market	Variables	Estimate	t-Stat	R ²	Estimate	t-Stat	R ²
		individual securities			equally weighted portfolios		
All companies	Constant	0.0189**	2.368	0.006	0.0017	0.083	0.015
	$\hat{\beta}$	0.0045	0.639		0.0207	1.038	
	Constant	0.0207***	2.689	0.002	0.0116	0.631	0.005
	$\hat{\beta}^{HR}$	0.0028	0.396		0.0110	0.604	
DAX40 companies	Constant	0.0373**	2.391	0.038	0.0407	1.491	0.025
	$\hat{\beta}$	-0.0145	-0.960		-0.0195	-0.701	
	Constant	0.0362**	2.611	0.043	0.0376	1.390	0.018
	$\hat{\beta}^{HR}$	-0.0137	-1.012		-0.0166	-0.592	
MDAX companies	Constant	0.0229	1.683	0.001	0.0517	-0.882	0.112
	$\hat{\beta}$	-0.0014	-0.112		-0.0308	1.508	
	Constant	0.0177	1.275	0.004	-0.0861	-2.440	0.342
	$\hat{\beta}^{HR}$	0.0035	0.289		0.1020***	3.064	
SDAX companies	Constant	0.0097	0.711	0.071	-0.0325	-1.279	0.202
	$\hat{\beta}$	0.0150	1.327		0.0514**	2.196	
	Constant	0.0147	1.089	0.037	-0.0163	-0.645	0.113
	$\hat{\beta}^{HR}$	0.0107	0.935		0.0374	1.558	

Note: $\hat{\beta}_i$ – estimates of conventional beta coefficients, $\hat{\beta}_i^{HR}$ – estimates of downside beta coefficients. Statistical significance at the 10%, 5%, and 1% levels is indicated by *, **, and ***, respectively.

Source: own elaboration.

The analysis of the standard CAPM under the conventional approach was extended to incorporate measures reflecting firm profitability. The estimation results for both the full sample and the subsamples of firms of different sizes, presented in Tables 6, 7, 8, and 9, indicate that the accounting-based CAPM substantially outperforms the classical CAPM in explaining return variability. This advantage primarily pertains to models incorporating profitability ratios (ROA, ROE): both risk premia are positive and statistically significant at the 0.05 level, except in the case of ROE-based models for individual securities. Similar relationships were observed in the study by Rutkowska-Ziarko (2022). Notably, model fit reaches over 80% explanatory power for portfolio-level ROA models, which also yield the highest nominal premia.

Accounting betas based on both profitability measures generate statistically significant, yet unexpectedly negative, risk premia. However, in non-standard

Table 6. Estimates of symmetrical accounting CAPM (all companies)

Variables	Estimate	<i>t</i> -Stat	<i>R</i> ²	Estimate	<i>t</i> -Stat	<i>R</i> ²
	individual securities (<i>N</i> = 74)			equally weighted portfolios (<i>N</i> = 70)		
Constant	0.0138***	3.166	0.122	−0.0077	−1.521	0.390
$\overline{ROA}$	0.0092***	3.157		0.0289***	6.600	
Constant	0.0088	1.071	0.128	−0.0158	−0.967	0.393
$\hat{\beta}$	0.0049	0.726		0.0083	0.519	
$\overline{ROA}$	0.0092***	3.157		0.0286***	6.453	
Constant	0.0291	1.411	0.050	0.0438***	6.423	0.142
$\hat{\beta}$	−0.0053*	−1.948		−0.0209***	−3.357	
Constant	0.0236***	2.890	0.058	0.0266	1.296	0.152
$\hat{\beta}$	0.0055	0.786		0.0167	0.892	
$\hat{\beta}(\overline{ROA})$	−0.0055*	−1.992		−0.0205***	−3.286	
Constant	0.0171***	3.779	0.054	−0.0097	−1.654	0.343
$\overline{(ROE)}$	0.0006**	2.030		0.0031***	5.968	
Constant	0.0127	1.511	0.059	−0.0124	−0.732	0.344
$\hat{\beta}$	0.0043	0.615		0.0028	0.167	
$\hat{\beta}(\overline{ROE})$	0.0006**	2.010		0.0030***	5.791	
Constant	0.0261***	7.148	0.030	0.0303***	6.984	0.070
$\hat{\beta}(\overline{ROE})$	−0.0038	−1.489		−0.0121**	−2.266	
Constant	0.0195**	2.465	0.042	0.0105	0.522	0.084
$\hat{\beta}$	0.0068	0.953		0.0195	1.005	
$\hat{\beta}(\overline{ROE})$	−0.0043	−1.644		−0.0120**	−2.237	

Note: $\hat{\beta}_i$ – estimates of conventional beta coefficients; $\overline{(ROA)}_i$, $\overline{(ROE)}_i$ – mean of ROA and ROE ratios; $\hat{\beta}_i(\overline{ROA})$, $\hat{\beta}_i(\overline{ROE})$ – estimates of accounting beta coefficients in conventional framework; *N* – Number of observations in the cross-sectional regression. Statistical significance at the 10%, 5%, and 1% levels is indicated by *, **, and ***, respectively.

Source: own elaboration.

CAPM specifications, where the risk factor is an accounting beta derived from ROE, the risk premium turns positive, and in the extended model, remains significant at the 10% level. In summary, while ROA is a superior valuation metric in nominal terms, ROE offers better insights into financial sensitivity.

Unlike the results obtained for large and medium-sized firms, the accounting variables included in the extended CAPM specification were not statistically significant for small firms. One possible explanation is that accounting information is less informative in the valuation of smaller companies due to greater earnings volatility, lower reporting quality, and more pronounced information asymmetries. Furthermore, returns on small-cap stocks may be

driven primarily by factors such as liquidity constraints, firm-specific risk, and limited analyst coverage, which are not fully captured by accounting-based measures. The absence of significant accounting effects may also reflect the greater heterogeneity of small firms and the dominance of size-related risk factors in determining expected returns. Consequently, accounting indicators appear to provide limited incremental explanatory power beyond market risk in the case of small-cap companies.

These findings, particularly those regarding profitability ratios, align with recent advances in accounting-based and downside CAPM research. For in-

Table 7. Estimates of symmetrical accounting CAPM relationships (DAX40 companies)

Variables	Estimate	t-Stat	R ²	Estimate	t-Stat	R ²
	individual securities (N = 25)			equally weighted portfolios (N = 21)		
Constant	0.0024	0.252	0.230	-0.0244**	-2.744	0.607
$\overline{ROA}$	0.0228**	2.619		0.0509***	5.422	
Constant	0.0185	1.201	0.285	0.0233*	1.854	0.811
$\hat{\beta}$	-0.0175	-1.309		-0.0590***	-4.407	
$\overline{ROA}$	0.0237**	2.757		0.0616***	8.655	
Constant	0.0337***	4.749	0.162	0.0249***	3.189	0.011
$\hat{\beta}$	-0.0120**	-2.108		-0.0043	-0.465	
Constant	0.0421**	2.810	0.177	0.0423	1.215	0.025
$\hat{\beta}$	-0.0092	-0.637		-0.0220	-0.514	
$\hat{\beta}(\overline{ROA})$	-0.0112*	-1.924		-0.0011	0.077	
Constant	0.0125	1.376	0.087	0.0004	0.027	0.138
$(\overline{ROE})$	0.0009	1.480		0.0019*	1.741	
Constant	0.0272	1.642	0.131	0.0491**	2.117	0.344
$\hat{\beta}$	-0.0156	-1.062		-0.0727**	-2.462	
$\hat{\beta}(\overline{ROE})$	0.0010	1.534		0.0038***	2.962	
Constant	0.0235***	3.766	0.001	0.0175***	2.922	0.046
$\hat{\beta}(\overline{ROE})$	-0.0003	-0.076		0.0069	0.963	
Constant	0.0374**	2.343	0.042	0.0712**	2.384	0.196
$\hat{\beta}$	-0.0150	-0.947		-0.0620*	-1.832	
$\hat{\beta}(\overline{ROE})$	0.0005	0.138		0.0174*	1.958	

Note: $\hat{\beta}_i$ – estimates of conventional beta coefficients; $(\overline{ROA})_i, (\overline{ROE})_i$ – mean of ROA and ROE ratios; $\hat{\beta}_i(\overline{ROA}), \hat{\beta}_i(\overline{ROE})$ – estimates of accounting beta coefficients in conventional framework; N – Number of observations in the cross-sectional regression. Statistical significance at the 10%, 5%, and 1% levels is indicated by *, **, and ***, respectively.

Source: own elaboration.

Table 8. Estimates of symmetrical accounting CAPM relationships (MDAX companies)

Variables	Estimate	t-Stat	R ²	Estimate	t-Stat	R ²
	individual securities (N = 24)			equally weighted portfolios (N = 20)		
Constant	0.0098	1.548	0.230	−0.0061	−1.232	0.684
$\overline{ROA}$	0.0091**	2.563		0.0222***	6.253	
Constant	0.0035	0.242	0.239	−0.0336	−1.656	0.717
$\hat{\beta}$	0.0057	0.0498		0.0283	1.396	
$\overline{ROA}$	0.0095**	2.565		0.0213***	6.030	
Constant	0.0227***	3.418	0.004	0.0344***	2.966	0.070
$\hat{\beta}$	−0.0012	−0.283		−0.0131	−1.167	
Constant	0.0243	1.645	0.004	−0.0151	−0.393	0.160
$\hat{\beta}$	−0.0016	−0.122		0.0467	1.346	
$\hat{\beta}(\overline{ROA})$	−0.0012	−0.282		−0.0109	−0.982	
Constant	0.0144**	2.163	0.097	−0.0150**	−2.708	0.736
$\overline{(ROE)}$	0.0006	1.536		0.0031***	7.091	
Constant	0.0128	0.861	0.098	−0.0567***	−3.347	0.810
$\hat{\beta}$	0.0015	0.123		0.0420**	2.570	
$\hat{\beta}(\overline{ROE})$	0.0006	1.502		0.0030***	7.905	
Constant	0.0262***	5.015	0.152	0.0354***	8.774	0.536
$\hat{\beta}(\overline{ROE})$	−0.0060*	−1.991		−0.0216***	−4.464	
Constant	0.0226*	1.767	0.156	0.0027	0.103	0.577
$\hat{\beta}$	0.0037	0.309		0.0316*	1.277	
$\hat{\beta}(\overline{ROE})$	−0.0062	−1.970		−0.0205***	−4.323	

Note: $\hat{\beta}_i$ – estimates of conventional beta coefficients; $\overline{(ROA)}_i$, $\overline{(ROE)}_i$ – mean of ROA and ROE ratios; $\hat{\beta}_i(\overline{ROA})$, $\hat{\beta}_i(\overline{ROE})$ – estimates of accounting beta coefficients in conventional framework; N – Number of observations in the cross-sectional regression. Statistical significance at the 10%, 5%, and 1% levels is indicated by *, **, and ***, respectively.

Source: own elaboration.

stance, Rutkowska-Ziarko et al. (2024) propose a conditional, non-standard CAPM that incorporates accounting betas and profitability ratios, concluding that the average values of profitability ratios and accounting betas proved to be significant sources of systematic risk.

The subsequent phase of the study examined non-standard extensions of the CAPM framework, integrating market-based and accounting-based variables under a downside risk perspective. This approach focuses on returns that fall below a specified target rate and, for financial ratios, values that are

Table 9. Estimates of symmetrical accounting CAPM relationships (SDAX companies)

Variables	Estimate	t-Stat	R ²	Estimate	t-Stat	R ²
	individual securities (N = 25)			equally weighted portfolios (N = 21)		
Constant	0.0187	2.229	0.068	0.0084	0.846	0.120
$\overline{ROA}$	0.0070	1.298		0.0150	1.613	
Constant	0.0050	0.354	0.125	-0.0382	-1.089	0.205
$\hat{\beta}$	0.0135	1.196		0.0602	1.384	
$\overline{ROA}$	0.0063	1.165		-0.0040	-0.241	
Constant	0.0330***	3.785	0.061	0.0481***	3.313	0.158
$\hat{\beta}$	-0.0060	-1.228		-0.0211*	-1.891	
Constant	0.0164	1.147	0.142	-0.0098	-0.411	0.417
$\hat{\beta}$	0.0160	1.439		0.0587	2.826	
$\hat{\beta}(\overline{ROA})$	-0.0064	-1.351		-0.0247	-2.575	
Constant	0.0210**	2.458	0.031	0.0134	1.408	0.063
$\overline{(ROE)}$	0.0006	0.855		0.0011	1.127	
Constant	0.0078	0.548	0.087	-0.0475	-1.471	0.228
$\hat{\beta}$	0.0136	1.161		0.0739*	1.961	
$\hat{\beta}(\overline{ROE})$	0.0004	0.616		-0.0011	-0.766	
Constant	0.0323***	3.384	0.037	0.0807***	4.764	0.400
$\hat{\beta}(\overline{ROE})$	-0.0128*	-0.935		-0.1138***	-3.557	
Constant	0.0141	1.034	0.161	0.0240	1.114	0.633
$\hat{\beta}$	0.0212	1.811		0.0554***	3.387	
$\hat{\beta}(\overline{ROE})$	-0.0215	-1.541		-0.1183***	-4.600	

Note: $\hat{\beta}_i$ – estimates of conventional beta coefficients; $\overline{(ROA)}_i$, $\overline{(ROE)}_i$ – mean of ROA and ROE ratios; $\hat{\beta}_i(\overline{ROA})$, $\hat{\beta}_i(\overline{ROE})$ – estimates of accounting beta coefficients in conventional framework; N – Number of observations in the cross-sectional regression. Statistical significance at the 10%, 5%, and 1% levels is indicated by *, **, and ***, respectively.

Source: own elaboration.

below their respective sample means. The extended versions of the CAPM, incorporating profitability and sensitivity measures, were also analysed within a downside risk framework (Tables 10, 11, 12, and 13). The results for the full sample of firms do not exhibit substantial deviations from those obtained under the conventional specification. Both downside beta coefficients and downside accounting betas generally emerge as statistically insignificant predictors, yielding negative risk premiums associated with firms' sensitivity to shifts in the aggregate financial condition of the analysed securities. Nonetheless,

Table 10. Estimates of downside accounting CAPM (all companies)

Variables	Estimate	<i>t</i> -Stat	<i>R</i> ²	Estimate	<i>t</i> -Stat	<i>R</i> ²
	individual securities (<i>N</i> = 74)			equally weighted portfolios (<i>N</i> = 70)		
Constant	0.0111	1.411		−0.0036	−0.247	
$\hat{\beta}^{HR}$	0.0026	0.397	0.123	−0.0043	−0.299	0.391
$\overline{ROA}$	0.0092***	3.135		0.0291***	6.518	
Constant	0.0273***	6.957		0.0260***	4.479	
$\hat{\beta}^{HR}(ROA)$	−0.0034	−1.665	0.037	−0.0050	−0.663	0.006
Constant	0.0226***	2.939		0.0118	0.641	
$\hat{\beta}^{HR}$	0.0050	0.717	0.044	0.0153	0.808	0.016
$\hat{\beta}^{HR}(ROA)$	−0.0037*	−1.762		−0.0067	−0.853	
Constant	0.0146*	1.782		−0.0025	−0.167	
$\hat{\beta}^{HR}$	0.0025	0.365	0.056	−0.0077	−0.511	0.346
$\overline{ROE}$	0.0006**	2.011		0.0031***	5.911	
Constant	0.0254***	7.082		0.0268***	6.484	
$\hat{\beta}^{HR}(ROE)$	−0.0027	−1.184	0.019	−0.0067	−1.367	0.027
Constant	0.0200**	2.589		0.0165	0.881	
$\hat{\beta}^{HR}$	0.0058	0.795	0.028	0.0103	0.570	0.031
$\hat{\beta}^{HR}(ROE)$	−0.0033	−1.367		−0.0066	−1.344	

Note: $\hat{\beta}_i^{HR}$ – estimates of downside beta coefficients; $\overline{ROA}_i$, $\overline{ROE}_i$ – mean of ROA and ROE ratios; $\hat{\beta}_i^{HR}(ROA)$, $\hat{\beta}_i^{HR}(ROE)$ – estimates of accounting beta coefficients in downside framework; *N* – Number of observations in the cross-sectional regression. Statistical significance at the 10%, 5%, and 1% levels is indicated by *, **, and ***, respectively.

Source: own elaboration.

these premiums are of lower absolute magnitude compared to their counterparts derived from the conventional model.

The absence of significant relationships between expected returns and accounting beta coefficients may be attributable to the inclusion of all firms in the analysis, irrespective of their heterogeneity in terms of market capitalisation. Firm size plays a critical role in risk perception and, consequently, affects the financial stability of a company. Smaller firms, although often more dynamic, tend to face greater challenges in capital acquisition, lower liquidity, and heightened susceptibility to market fluctuations, which may lead them to respond differently to changes in overall economic conditions. A similar observation regarding firm size in the German capital market is reported by Amel-Zadeh (2011). He identifies a number of differences in firm-specific variables between large and small companies. In this paper, it is partially supported by the results obtained for the subsample of large firms. For portfolio-level invest-

Table 11. Estimates of downside accounting CAPM (DAX40 companies)

Variables	Estimate	t-Stat	R ²	Estimate	t-Stat	R ²
	individual securities (N = 25)			equally weighted portfolios (N = 21)		
Constant	0.0160	1.118		0.0245**	2.121	
$\hat{\beta}^{HR}$	-0.0150	-1.246	0.280	-0.0637***	-4.937	0.833
$\overline{ROA}$	0.0232**	2.697		0.0640***	9.379	
Constant	0.0299***	4.722		0.0211***	3.499	
$\hat{\beta}^{HR}(ROA)$	-0.0080*	-1.833	0.127	0.0011	0.149	0.001
Constant	0.0373**	2.779		0.0522	1.557	
$\hat{\beta}^{HR}$	-0.0084	-0.622	0.142	-0.0367	-0.943	0.048
$\hat{\beta}^{HR}(ROA)$	-0.0073	-1.602		0.0076	0.754	
Constant	0.0259*	1.729		0.0414*	1.742	
$\hat{\beta}^{HR}$	-0.0148	-1.124	0.136	-0.0607*	-2.037	0.288
$\overline{ROE}$	0.0010	1.547		0.0033**	2.613	
Constant	0.0229***	3.815		0.0155***	3.294	
$\hat{\beta}^{HR}(ROE)$	0.0006	0.161	0.001	0.0130**	2.110	0.190
Constant	0.0377**	2.632		0.0738***	3.002	
$\hat{\beta}^{HR}$	-0.0168	-1.134	0.056	-0.0654**	-2.406	0.387
$\hat{\beta}^{HR}(ROE)$	0.0021	0.564		0.0216***	3.291	

Note: ; $\hat{\beta}_i^{HR}$ – estimates of downside beta coefficients; $\overline{ROA}_i, \overline{ROE}_i$ – mean of ROA and ROE ratios; $\hat{\beta}_i^{HR}(ROA), \hat{\beta}_i^{HR}(ROE)$ – estimates of accounting beta coefficients in downside framework; N – Number of observations in the cross-sectional regression. Statistical significance at the 10%, 5%, and 1% levels is indicated by *, **, and ***, respectively.

Source: own elaboration.

ments, accounting sensitivity measures based on the ROE indicator proved to be significant pricing factors. The associated risk premiums were significant at the 5% and 1% levels, depending on the model specification. In contrast, the downside beta based on ROA yielded premiums consistent in sign with expectations but statistically insignificant. Similar to the conventional framework, models incorporating profitability indicators showed greater explanatory power for return variability when based on ROA, whereas models employing accounting betas performed better in this regard when ROE was used.

Given the well-documented shortcomings of the traditional CAPM in adequately capturing return dynamics for Frankfurt Stock Exchange-listed equities, this study positions itself as both a critical reassessment and a forward-looking refinement of asset pricing frameworks. Our empirical results reinforce a growing body of literature questioning the CAPM’s empirical robustness, particularly its limited ability to generate statistically meaningful

Table 12. Estimates of downside accounting CAPM (MDAX companies)

Variables	Estimate	t-Stat	R ²	Estimate	t-Stat	R ²
	individual securities (N = 24)			equally weighted portfolios (N = 20)		
Constant	0.0014	0.099	0.247	−0.0484*	−1.994	0.734
$\hat{\beta}^{HR}$	0.0076	0.687		0.0438*	1.777	
$\overline{ROA}$	0.0094**	2.604		0.0191***	5.002	
Constant	0.0295***	3.676	0.044	0.0272***	2.966	0.025
$\hat{\beta}^{HR}(ROA)$	−0.0009	−0.312		−0.0050	−0.681	
Constant	0.0184	1.285	0.009	−0.0853**	−2.491	0.415
$\hat{\beta}^{HR}$	0.0041	0.322		0.1105***	3.365	
$\hat{\beta}^{HR}(ROA)$	−0.0011	−0.342		−0.0086	−1.447	
Constant	0.0074	0.497	0.108	−0.0791***	−4.793	0.864
$\hat{\beta}^{HR}$	0.0062	0.521		0.0650***	−4.009	
$\overline{ROE}$	0.0006	1.570		0.0027***	8.090	
Constant	0.0256***	4.892	0.130	0.0352***	8.391	0.506
$\hat{\beta}^{HR}(ROE)$	−0.0047	−1.816		−0.0189***	−4.295	
Constant	0.0151	1.153	0.160	−0.0448	−1.632	0.672
$\hat{\beta}^{HR}$	0.0104	0.866		0.0738***	2.937	
$\hat{\beta}^{HR}(ROE)$	−0.0054*	−1.979		−0.0158***	−4.136	

Note: $\hat{\beta}_i^{HR}$ – estimates of downside beta coefficients; $\overline{ROA}_i$, $\overline{ROE}_i$ – mean of ROA and ROE ratios; $\hat{\beta}_i^{HR}(ROA)$, $\hat{\beta}_i^{HR}(ROE)$ – estimates of accounting beta coefficients in downside framework; N – Number of observations in the cross-sectional regression. Statistical significance at the 10%, 5%, and 1% levels is indicated by *, **, and ***, respectively.

Source: own elaboration.

risk premiums (see Markowski, 2024; Nurjannah et al., 2012; Vendrame et al., 2018). In this context, traditional models serve primarily as benchmarks, providing a reference point for evaluating the relative performance of more sophisticated alternatives.

A key contribution of this paper is the development of a non-standard, variant of the CAPM that integrates accounting-based betas and firm-level profitability metrics such as return on equity (ROE) and return on assets (ROA) with market risk coefficients. This enriched specification significantly enhances explanatory power relative to models relying solely on market betas. Of particular interest is the incorporation of the downside accounting beta. Our results confirm that this measure not only captures asymmetric risk more effectively in terms of explanatory power than measures based on the conventional approach, but also retains strong statistical relevance across more mature markets, suggesting a broader applicability beyond the confines of

Table 13. Estimates of downside accounting CAPM (SDAX companies)

Variables	Estimate	t-Stat	R ²	Estimate	t-Stat	R ²
	individual securities (N = 25)			equally weighted portfolios (N = 21)		
Constant	0.0091	0.646		−0.0028	−0.075	
$\hat{\beta}^{HR}$	0.0097	0.848	0.098	−0.0157	0.311	0.125
$\overline{ROA}$	0.0067	1.220		0.0097	0.492	
Constant	0.0307***	3.756		0.0307**	2.386	
$\hat{\beta}^{HR}(ROA)$	−0.0038	−0.994	0.041	−0.0062	−0.716	0.026
Constant	0.0181	1.324		−0.0117	−0.467	
$\hat{\beta}^{HR}$	0.0132	1.141	0.095	0.0479*	1.930	0.193
$\hat{\beta}^{HR}(ROA)$	−0.0046	−1.189		−0.0113	−1.335	
Constant	0.0121	0.853		−0.0239	−0.655	
$\hat{\beta}^{HR}$	0.0094	0.801	0.058	0.0491	1.059	0.118
$\overline{ROE}$	0.0005	0.710		−0.0005	−0.295	
Constant	0.0299***	3.100		0.0378	1.673	
$\hat{\beta}^{HR}(ROE)$	−0.0081	−0.587	0.015	−0.0292	−0.705	0.025
Constant	0.0152	1.146		0.0007	0.026	
$\hat{\beta}^{HR}$	0.0215	1.573	0.114	0.0643**	2.445	0.268
$\hat{\beta}^{HR}(ROE)$	−0.0226	−1.389		−0.0846*	−1.954	

Note: ; $\hat{\beta}_i^{HR}$ – estimates of downside beta coefficients; $\overline{ROA}_i$, $\overline{ROE}_i$ – mean of ROA and ROE ratios; $\hat{\beta}_i^{HR}(ROA)$, $\hat{\beta}_i^{HR}(ROE)$ – estimates of accounting beta coefficients in downside framework; N – Number of observations in the cross-sectional regression. Statistical significance at the 10%, 5%, and 1% levels is indicated by *, **, and ***, respectively.

Source: own elaboration.

emerging market contexts (Rutkowska-Ziarko et al., 2024). The superior explanatory power of the downside accounting measures may reflect the substantially greater variation in downside accounting beta coefficients compared with their conventional counterparts, as shown in Table 4.

An alternative stream of literature explores the integration of financial statement information into asset pricing models through the development of novel risk measures. A notable example is the accounting-based downside risk (ABDR) framework introduced by Konchitchki et al. (2016). While ABDR contributes meaningfully to this domain, it diverges substantially from the DAB construct proposed in this study, both conceptually and methodologically. Fundamentally, DAB captures a firm’s downside sensitivity of accounting profitability relative to that of the broader market or sector, positioning it as a covariance-based risk metric. In contrast, ABDR does not reflect sensitivity per se, rather its magnitude is invariant to co-movements with market

or sector-level benchmarks. Methodologically, DAB leverages lower partial moments (LPMs) to isolate adverse performance realisations, focusing exclusively on the left tail of the profitability distribution. ABDR, by comparison, employs a ratio of the square root of the LPMs to the square root of the upper partial moments (UPMs), thereby providing a relative assessment of downside versus upside risk.

Empirical support for ABDR's relevance in explaining cross-sectional variation in returns has been documented by W. Huang et al. (2022) and Luo et al. (2021). However, the comparative structure of ABDR makes it inherently distinct from DAB, which emphasises direct downside co-movement, an aspect more aligned with systematic risk pricing in traditional asset pricing theory. Luo et al. demonstrate that market-level aggregated earnings downside risk, along with its constituent components, exhibits a significant positive relationship with subsequent stock market returns. Conversely, Huang et al. examine the relationship between accounting-based downside risk and stock price crash risk in the context of the Chinese market. They find that both earnings downside risk and its component, accruals downside risk, serve as negative predictors of future stock price crash risk. Instead of focusing on tail risk events, our study incorporates accounting information into asset pricing models to investigate how these variables affect expected returns and the overall risk–return trade-off. This approach shifts the emphasis away from crash risk analysis, offering new insights into the broader role of downside risk in asset pricing. By extending the analysis beyond firm-specific crash risk to encompass systematic pricing mechanisms, our research provides a more comprehensive perspective on how accounting variables can be integrated into capital market valuation models.

This study extends the downside CAPM by incorporating accounting profitability measures (ROA and ROE) and accounting beta coefficients. The proposed framework links firm fundamentals to the accounting risk premium and complements the existing asset pricing literature by moving beyond traditional variance-based models toward a downside risk perspective.

Conclusions

The empirical investigation conducted on the Frankfurt Stock Exchange (FSE) provides a novel approach to estimating the cost of equity by augmenting the classical CAPM framework with accounting information, specifically profitability ratios and risk measures such as accounting beta coefficients.

Over the analysis period from 2015 to 2024, the traditional Capital Asset Pricing Model (CAPM) failed to adequately explain the cross-section of re-

turns. However, incorporating additional explanatory variables into the form of accounting-based profitability ratios markedly enhanced model performance, yielding statistically significant parameter estimates and a higher degree of explanatory power. The most robust results were obtained when the return on assets (ROA) ratio was included in models for the large securities group.

The study also integrates downside risk measures into the analysis. Similar to the classical CAPM, the Downside CAPM when applied to market returns did not produce a satisfactory explanation of return behaviour on the FSE. Nevertheless, within the downside risk framework for large-cap firms, a negative downside market risk premium was identified in the Accounting-based CAPM when risk was measured using the DAB-downside accounting beta. Conversely, positive risk premiums were observed for downside accounting betas based on return on equity (ROE), particularly within equally weighted portfolios, suggesting an asymmetric and nuanced risk-return relationship. The empirical findings from the FSE indicate that enhancing asset pricing models with profitability ratios and accounting-based downside beta coefficients improves our understanding of return dynamics in this market. Furthermore, the downside risk approach appears to better capture observed market behaviour compared to symmetric risk modelling frameworks.

Two principal conclusions emerge from this research. Firstly, financial statements are a critical source of information for equity investors and should be disclosed at least quarterly to enable monitoring not only of profitability levels but also their temporal variability. Pricing model factors based on accounting information may serve as an alternative to beta coefficients derived solely from capital market data. This becomes particularly relevant for unlisted firms. Secondly, the inclusion of asymmetric risk measures in asset pricing models is essential, as such extensions can significantly improve the models' explanatory power.

The study presented focuses on firms listed in developed markets. It is important to note that these markets differ from emerging ones in several respects: they are characterised by higher market capitalisation, a longer history of more regulated capital trading mechanisms, and, at the same time, a generally slower pace of economic growth. Consequently, developed capital markets may offer lower expected returns compared to emerging markets, typically at the cost of reduced risk. Comparing the present findings with evidence from emerging economies would therefore be of particular interest, given the distinct asset class involved. Future research will thus be directed toward applying the proposed accounting-based risk measures to emerging markets. Moreover, it is essential to consider the sensitivity of CAPM results derived from accounting-based risk measures across different market conditions. This line of inquiry is particularly relevant for both investors' decision-making processes and for evaluating the extent to which these account-

ing measures behave in line with the traditional market-based risk measure, namely the beta coefficient.

Several limitations related to the data and empirical methodology should be acknowledged. Firstly, the comparability of accounting data across firms from different industries and of different sizes may be limited. Secondly, there is no market or sector-wide stock index that directly reflects firms' accounting profitability, constraining the construction of benchmark accounting returns. Finally, the estimates may be subject to potential measurement error in beta coefficients, as the original Fama–MacBeth procedure could not be fully implemented. Nevertheless, the use of portfolio formation based on stock returns helps mitigate measurement error in portfolio beta estimates.

Open Science Practices

The data collected during the study are publicly available at <https://doi.org/10.18150/6VQF3B>

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Rethinking corporate welfare: Unpacking its meaning and misconceptions

 Adam Piłat¹

Abstract

The main goal of the article is to propose a new definition of corporate welfare, a concept coined in the 1970s to describe the state's support for entrepreneurs and counterbalance criticisms of the welfare state. Based on a critical review of the literature on historical origins and existing definitions, a new approach has been proposed, which offers objectivity, applicability, and integration with the concept of social welfare. Moreover, clearly embedding the concept of corporate welfare within the theory of market and state failures links the new definition with the existing theory of public economics and institutional economics. The discussion of corporate welfare is exemplified by two case studies to illustrate the boundaries of the proposed definition and demonstrate the adequacy of the theoretical framework (available in Appendix C).

Keywords

- corporate welfare
- market failure
- public policy
- welfare state
- state aid

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¹ Faculty of Economic Sciences, University of Warsaw, 44/50 Długa Street, 00-241 Warsaw, Poland, apilat@wne.uw.edu.pl, <https://orcid.org/0000-0003-4118-067X>.

Introduction

Recent years have seen a growing role for the state in contemporary mixed economies and increasingly bold actions undertaken by governments all over the world to support businesses to survive and thrive. Notable examples include rescue packages prepared to counteract the detrimental economic consequences of the COVID-19 pandemic or industrial policies intended to bolster the resilience of strategic sectors in response to the growing volatility and fragmentation of the global economy (Evenett et al., 2024; Juhász et al., 2023). It seems that the historical pendulum swinging between the free market and the active state is again leaning towards interventionism (Gills, 2008). Obviously, this raises valid questions about the reasonability of public funds spent to support businesses and individuals.

Importantly, none of these issues is new in public debate: discussions about tensions between the welfare state and support offered to business have been ongoing at least since the 1970s, when the concept of corporate welfare was coined and introduced to public debate (Olson & Champlin, 1998) to counterbalance ideas known as the welfare state. However, for some reason, this concept still does not receive sufficient attention from academics and politicians (Farnsworth, 2013). As can be observed in Figure 1, the simple comparison of some buzzwords searched in Google produced by Google Trends confirms that corporate welfare is not especially popular.² Google Trends compares the relative popularity of selected topics in a given period, with a value of 100 being assigned to the topic and day with the highest number of searches within a given timeframe. The popularity of all other topics on all other days from the analysed period is compared to this reference value. Figure 1 reveals that in the last five years, 'industrial policy' has been more popular than 'sharing economy', 'political capitalism', and definitely much more than 'corporate welfare'.

Despite the discussion about the meaning, scope, and reasonability of corporate welfare having a long history (Egan, 2004) and remaining lively (Bulfone et al., 2023; Klebaner, 2024), it still receives insufficient attention from academics and experts. This study attempts to narrow this gap. Two main hypotheses considered in the article are as follows: (1) existing definitions of corporate welfare are imprecise and impractical; (2) the market failures theory is sufficient to explain and justify the state's interventions denoted as corporate

² Regardless of the outcomes presented in Figure 1, the concept of corporate welfare was also compared with topics such as welfare state, cronyism, state aid, interventionism, trade war, and cryptocurrencies. In all cases, the popularity of corporate welfare was many times lower than that of all other topics taken into consideration.

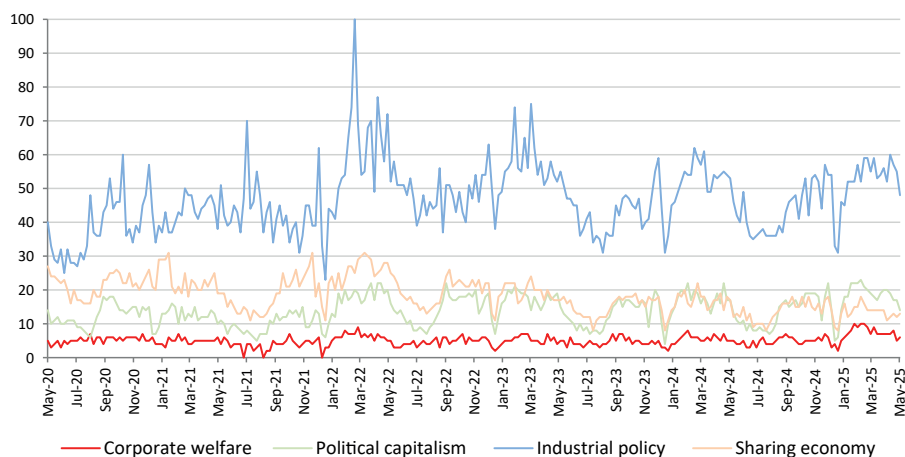


Figure 1. The relative popularity of corporate welfare in comparison to selected topics in the last 5 years

Note: Data retrieved on 13 May 2025. Numbers show the relative popularity of all topics—the number of searches of a given term on a particular day is compared to the highest number of searches among all terms during the selected time span.

Source: Google Trends.

welfare. The main aim is to establish a new definition of corporate welfare, based on a thorough analysis of definitions that can be found in the literature.

The main value added of this research is twofold. Firstly, providing a more precise and objective definition will allow for fruitful and conclusive discussions and empirical analysis of corporate welfare. In order to properly measure and assess corporate welfare activities, it is necessary to use an operative, objective, and coherent definition. In this sense, this article may affect all subsequent research on this topic. Secondly, by explicitly incorporating corporate welfare into the theory of market failure, the study clarifies the justification for state intervention in this area. Welfare economics clearly defines the conditions of justified intervention and underscores some risks entailed by the state's activity.

The rest of the paper is organised as follows. Section 1 outlines the origins of the corporate welfare concept, presents existing definitions of corporate welfare, and discusses the drawbacks of the approaches proposed in the literature. A revised definition of corporate welfare is proposed in Section 1 as well. The subsequent Section 2 tends to locate the corporate welfare concept within the framework of the market failures theory and welfare economics. Finally, the conclusion summarises the main findings and proposes some pathways for future research.

1. Corporate welfare: Peculiarities of the concept

The literature reveals numerous misunderstandings and incoherencies concerning the concept of corporate welfare. Different authors use various terms to name more or less the same phenomenon: some refer to 'shadow welfare' (Abramovitz, 1983; Titmuss, 1965) or 'phantom welfare' (Huff & Johnson, 1993) to describe the problem researchers such as Farnsworth (2013) or Dawkins (2002) classify as corporate welfare. Theoretical complications amplify when we consider relations between corporate welfare and concepts such as industrial policy, developmental state, and state aid.

The relative scarcity of academic studies concerning corporate welfare and the ambiguity of this concept justify an attempt to reconsider the definition of corporate welfare more thoroughly. At the same time, since the active role of the state seems to be gaining importance, reassessing the concept of corporate welfare becomes particularly relevant. This concept was originally formulated as both a complement and a response to the discussion on the efficiency of the welfare states. Hence, it is vital nowadays given that the global economy faces multiple challenges that require an active response from the state.

The following section discusses the historical origins of the corporate welfare idea and present selected attempts to define this concept. Finally, Section 1 proposes a novel definition of corporate welfare.

1.1. Origins of the corporate welfare concept

According to Dawkins (2002), one of the earliest uses of the term 'corporate welfare' in the public debate appeared in a *Washington Post* editorial in 1981, where corporate welfare was negatively depicted as wasteful usage of public resources for business subsidies. However, Farnsworth (2012) indicates that the origins of the term can be found in the political activity of Canadian left parties from the 1970s. David Lewis, a former leader of the New Democratic Party in Canada, was probably one of the first to use the term 'corporate welfare' to express his concerns about the benefits derived by corporations to the detriment of ordinary citizens. Meanwhile, Ralph Nader, an American politician and activist, ran a series of campaigns criticising corporate welfare. He summarised his negative attitude towards benefits provided by the government to powerful and influential corporations in his 2000 book (Nader, 2000). Notably, the term 'corporate welfare' was initially coined and used as a response to ambitions to retrench the post-war welfare states. Hence, its original connotations were purely pejorative.

Bader et al. (2003) explain that the problem of unequal treatment of business and citizens is strictly linked to the history of income taxation. When income taxes were introduced, the burden of contribution was primarily concentrated on affluent corporations and individuals. Although income taxes evolved after World War II and became mass taxes rather than class taxes, they were still noticeably progressive. According to Bader et al. (2003), an important change occurred in 1967, when the concept of tax expenditures was formulated. In subsequent decades, numerous exclusions, exemptions, deductions from gross income, and preferential rates were extensively used by powerful corporations to minimize their tax burden. The evolution of the tax system also drew more attention to the concept of corporate welfare and stimulated more academic research on this issue.

Titmuss (1965) was one of the first to note that the redistributive policy of the state is a much more complex issue than initially seems. He distinguished three fundamental categories of social policy: social welfare, including all traditional services provided for individuals (e.g., health care and education); occupational welfare (all facilitations and benefits connected with the labour market), and fiscal welfare encompassing taxation policy of the state. Titmuss noted that the traditional understanding of the welfare state is only a visible part of a more complex construction that can be dubbed the 'shadow welfare state'. He argued that the accumulation of numerous disjointed programmes with incoherent definitions, various goals, and differentiated eligibility criteria tends to benefit relatively well-situated individuals most. This conclusion was in line with the observable effects of tax exemptions introduced and popularised more or less around the time of Titmuss's writing.

Observations raised by Titmuss inspired many authors. Abramovitz (1983) criticised the tax system as a platform for the redistribution of resources from the poor masses to the wealthy and influential individuals. Moreover, she directly referred to corporate welfare, claiming that "like individuals and families, corporations ask for and receive welfare through both direct government outlays and tax expenditures". This strand of analysis was continued by Huff and Johnson (1993), who highlighted that governments are relatively keen on restricting social programmes for poor individuals, whereas, at the same time, they expand the generous support for the upper classes and business. A similar line of reasoning was repeated in the follow-up article by Abramovitz in 2001, where she points out that support schemes provided for poor citizens are visible, which makes them an easy target of criticism. By contrast, corporate welfare is less transparent, enabling it to flourish much more easily. Abramovitz claims that this makes welfare states both undemocratic and unfair (Abramovitz, 2001).

Scholars such as Titmuss (1965), Abramovitz (1983, 2001), and Huff and Johnson (1993) shed light on the dichotomy between broad tolerance and benevolence associated with corporate welfare initiatives on the one hand,

and reluctance towards social programmes on the other. Olson and Champlin (1998) investigated the cultural origins of this discrepancy, arguing that the 'dual structure of welfare' is deeply rooted in a cultural dualism prevalent in Western societies. In this view, all activities linked to the economic sphere are naturally perceived as more legitimate and important than those associated with the family. Consequently, public perceptions of welfare conjure up images of poor, needy individuals unable to deal with adversities on their own. This negative view is never applied to corporations: these are invariably perceived as independent, dynamic, and thriving. As a result, state resources provided to businesses are framed as 'investment', not as welfare support, and as incentives for business, not state handouts. It is by highlighting this linguistic double standard that made the observations of Titmuss (1965) and later researchers so influential.

In subsequent years, a negative sentiment towards the concept of corporate welfare still dominated the academic and political debate, with clear-cut examples being provided by researchers from the CATO Institute, an American libertarian think-tank (DeHaven, 2012; Slivinski, 2007). Interestingly, this strand of literature presents a substantially different critique of corporate welfare than the leftist authors evoked above: since all state interventions disrupt the natural functioning of the free market, corporate welfare is also perceived as adverse (Egan, 2004).

Contemporary studies often propose more nuanced and balanced assessments of corporate welfare (Bulfone et al., 2023; Bürbaumer & Pinsard, 2025; Farnsworth, 2013; Klebaner, 2024). In a recent work, Farnsworth advocates a holistic approach towards the whole-economy public and social policy of the state, treating corporate welfare as a part of a more comprehensive welfare mix (Farnsworth, 2019). The ongoing debate concerning corporate welfare becomes even more inconclusive when we take into consideration the experiences of the financial crisis from 2008, attempts to deal with the economic disturbances induced by the COVID-19 pandemic, and all other global challenges recently faced by societies. The expanding role of state involvement in the economy is regaining prominence in the mainstream (Gills, 2008; Juhász et al., 2023; Kattel & Mazzucato, 2018), and is obviously relevant to discussions regarding corporate welfare.

1.2. Definition of corporate welfare

We can distinguish two basic approaches to the corporate welfare concept that delimit two extreme positions toward this phenomenon.³ The definition proposed by Farnsworth (2013) denotes corporate welfare as all benefits and services provided by the government to satisfy businesses' needs in a direct and indirect way. This definition is evoked by such authors as O'Connor and Sweeney (2016), and interestingly, corporate welfare is also similarly defined in the Oxford Dictionary. Since this understanding of the corporate welfare concept is extremely broad, we might call it 'the maximalist approach'. Importantly, Farnsworth (2013) argues that most policies introduced by governments serve both citizens and corporations to some extent, and consequently contain elements of corporate and social welfare. This observation provides a basis for defining the socio-economic continuum, allowing for ordering particular interventions according to their prevalent nature and goals (from the most social to the most corporate beneficial). Farnsworth maintains this approach in his subsequent study (Farnsworth, 2021). Moreover, the definition of corporate welfare applied by Klebaner (2024) also can be considered extremely broad: he argues that any transfer of public funds or power to businesses should be deemed corporate welfare.

On the other hand, Schlomach et al. (2019) define corporate welfare as 'any financial benefit purposely granted by the government to a specific business or class of businesses and that is not generally available to all businesses and taxpayers'. The authors formulate two auxiliary questions that allow corporate welfare activities to be identified more accurately. In their opinion, if a given measure is not uniformly available to every business in every industry and simultaneously does not put the recipients on an equal footing with similar firms, then we can conclude it is corporate welfare. Crucially, Schlomach et al. (2019) claim that all tax provisions that can be viewed as economically efficient and justified should not be related to corporate welfare. This means that they implicitly introduce an additional condition that has to be fulfilled by a given measure to be deemed corporate welfare—it must be economically inefficient. The multilayer definition proposed by Schlomach et al. (2019)

³ Some authors use the term 'corporate welfare' to describe a broad spectrum of programmes and facilitations offered by entrepreneurs to their employees. For example, Darrough et al. (2019) analyse the relationship between employee-welfare policies proposed by entrepreneurs (denoted in their research as corporate welfare) and changes in firms' productivity induced by the introduction of unemployment insurance benefits. On the other hand, Stoesz (1986) used the term 'corporate welfare' to describe market initiatives aimed at providing some social services for individuals (e.g., private nursing homes, health maintenance organizations, entrepreneurs offering childcare). He called it the 'third stage of welfare'.

is restrictive; thus, it can be dubbed the minimalistic approach to the definition of corporate welfare.

Bulfone et al. (2023) also proposed a definition of corporate welfare that can be perceived as restrictive. Their approach is founded upon the concept of conditionality. In their view, if the state demands particular behaviour from the business and support is granted only when this condition is fulfilled, the state's intervention does not constitute corporate welfare. However, when support is granted unconditionally, it should be considered corporate welfare. This approach is presented as a direct response to the weaknesses of the far-reaching definition formulated by Farnsworth (2013). This definition has been evoked recently by other authors (Bürbaumer & Pinsard, 2025). Notably, Klebaner (2024) alludes to the definition formulated by Bulfone et al. (2023) and embraces the concept of conditionality in his understanding of corporate welfare.

Both approaches presented above are prone to criticism. The definition of corporate welfare popularised by Farnsworth (2013) seems too far-reaching. If we accept the concept of the socio-economic continuum and admit that each governmental programme can be partially dedicated to supporting business and individual citizens, then virtually every initiative undertaken by the state can be deemed corporate welfare on the grounds of the maximalist definition. It is likely that all policies, even those with clear social goals, at least marginally affect business and satisfy business needs. This observation makes the maximalist definition of corporate welfare difficult to use, a flaw noticed by Ruane (2013) in her comment on Farnsworth's article. In it, she pointed out that, according to Farnsworth's view, corporate welfare also encompasses an effective legal system or police forces protecting corporate assets because these provisions are also a form of response to some general business needs.

Minimalist definitions of corporate welfare face two main drawbacks: the pejorative meaning many authors assign to the concept, and the impracticality stemming from the excessive specificity of the proposed definitions (Farnsworth, 2021). Schlomach et al. (2019) assume that all corporate welfare measures are economically inefficient and should be automatically condemned on these grounds. This renders this minimalistic definition not only non-neutral but also less operational; it suggests that we should systematically consider the efficiency of each particular financing measure to decide whether it constitutes corporate welfare or not. In reality, states often actively support businesses in their R&D efforts, seeking to spur innovations, regardless of the fact that many individual projects supported with public resources ultimately prove to be failures. For example, an investment in new green technologies may seem inefficient from the point of view of individual projects, but such an endeavour very often entails important social and environmental spillovers, making it justifiable from the broader perspective (Rodrik, 2014). Government subsidies to support such investments should certainly

be treated as examples of corporate welfare, but should not be automatically disregarded, even though they may be inefficient from a purely economic perspective. Similarly, Bulfone et al. (2023) argue that all *quid pro quo* relations between business and state should be excluded from the scope of corporate welfare. At the same time, they regard all unconditional forms of support as signs of state weakness. This makes their definition clearly pejorative and difficult to apply in practice. Moreover, linking the definition of corporate welfare to conditionality seems to be questionable if any resemblance to the concept of traditional social welfare is to be maintained.⁴ In the case of traditional welfare programmes addressed to individuals, conditionality is treated as a non-mandatory feature, not as an essential, intrinsic part of the definition. For example, although cash transfer programmes such as Brazilian Bolsa Família or Mexican Progresas are based on conditionality, they are univocally accounted as social welfare programmes (Bergstrom & Dodds, 2021). Similar reservations apply to the definition proposed by Klebaner (2024), since it builds on and extends the approach of Bulfone et al. (2023).

Obviously, in the literature we can find other attempts to define corporate welfare, and these can usually be situated somewhere between the two extreme approaches described above. Dawkins (2002) claims that ‘any government subsidy to business, (...), that provides unique benefits or advantages to specific companies or industries for activities they may generally be expected to perform for reason of profit’ should be deemed corporate welfare. Crucially, Dawkins explicitly excludes measures available to all companies in all industries from the definition of corporate welfare. DeHaven (2012) does not explicitly define corporate welfare, but concentrates his analysis on direct and indirect subsidies granted to small businesses, large corporations, and industry organizations. DeHaven also mentions tax preferences, regulations, and trade barriers as other forms of corporate welfare. Slivinski’s definition (2007) is more concrete; in his opinion, any federal spending programme that provides payments or unique benefits and advantages to specific companies or industries can be understood as corporate welfare. Notably, some authors deliberately exclude all tax-based measures from the scope of corporate welfare (McGee, 2003). Finally, Angresano (2016) uses the corporate welfare concept to describe the contemporary economic system of the United States. He evokes definitions proposed by Slivinski (2007) and Nader (2000), using them to list the characteristics of the corporate welfare economy. Importantly, his assessment of corporate welfare and the corporate welfare economy is clearly negative.

⁴ As shown in Section 1.1.1, the perception of traditional social welfare and corporate welfare is clearly divergent (so-called dual structure of welfare), which is misleading and unfair. The parallel between those two categories of welfare seems to be a necessary condition to alleviate this unjustified distinction.

Some definitions found in the literature (Farnsworth, 2012, 2021) emphasise deeply-rooted similarities between corporate and traditional welfare and define the corporate welfare concept in accordance with the traditional understanding of the welfare state. These definitions underscore the role of corporate welfare measures in socializing the costs and risks associated with natural market-based activities undertaken by businesses. In this sense, corporate welfare is similar to the state's traditional social welfare activities, which seek to protect individual members of society from unexpected but natural risks that may be encountered during their lifetime.

Consequently, in order to ensure analytical usefulness and maintain consistency with traditional welfare, a new definition of the concept of corporate welfare seems necessary. It is proposed that corporate welfare should be understood as: *(1) any state action that has a positive impact on businesses, (2) grants them a privileged position, and (3) is primarily aimed at supporting businesses or protecting them against various types of market risk.*

The proposed definition offers several distinct advantages over the other definitions of corporate welfare discussed above.⁵ Firstly, by assuming that corporate welfare grants a privileged position to its recipients, the proposed definition excludes all universal activities of governments, especially all legal provisions determining the general rules of market functioning, concluding contracts, starting and running a business, as well as all universal institutions, such as a stable financial system, efficient judiciary, and police forces. Crucially, however, it includes horizontal measures applicable to particular sectors or groups of companies distinguished by particular characteristics. The recipients of horizontal corporate welfare measures are treated preferentially compared to all other businesses that did not obtain a similar support. In this sense, the proposed definition is robust to the concerns raised by Ruane (2013) and coherent with the approaches proposed by Dawkins (2002) or Slivinski (2007). Secondly, the proposed approach is free of any a priori value judgments; it does not automatically equate corporate welfare with cronyism, corruption, or other negative phenomena. Instead, it acknowledges that some corporate welfare measures may be socially desirable, well-conceived, and efficient, while others may be unjustified and wasteful. In this sense, the definition proposed above stands in opposition to the approaches of Schlomach et al. (2019), Angresano (2016), and Bulfone et al. (2023). Thirdly, it is not limited to subsidies understood as positive transfers, which means that all forms of preferential tax policies can also be deemed corporate welfare. This stands in stark contrast to definitions employed by McGee (2003). Ruane (2013) noted that incorporating corporate welfare into the broader discussion of public provision of welfare elevates the importance of tax policies. Since tax-related

⁵ Selected definitions of corporate welfare are presented and discussed in Appendix A.

measures constitute an important part of the support provided to businesses, it does not seem reasonable to disregard them in the definition.

One important clarification should be made at the end of this section. Although terms such as business, firm, corporation, company, and entrepreneur have distinct meanings, they may all refer to potential recipients of corporate welfare. Most authors employ the concept of business to denote the set of entities that benefit from corporate welfare (Dawkins, 2002; Farnsworth, 2013; Schlomach et al., 2019), as it is the most encompassing term. Accordingly, the definition proposed above also adopts this term to identify the recipients of corporate welfare. Notably, both sole proprietorships and state-owned enterprises may qualify as recipients of corporate welfare. As such, ownership structure and scale are irrelevant in the context of corporate welfare.

2. Rationale of the corporate welfare interventions

After defining the concept of corporate welfare, it is natural to consider the prerequisites of such state interventions. It seems that the traditional theory of welfare economics and the concept of market failure are sufficient to explain the reasonability of corporate welfare in most cases. Both Slivinski (2007) and Milke (2007) refer to market failure theory to indicate the typical justification of corporate welfare programmes. Similarly, Bennett and DiLorenzo (1982) use this theory to explain the reasonability of industrial revenue bonds issued by local governments of the United States. Notably, some authors use the market failures framework to justify industrial policies (Juhász et al., 2024; Piechucka et al., 2023) or entrepreneurship policies (Bennett, 2025). Taking into account the close correspondence of the mentioned concepts and corporate welfare, this argument appears particularly suitable.

The subsequent section offers a concise summary of arguments raised in the literature to explain the rationale of the corporate welfare activities. The goal of this section is to provide a general justification for state interventions denoted as corporate welfare and explain when such activities become inefficient.

2.1. Corporate welfare and market failures theory

Two basic principles of welfare economics provide key guidelines for state intervention. According to the First Fundamental Theorem of Welfare Economics, a well-functioning market economy tends to lead to a Pareto-

efficient equilibrium in the allocation of resources. Consequently, state intervention is required only when market competition does not function efficiently, i.e. when market failure occurs. Nevertheless, market failure is only a necessary, rather than a sufficient, condition for intervention; potential gains from intervention should always be compared with the costs of government involvement (arising from government failure). The Second Fundamental Theorem of Welfare Economics states that the choice of the initial allocation of resources can shape market forces in such a way that they lead to a Pareto-efficient equilibrium preferred by society. This implies that even when the market mechanism is efficient, state intervention may still be justified by the goal of changing the initial allocation of resources (Arrow, 1951; Arrow & Debreu, 1954; Stiglitz, 1991). These directives can also be applied to successfully justify interventions classified as corporate welfare. Stiglitz and Rosengard (2015) enumerate such market failures as imperfect competition, the existence of public goods, externalities, incomplete markets (or lack of markets), imperfect information, unemployment, and other macroeconomic disturbances. All these market imperfections can be applied to justify and explain the rationale of state interventions recognized as corporate welfare.⁶

For example, usually only a part of the external financing demanded by the businesses is provided by the market. Some businesses are assessed as too high-risk to be perceived as reliable clients for any market capital provider, resulting in typical market failure: the absence of financial markets for some entities. Underlying this is information asymmetry: capital providers know too little about the specificity of the given businesses to offer them acceptable financing. We typically refer to this imperfection as the ‘finance gap’ (Lin et al., 2022). All state interventions designed to facilitate access to capital are instances of corporate welfare; Australia’s Innovation Investment Fund, or the *de minimis* guarantee programme offered by the Polish state, exemplifies interventions aimed at narrowing the financing gap.⁷ The same rationale was used by Bennett and DiLorenzo (1982) to explain the theoretical foundations of industrial revenue bonds issued by local developmental agencies in particular regions of the United States. These bonds were intended to raise funds to finance small businesses with restricted access to capital.

Besides, states’ efforts to spur innovativeness are classic examples of providing public goods that cannot be efficiently supplied by the market because the research or production costs exceed the potential gains for any single entrepreneur. However, when accounting for the positive spillovers

⁶ However, it does not mean that the existence of market failures is a part of the definition of corporate welfare. As explained in Section 2.2. corporate welfare can appear even without market failures, but in such cases, its reasonability is much more difficult to defend on the grounds of the traditional theory of the state’s intervention.

⁷ The *de minimis* guarantee programme is described in more detail in Appendix C.

from the invention and dissemination of a given technology or good, public financial support proves to be socially beneficial. For instance, the invention of the COVID-19 vaccines by companies such as Pfizer/BioNTech, Moderna, or AstraZeneca would not have been possible without the injection of public funding; in the period up to March 2021, almost all of the USD 5.9 bn invested in researching and developing COVID-19 vaccines was funded by the United States, Germany, and other governments.⁸ Fink (2022) estimated that the social benefit of COVID-19 vaccine innovation was indeed enormous and exceeded private benefit by a factor of 887. Not only vaccines but most dual-use or green technologies (Mazzucato, 2013; Rodrik, 2014) exemplify products that probably would not be invented without public funds, but once they are invented, they bring enormous benefits to societies.

The stimulus packages provided by governments all over the world at the time of the COVID-19 pandemic aimed to restore macroeconomic stability, preventing unemployment and bankruptcies. Particular instruments, such as preferential loans, tax deferrals, grants, and wage subsidies, were provided to reduce liquidity shortfalls and mitigate the risk of massive insolvencies (Ebeke et al., 2021). Moreover, the sizeable bailouts awarded to the banking and automotive industries during the 2008 global financial crisis were driven by the same logic: governments had to intervene on a massive scale to rescue the damaged sectors, sustain employment, and ensure the basic viability of the economic system (Culpepper & Reinke, 2014; Farnsworth, 2015). Interestingly, we can justify specific activities undertaken by governments during the crises by referring to particular market failures, without the general reference to macroeconomic stability (Piechucka et al., 2023; Stiglitz, 2021). For example, the bankruptcy of one firm amplifies the risk of subsequent company collapses—a classic example of negative externality. Likewise, state rescue packages can be understood as a response to the absence of an efficient risk market. It is not possible to buy insurance against the consequences of potential diseases such as the COVID-19 pandemic.

Importantly, all state interventions dubbed corporate welfare should be explainable using market failure theory because the existence of the market failure is a necessary condition for state economic intervention. However, not all state activities justified by some market imperfection satisfy the definition of corporate welfare. For example, by investing in infrastructure, the state responds to the market failure, providing society with a public good. Yet, because infrastructure investments are typically not selective, and are usually not aimed at satisfying the needs of businesses, the provision of public goods such as local roads or waterworks does not satisfy all conditions of the

⁸ Access online on 26 November 2025, at: <https://www.forbes.com/sites/niallmccarthy/2021/05/06/which-companies-received-the-most-covid-19-vaccine-rd-funding-info-graphic/?sh=3acba8804333>.

proposed definition of corporate welfare. Notably, the extensive definitions proposed in literature categorise investments in infrastructure as corporate welfare because they bring at least some marginal benefits for businesses (Farnsworth, 2013; O'Connor & Sweeney, 2016).

Additionally, fundamental tax regulations that are universally applicable by definition cannot be selective. Moreover, the primary goal of tax law is redistribution (changing the initial resource allocation from the point of view of welfare economics), not solving any particular market failure. For example, according to the proposed definition, reducing the general corporate income tax rate, which is uniformly applicable to all businesses within the state's jurisdiction, should not be deemed corporate welfare, since it does not provide any privilege to any selected group of recipients. However, various preferential tax provisions that directly affect the costs and profits of particular businesses constitute exemptions from the general tax regulations. Although some authors tend to exclude these selective tax-based measures from corporate welfare (e.g., McGee, 2003), treating selective tax provisions as state assistance aligns with the definition of corporate welfare proposed here, and with that previously applied by Schlomach et al. (2019) and Milke (2007). Notably, the concept of policy tax gap is instrumental in understanding the logic of tax-based corporate welfare. This gap is defined as the difference between the total amounts of tax theoretically collectible under general rules of tax law (i.e. without any exemptions and preferential treatment) and the total amount of tax theoretically collectible in the existing tax system. Since the policy tax gap measures an exceptional tax-based support granted to selected entities, it is a good approximation of tax-based corporate welfare. According to rough estimations, in the case of Poland, the policy tax gap in the corporate income tax reached the value of PLN 7.2 bn in 2018 (Sawulski et al., 2020).

Two other examples of interventions frequently misclassified as corporate welfare derive from the fact that the state can affect the market not only by exercising its public power, but also through ordinary economic activities. When the state exerts its unique role associated with the monopoly right to use coercion, we deal with the *imperium* role of the state. By contrast, when the state engages in market activities on competitive grounds as an economic agent, we deal with the *dominium* sphere of the state activity (Nykiel-Mateo, 2009). It has to be noted that corporate welfare belongs to the *imperium* sphere of the state's activities (e.g., when the state arbitrarily provides some exceptional tax provisions to selected entrepreneurs or decides to fund some grants from public resources collected thanks to its right to use coercion). Consequently, all instances when the state behaves as an ordinary market participant should not be considered corporate welfare. In particular, this concerns procurement processes and non-strategic ownership of enterprises. All market entities have to purchase some goods and services, and the state is no exception. Procurement processes serve the state and satisfy the state's

needs in the first place. And while particular purchasing decisions are always beneficial for selected entrepreneurs, this is rather a byproduct of state activity than its primary goal. Moreover, precisely the same tool is available for all other market players, since their procurement decisions are also beneficial for selected providers of goods and services. De Rugy and DeHaven (2020) and Klebaner (2024) are also reluctant to treat procurement as a form of corporate welfare. Similarly, state ownership of companies is common all over the world, and this is an ordinary activity intended to bring profits into the state budget. Even if a particular state-owned enterprise benefits from a government capital injection, this tool is available to all other investors. Ultimately, it seems that other authors are also reluctant to treat state ownership as an example of corporate welfare (Bulfone et al., 2023).

In specific circumstances, it may be reasonably argued that infrastructure investments, taxation policy, procurement processes, and ownership engagement of the state do constitute corporate welfare. For example, the strategic state ownership of some assets can fulfil the corporate welfare definition formulated above. Moreover, state capital injections are sometimes used as a rescue mechanism (Farnsworth, 2013). In such cases, the state interventions usually aim to preserve macroeconomic stability, and are therefore grounded in market failure theory. In a similar vein, local content requirements can also constitute corporate welfare when applied exceptionally in some strategic procurements. When the state arbitrarily decides to prefer some selected providers of goods or services, it ceases to operate as a normal market player focused on profit maximisation, and instead can select the higher offer for the sake of the supply stability. In those examples, the market logic is superseded or supplemented by other concerns derived from market failure theory (e.g., the provision of public goods such as safety or stability of the financial system). This means that the state uses the *imperium* power to solve an important social challenge. Finally, the ambiguous nature of the taxation policy has been described above. A graph included in Appendix B outlines interdependencies between corporate welfare and other forms of market interventions that should not be classified as corporate welfare.

2.2. Malpractices and inefficiencies

Most corporate welfare interventions can be explained by the theory of market failure and should therefore not be automatically deemed undesirable. However, in some cases, intervention's side-effects and unintended costs may outweigh its benefits. These indirect consequences were noted by de Rugy and DeHaven (2020) in their study of non-budgetary costs of corporate welfare. Moreover, in extreme cases, business pressure may even induce corpo-

rate welfare without any clear justification in market failure theory. However, from the welfare economics perspective, state intervention should not occur when its total costs exceed expected gains, nor when market failure does not exist. Thus, excessive (pathological) forms of corporate welfare are unjustified on the basis of market failure theory. These principles apply to all state interventions, not only those related to corporate welfare (Stiglitz & Rosengard, 2015), and are widely acknowledged even by critics of corporate welfare (Bennett & DiLorenzo, 1982; Slivinski, 2007).

In summary, state intervention is desired and advantageous provided its aim is to address market failures and produces negligible side-effects. In practice, however, this is not always the case. Sometimes we converge towards a position de Rugy and DeHaven (2020) describe as ‘the pathology of privilege’. In both cases, we have interventions fulfilling the definition of corporate welfare proposed above. The relationship between market failures, corporate welfare, and business pressure is presented in Figure 2.

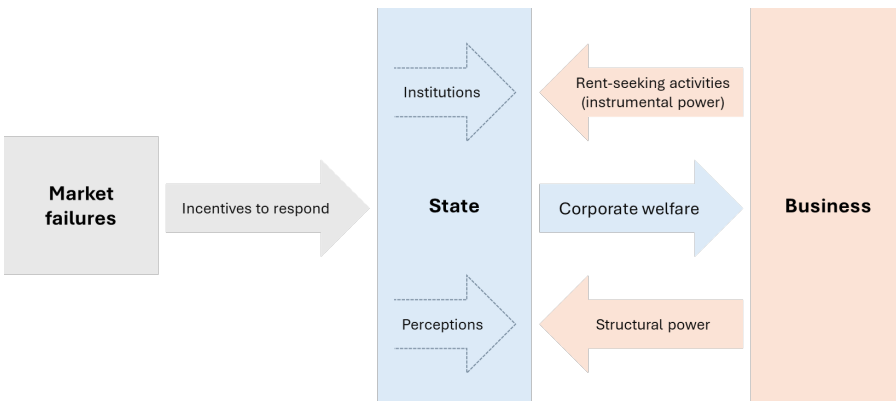


Figure 2. The relationship between market failures, corporate welfare, and business power

Source: own elaboration.

The path from advantageous corporate welfare to the pathology of the privilege, is always accompanied by rent-seeking. Since corporate welfare always offers an opportunity to redistribute resources, the rent-seeking naturally accompanies such interventions. Rent-seeking always appears when the potential gains from such activities exceed the costs borne by rent-seekers. Baumol (1990) and Sobel (2008) point out that whenever potential benefits from redistributive policies appear, entrepreneurs will estimate the resources and effort they should allocate to productive activities and how much to unproductive rent-seeking. The intensity and harmfulness of rent-seeking depend primarily on the state's capacity and quality of institutions, or what Baumol (1990) describes as ‘rules of the game’. As Acemoglu and Robinson (2019) explain, when institutions are weak, we face the extractive and patho-

logical state, and the word ‘extractive’ is chosen deliberately to underscore the reference to rent-seeking. Importantly, Acemoglu and Robinson (2019) argue that it is a matter not only of economic institutions, but also political institutions: both categories are entangled and relevant. Importantly, if the rent-seeking pressure exerted by entrepreneurs is sufficiently strong, it can distort the state’s decision and lead to a pathological distribution of public resources, not solving any market failure.

Importantly, rent-seeking activities reflect the so-called instrumental power of business, defined as non-core activities that enable firms to attain political leverage (e.g., lobbying or campaign donations). Instrumental power is exercised deliberately and depends on the resources at the disposal of a particular entity. It is, however, not the only channel allowing corporations to affect political decisions. The ability to shape the general condition of the economy through individual decisions concerning the location of activity, investment, and employment is a source of specific structural power of business (Culpepper, 2015). The threat of disinvestment or capital flight indirectly affects decisions made by politicians, and can also determine corporate welfare, a point illustrated by Farnsworth (2012), Bürbaumer & Pinsard (2025), Culpepper & Reinke (2014), or Fairfield (2015). Crucially, as Fairfield (2015) emphasises, structural power does not require concentrated and intentional actions of the business; policymakers’ perceptions of the credibility of the threat play a key role in transmitting the structural business power into political decisions.

Both the instrumental and structural power of business affect the decision-making process and can distort the reasonability of the state’s intervention stemming from the market failures theory. An extractive state with weak institutions can be significantly affected by state failures, since it has limited access to information, limited capacity to foresee market responses, limited control over the bureaucracy, and high vulnerability to side-effects of the political processes (Stiglitz & Rosengard, 2015). Institutional failures inhibit the state’s capacity to defend from rent-seeking pressure and make it particularly vulnerable to structural business power. As a result, distribution of public resources may be distorted or even unjustified. Ultimately, this institutional failure results in ‘a pathology of privilege’, distortion of incentives leading to the ‘too big to fail’ problem, ineffective ‘picking winners’ policies, or even corruption and cronyism.

Conclusions

Despite corporate welfare’s ubiquity, it remains insufficiently explored in the literature. The definition proposed in this article produces a corporate welfare concept that is narrow, objective, and tightly connected to its roots

in the idea of the welfare state. The ability to precisely and correctly describe relevant concepts is essential for formulating any further hypotheses properly. For these reasons, this study potentially provides important value added to all studies on the changing role of the state or the efficiency of contemporary welfare states.

Clearly, the economic justifications for particular interventions cannot be determined *a priori*: assessment depends on the specific circumstances of the given action. In general, corporate welfare should not be assessed as adverse or pathological in advance. Taking into account the proposed definition, it seems that many manifestations of corporate welfare can be successfully explained and justified on the basis of market failure theory. However, the opposite also holds: not all state interventions coherent with market failure theory fulfil the premises of corporate welfare. For example, infrastructure investments or public procurement are typically not targeted at satisfying business needs, and cannot therefore be deemed corporate welfare. At the same time, the state does not operate in a vacuum; all policymaker decisions are exposed to the instrumental and structural power of business. This pressure may distort the logic of intervention and, in extreme cases, result in corporate welfare that is not justified by welfare economics.

There are many potential fields for follow-up studies. Firstly, exploring main strands of economic thought could illuminate the historical context of corporate welfare, examining whether the idea of corporate welfare is in fact much older than the term itself. Secondly, as mentioned in this article, corporate welfare overlaps to some extent with concepts such as industrial policy or developmental state. It might be valuable to put more effort into disentangling these relations and explaining how those terms are situated in relation to each other. Last but not least, research could scrutinise the importance of the European Union, European competition law, and European rules concerning state aid for the concept of corporate welfare.

Appendix A. Selected definitions of corporate welfare

Table A1. Selected definitions of corporate welfare

Source	Definition	Comments
Dawkins (2002)	Corporate welfare can be defined as any government subsidy to business, excepting socially directed partnership with nonprofit organizations, that provides unique benefits or advantages to specific companies or industries for activities they may generally be expected to perform for reason of profit. That includes provision of direct grants, research and other services, and subsidized loans and insurance (p. 272).	• Dawkins underscores the selectivity of corporate welfare measures (“all forms of corporate welfare are subsidies, but the reverse is not true”). • Dawkins accepts social goals fulfilled as side-effects of corporate welfare (“when defining corporate welfare I have not discounted the strategic uses of public policy by including programs with broadly accepted social objectives”, p. 272). • Corporate welfare is presented in a negative context.
Milke (2007)	A government subsidy to business occurs when a government transfers tax dollars to business for reasons other than for goods or services. In academic jargon, such a subsidy is often referred to as “targeting” because government support is “targeted” at a particular business or industry. In common parlance, business subsidies are known as “corporate welfare.” These terms are largely interchangeable. Note that this definition of corporate welfare does not include tax reductions, deductions, credits, or exemptions for individual businesses or business as a sector (p. 6).	• Sensible approach to tax-based corporate welfare. As the author explained in footnote 1: “An exception to this is arguably where one business or sector is given preferential treatment on its own tax burden vis-a-vis other businesses who must pay regular rates.” (p. 6) • Corporate welfare is presented in a negative context.
Slivinski (2007)	For the purposes of this study, “corporate welfare” is defined as any federal spending program that provides payments or unique benefits and advantages to specific companies or industries (p. 2).	• The author underscores the selectivity and does not exclude tax-based measures from the definition. • Corporate welfare is presented in a negative context.
Farnsworth (2013)	The term corporate welfare is defined here as the various benefits and services that directly, or indirectly, meet the needs of businesses (p. 5).	• The definition is formulated in a direct reference to the classical concept of social welfare. • It is neutral, free of any value judgments. • Extremely broad.

Source	Definition	Comments
Schlomach et al. (2019)	Corporate welfare is any financial benefit purposely granted by government to a specific business or class of businesses and that is not generally available to all businesses and taxpayers. Corporate welfare either lowers the costs of doing business or increases revenue for a business without its customers providing the revenue, relative to other similarly situated businesses, broadly speaking (p. 3).	• The authors underscore the selectivity and do not exclude tax-based measures from the definition. • The authors implicitly introduce an additional condition of inefficiency to identify a given intervention as corporate welfare. They explain that „some tax provisions, though often viewed as corporate welfare, are often consistent with economically efficient tax policy and should not be viewed as welfare” (p. 9).
Bulfone et al. (2023)	We argue that there is a fundamental political economy reason to adopt a more restrictive definition, premised upon the existence (or not) of conditionality – that is to say, whether or not states demand that firms behave in a certain manner in order to qualify for resource transfers. When they do, we contend that this should not be considered an instance of corporate welfare, given that states are able to impose their own logic of action in promoting economic growth (p. 256).	• Pejorative. The authors clearly distinguish unconditional corporate welfare from conditional interventions and assess the former negatively. • Narrow („Toward a restrictive definition of corporate welfare”).
Klebaner (2024)	Corporate welfare system definition can encompass any transfer of public funds or power to corporations (p. 4).	• The author does not exclude tax-based measures from the definition. • Extremely broad. • Corporate welfare is presented in a negative context.

Source: own elaboration.

Appendix B. Corporate welfare in the context of justified and unjustified state interventions

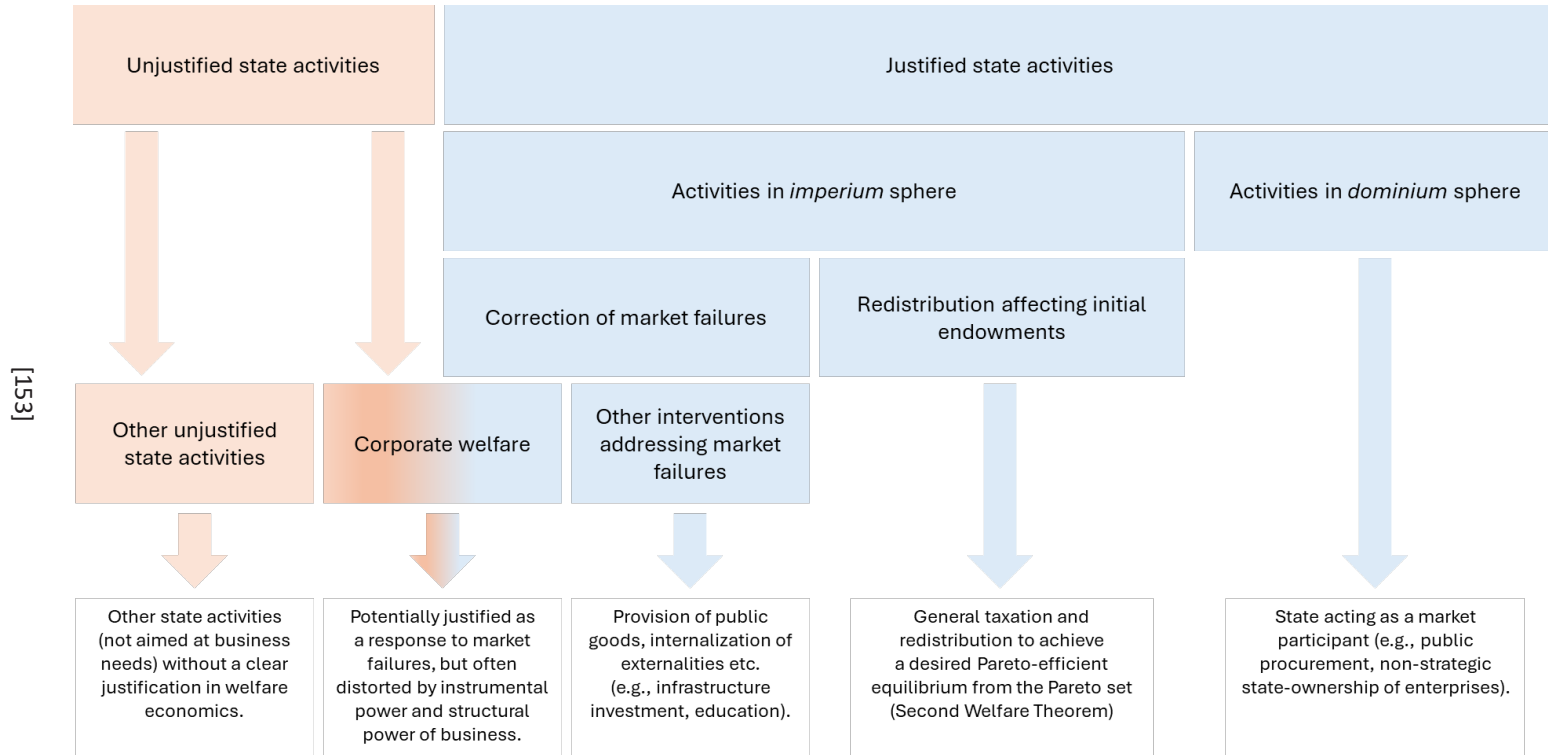


Figure B1. Simplified classification framework of state interventions

Source: own elaboration.

Appendix C. Selected aspects of the corporate welfare concept in practice

Appendix C includes two case studies intended to highlight some aspects of corporate welfare raised in previous parts and portray their practical dimension. The story of Solyndra exemplifies controversial features of the government support provided to entrepreneurs, whereas *de minimis* guarantees represent an unequivocal success. Moreover, the case of Solyndra offers more in-depth insight into the nature of the inefficiencies of corporate welfare described above. *De minimis* guarantees, in turn, allow discerning differences between corporate welfare and the well-known concept of state aid. Both examples are coherent with the definition of corporate welfare proposed above and both can be justified by market failures.

Controversial bankruptcy of Solyndra

The famous case of the support provided to Solyndra is a very instructive example of corporate welfare activity. Although the support scheme applied in this case was rather straightforward, the reasonability of the intervention is assessed extremely disparately, and it makes this example interesting. Solyndra was a solar cell company founded in 2005 and quickly hailed as the American symbol of progress. Based on the American Reinvestment and Recovery Act, Solyndra received in 2010 enormous support from Obama's administration. The goal of public funding was to facilitate the development of green technologies. Support took the form of an expanded loan guarantee program and reached a value of USD 535m (Rodrik, 2014). Since this intervention was exclusive and aimed at the reduction of market-based risk stemming from the innovativeness of the technology, it can be treated as an example of corporate welfare.

Unfortunately, Solyndra went bankrupt in 2011. Naturally, this event raised many questions concerning the reasonability of the government's support and the plausibility of 'picking winners' policies. For many, it was a perfect example of the inefficiency and wastefulness of corporate welfare. Moreover, there are reasons to believe that the decision to confer support to Solyndra was forced by intensive lobbying and backed by strictly political arguments (DeHaven, 2012), which illustrates the tension between rent-seeking and the quality of institutions.

However, Rodrik (2014) is much more reluctant to assess this example as an apparent failure of corporate welfare. He points out that the reasons for Solyndra's collapse should not be boiled down to the incompetence of the

administration. When Solyndra was founded, silicon was perceived to be the most efficient semiconductor, and consequently, it was a very popular solution used in the industry. However, the price of silicon was growing rapidly and was expected to grow further. Therefore, Solyndra decided to base its technology on copper indium gallium diselenide used as a semiconductor. Unexpectedly, the silicon market dramatically changed in 2008—the prices declined due to new capacities coming from China. It became much more difficult for Solyndra to compete with technologies based on silicon. Obviously, the American Department of Energy should be aware of all these circumstances and should base its decision on a comprehensive assessment of all economic conditions accompanying intervention (insufficient information is one of the so-called state failures). Despite that, Rodrik does not conclude that the support conferred to Solyndra was a clear-cut mistake. He argues that the correct measure of success should be based on the efficiency of the entire portfolio of projects, not on the story of an individual entrepreneur. Moreover, as was already mentioned, since we consider initiatives with clear positive externalities for society (spillover of technology and environmental benefits), the overall performance of the portfolio should not be evaluated solely in the financial dimension.

As explained by Mazzucato (2013), the case of Solyndra and the reasons for its bankruptcy may be even more complicated. Mazzucato explores the thread of the competition between Solyndra and Chinese solar producers, pointing out that the capabilities of Chinese entrepreneurs were reinforced by public support provided by the China Development Bank. It might mean that something that is interpreted as a ‘failure’ of the American corporate welfare initiative was fuelled by successful corporate welfare actions undertaken by Chinese authorities. Moreover, Mazzucato claims that the failure of the American solar producer was, to a great extent, a consequence of the impatience of venture investors, who withdrew their funds too hastily, making it virtually impossible for Solyndra to exploit expected economies of scale and successfully compete on the market.

At least two lessons important for the understanding of corporate welfare stem from the story of Solyndra. Firstly, it is not sound to base the assessment of corporate welfare programs on individual cases. Any plausible evaluation should be sufficiently comprehensive and cover a significant time period. Note that evaluations of traditional social welfare programs are also not based on individual cases of support provided to individual citizens. Secondly, the efficiency of corporate welfare policies partially depends on countermeasures applied by other governments. Globalization inevitably leads to competition between states, also on the grounds of corporate welfare – this process is discerned and described in literature (Evenett et al., 2024; Farnsworth, 2013; Piechucka et al., 2023). Again, similar, but not so fierce, competition can be observed in the field of social welfare.

De minimis guarantees as a remedy for financing-gap

De minimis guarantees are provided by the Polish development bank BGK for small and medium enterprises on the grounds of the general legal provisions⁹ and an agreement between BGK and the Polish ministry responsible for financial matters. The main goal of de minimis guarantees is to facilitate access to capital for entities that tackle the so-called financing gap. Interestingly, according to the analysis conducted by the Polish development bank, at the end of the second quarter of 2024, almost 20% of active loans provided to Polish small and medium enterprises were secured with de minimis guarantees. Simultaneously, results of the evaluation of the de minimis program reveal that 35% of enterprises that benefited from the guarantees would not get financing without support from the Polish development bank (Walewski et al., 2024).

It should be explained that de minimis aid is understood as sufficiently negligible to be irrelevant to the trade between member states of the European Union¹⁰. It means that it cannot be perceived as the state aid defined in Article 107 of the Treaty on the Functioning of the European Union. Obviously, guarantees provided by BGK are not the only form of de minimis support available for Polish entrepreneurs. However, according to the Polish Office of Competition and Consumer Protection, they are one of the most popular. As presented in Figure C1, the overall value of de minimis support provided to Polish entrepreneurs in 2023 exceeded EUR 2275m. It was 0.30% of GDP and, at the same time, 16.5% of the total value of state aid conferred by Polish authorities (also beyond the de minimis limits). De minimis guarantees provided by BGK constituted 26.8% of the de minimis support overall value¹¹ (UOKiK, 2024).

Since de minimis guarantees are publicly funded, available only for a selected group of entities that meet some particular conditions, and they clearly decrease the cost of acquiring capital, which is beneficial for entrepreneurs, they satisfy the definition of corporate welfare proposed above. Actually, de minimis guarantees constitute an interesting case of corporate welfare for two reasons. Firstly, as it was mentioned, due to the fact that guarantees are pro-

⁹ These issues are regulated by the Act of 8th May 1997 on securities and guarantees granted by the State Treasury and by certain legal persons.

¹⁰ De minimis aid is precisely defined in the Commission Regulation (EU) No 1407/2013 of 18th December 2013 on the application of Articles 107 and 108 of the Treaty on the Functioning of the European Union to de minimis aid.

¹¹ It should be noted that the value of the de minimis aid provided via guarantees is not equal to the face value of de minimis guarantees. In order to find the value of the de minimis aid conferred via de minimis guarantees, the total value of de minimis guarantees has to be recalculated to the so-called gross subsidy equivalent. Such recalculations are necessary because of the differentiated nature of instruments applied as the de minimis aid.

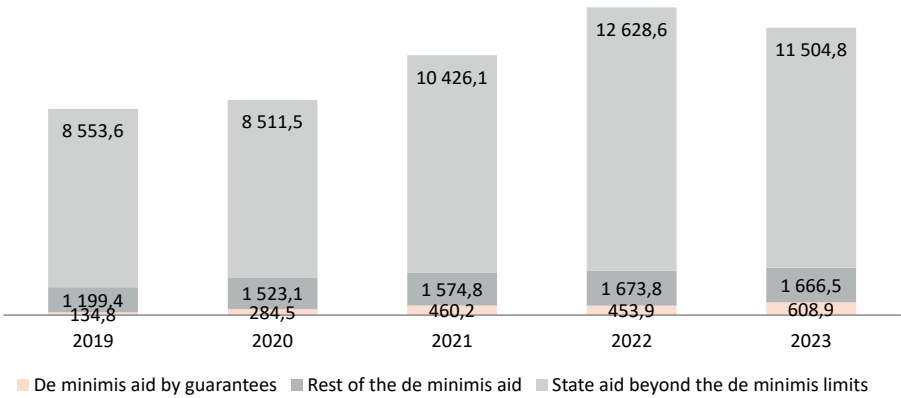


Figure C1. De minimis aid via guarantees, total de minimis aid, and total state aid in Poland (m EUR)

Source: (UOKiK, 2024).

vided as de minimis support, they are not encompassed by the legal definition of state aid. In this sense, de minimis guarantees allow us to notice the main difference between the concepts of corporate welfare and state aid. Secondly, the support provided by the Polish government to entrepreneurs via de minimis guarantees is an example of the measures executed indirectly, with the engagement of the external entity that acts as a middleman. Obviously, the Polish development bank is a state-owned enterprise with special status defined by the law. However, formally, it is not a part of the Polish government. Although the Polish development bank is responsible for managing, executing, and evaluating the program, distributed resources are public, and the state is the ultimate guarantor of the provided guarantees.

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