Public Sector Economics
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The puzzle of household savings in the European Union: tracing influences across time and space

ANA SKOBLAR, MA, MSc*

Article**
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Ana SKOBLAR
Croatian National Bank, Trg hrvatskih velikana 3, 10000 Zagreb, Croatia
e-mail: ana.skoblar@hnb.hr
ORCiD: 0009-0001-7690-3105

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Abstract

This paper uses dynamic panel data estimations based on annual data from 26 European Union countries to evaluate the driving factors of household savings dynamics. Alongside conventional determinants, such as household income and age dependency, the study also includes a less traditional variable, consumer confidence, which is often neglected in existing findings. This research extends previous empirical studies in three dimensions. First, it conducts sensitivity analysis using several estimation techniques to support the robustness of baseline results. Second, the investigation is expanded by including an extended set of potential savings drivers. Lastly, it explores variations in saving behaviour among different country groups (Euro Area, Central and Eastern European countries, and Croatia) as well as the crisis periods (Global Financial Crisis and Covid-19 pandemic). The findings highlight the importance of overlooked determinants, shed light on the ambiguous effect of classic variables, and partially confirm earlier research.

Keywords: household saving, GMM, dynamic panel analysis, macroeconomic variables

"The art is not in making money, but in keeping it."
– proverb

1 INTRODUCTION

In a time characterized by considerable economic volatility, highlighted by the recent pandemic, unravelling the factors influencing household saving behaviours has become more crucial than ever. Some questions arise regarding the nature of savings, such as the main drivers behind household savings and what motivates households to put their money aside relative to different country groups and challenging times. Furthermore, it is also interesting to investigate how savings differ structurally during crisis periods or if they are more similar than they seem.

Even with the growth of empirical research on this topic in recent years, few studies have answered these questions, especially those examining the factors influencing household savings rates within various EU country groups. This is mainly the result of inadequate research into the dynamics of household savings within these different groups and how they adjust over time to different economic difficulties. Moreover, empirical studies frequently find that essential factors have contradictory effects on savings, not always confirming theoretical predictions. This can be ascribed to the unique traits of individual countries or regions and the significance of the specific time periods under examination. For instance, the research of Hernando et al. (2018) and Loayza, Schmidt-Hebbel and Servén (2000a) show different effects of GDP growth on savings, indicating that the impact is very dependent on the larger economic environment and its main drivers. Rocher and Stierle (2015) also emphasize the complex relationship between inflation and savings, wherein inflation's dual effects can either encourage

cautious savings or reduce the actual value of current savings, resulting in different behaviours. The rate of return's intricate impact on savings is revealed in studies by Kukk and Staehr (2015) and Grigoli, Herman and Schmidt-Hebbel (2014), which are influenced by factors like investor confidence and the availability of other investment options. These results stress the need to consider different influences and particular economic conditions across different regions or countries to grasp the elements that influence household savings.

With a focus on Euro Area (EA) and Central and Eastern European (CEE) countries – with special attention to Croatia – this study investigates the factors influencing household savings inside the EU in the context of varied economic landscapes moulded by various crisis periods. At the core of this work is an analysis of conventional saving determinants, such as income levels, demographic shifts, and financial conditions, against the background of fiscal policies and macroeconomic uncertainties. A basic structure for this empirical investigation is provided by the dynamic character of these elements, as described by influential theorists such as Friedman (1957) on the permanent income hypothesis, Keynes (1936) on consumption, and Modigliani and Brumberg (1954) on the life-cycle hypothesis. Building on the vast empirical literature that identifies these common variables as important savings determinants, this study also includes consumer confidence as a crucial factor – a variable that is frequently disregarded in savings analyses. By integrating consumer confidence into the analysis, new insights are provided into saving decisions' psychological underpinnings, extending the existing literature. Using dynamic panel analysis, the study analyses saving patterns in the European Union between 2000 and 2021, a period of major economic upheavals, including the Global Financial Crisis (GFC), the sovereign debt crisis, and the Covid-19 pandemic. Additionally, this study includes a large number of extra variables, extending the sensitivity analysis to enhance the robustness of the baseline determinants in terms of their significance, signs, and magnitude. Accordingly, it clarifies the different saving habits observed throughout the EU and explains how economic downturns affect household financial resilience.

According to Loayza, Schmidt-Hebbel and Servén (2000a), the significant impact of the lagged dependent variable indicates the persistence of savings behaviour and emphasises the impact of past saving patterns on present decisions. In line with the research of Edwards (1996) and Masson, Bayoumi and Samiei (1995), the study confirms the basic economic tenet that wealth increases saving capacity by showing that real GDP growth and household disposable income have a positive and significant impact on saving rates. The terms of trade and age dependency's nuanced effects, alongside the positive relationship between real interest rates and savings, mirror the mixed outcomes in the literature, indicating regional peculiarities or deviations from traditional models within the EU context (Kessler, Perelman and Pestieau, 1993; Hernando et al., 2018). The negative relationship between savings rates and consumer confidence adds a new angle by implying that psychological aspects are important in saving decisions – a topic that has not

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been thoroughly examined in the current body of research. Together with the observed impact of household debt and government fiscal balance, this insight deepens our understanding of the complex nature of household savings behaviour, particularly in the face of economic ups and downs, and enhances the conversation started by researchers such as Edwards (1995) and Rocher and Stierle (2015).

The structure of the paper is as follows: after this introductory section, an examination of the theoretical and empirical underpinnings of the factors that influence household savings is presented. The empirical approach and variable selection are elaborated upon in the following section, focusing on incorporating consumer confidence in conjunction with conventional economic indicators during the baseline estimation. The empirical results are presented by including baseline and alternative specifications for various periods and EU country groups. In the concluding section, the findings are consolidated, their ramifications for policy and subsequent investigations are examined, and the study's distinctive contributions to the body of knowledge on household savings are underscored.

2 HOUSEHOLD SAVING DETERMINANTS AND EMPIRICAL FINDINGS

Numerous established theories that have received substantial empirical support underpin the investigation into the factors influencing household savings. These theories, influenced by economic policies, measures, and instruments such as taxation systems, provide a framework for understanding saving behaviours. The fundamental theoretical frameworks comprise the absolute income hypothesis, first postulated by Keynes in 1936, which posits that an individual's present income predominantly dictates their level of consumption. In contrast, the relative income hypothesis, first proposed by Duesenberry in 1949, suggests that it is an individual's income level in relation to others that impacts their consumption decisions. Additional insights are provided by Friedman's (1957) permanent income hypothesis and Modigliani and Brumberg's (1954) life cycle hypothesis, which posit that individuals strategise their savings and consumption by their anticipated lifetime income and savings requirements, respectively. In conclusion, Barro's (1974) refinement of the Ricardian equivalence hypothesis posits that the impact of government borrowing on aggregate consumption is negligible; instead, it causes a modification in the timing of taxation. Every one of these hypotheses enhances our comprehension of saving behaviours more intricately by accounting for various variables, including present economic conditions, anticipated future income, and social comparisons.

A critical factor often scrutinised in the exploration of household savings is the relationship between savings and income levels or the income growth rate. This line of inquiry is deeply rooted in the foundational work of Keynes (1936), who significantly advanced modern economic analysis by linking the consumption function directly to current income. By developing the absolute income hypothesis (AIH), Keynes posited that savings are the remainder of income after consumption expenditures. According to this hypothesis, consumers allocate a proportion of their income towards consumption, classifying any unspent earnings as savings. This

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theory has been extensively discussed and analysed in the literature, with various scholars elaborating on, critiquing, and building upon Keynes' original concepts. Notably, Hernando et al. (2018) provide a contemporary examination of the AIH, reaffirming its relevance in understanding consumer behaviour. In a comparable vein, additional investigations conducted by Friedman (1957) and Modigliani and Brumberg (1954) regarding the permanent income hypothesis and the life cycle hypothesis, respectively, have served to situate Keynes' theories within more extensive conceptual frameworks, thereby underscoring their lasting impact on empirical studies concerning savings behaviour and economic thought.

Duessenberry's (1949) relative income hypothesis (RIH) posits that a consumer's behaviour is influenced by the actions of others. This theory suggests that a consumer's spending and saving habits, relative to others and their own past behaviour, tend to remain stable over time (Lovrinčević, 2000). Essentially, individuals often increase their consumption at the expense of savings to maintain or improve their standard of living. This drive is fuelled by a constant desire for a higher level of consumption and a reluctance to reduce previous spending habits (Pojatina, 2000).

Given that Keynes' theory of absolute income ignores the influence of interest rates and future income in making decisions about savings and consumption, economic analysts' reflections led to the development of an intertemporal approach to consumption and savings (Hernando et al., 2018). Under this approach, the permanent income hypothesis (Friedman, 1957) and the life cycle hypothesis (Modigliani and Brumberg, 1954) were developed, introducing heterogeneity with respect to consumer age groups.

In 1957, Friedman presented his *permanent income hypothesis* (PIH), which established the relationship between consumption and both present and future income. Thus, Friedman divides income and consumption into permanent and transitory parts (Ozcan, Gunay and Ertac, 2003). Permanent income is that which can be spent without a change in the size of the wealth, i.e., permanent income represents the present value of lifetime income, while the transitory part of income represents the difference between current and permanent income. Loayza, Schmidt-Hebbel and Servén (2000b) stated that this hypothesis predicts that higher future income (higher income growth rate in the future) reduces today's savings.

The *life cycle hypothesis* (LCH) was originally explained by Modigliani and Brumberg (1954) and then presented in more detail in the works of Ando and Modigliani (1963), Modigliani (1986) and Modigliani and Brumberg (1990). According to this hypothesis, an individual strategizes his savings and consumption throughout his life cycle to guarantee an adequate level of consumption during his adulthood and later years. This hypothesis emphasizes the importance of pension savings accumulation. Proximity to retirement increases the propensity to save during the active working years. The individual will begin to utilize the earned income, or the net funds accumulated during their years of employment, upon retirement. Household

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income growth is age-dependent, and savings decline precipitously and become negative after retirement (Koski, 2016). As a result, an individual's consumption is constrained by the resources available to them at a particular moment. Furthermore, their consumption pattern can be described as bell-shaped: they anticipate amassing greater savings during their working years, but lower levels of savings during their youth and old age (Ozcan, Gunay and Ertac, 2003).

Barro-Ricardo's equality hypothesis (or *Ricardian equivalence hypothesis*, REH) was originally developed by Ricardo (1821) and was later supplemented with the help of Barro (1974). This hypothesis establishes a connection between public and private costs. According to this theory, agents plan their economic behaviour depending on their expectations about the future moves of the government (Koski, 2016). For example, if the government implements an expansionary fiscal policy that includes debt-financed tax cuts, households are assumed to redirect the increase in disposable income into consumption. According to this theory, households are aware that the government has taken on debt and expect a future tax increase (Koski, 2016).

Empirical research does not always support the conclusions of the stated theories. Hernando et al. (2018) state that in the case of insolvent households, consumer decisions are guided by current and not permanent income as dictated by the theory of permanent income. It is precisely for this reason that the assumptions of the mentioned models and theories were improved by introducing additional determinants that influence the decisions of the population, such as consumption habits, the substitution effect between private and public consumption, various forms of uncertainty (such as inflation or GDP volatility) that encourage savings for risk insurance, then consumer heterogeneity and financial imperfections.

The following section draws on theoretical and empirical studies to present a concise overview of key savings determinants and explain their mechanisms.

The positive effect of **income** increases on household savings is notable, with richer individuals tending to save more, as observed by Kolasa and Liberda (2014). This phenomenon is particularly evident in poorer countries where significant income rises enable individuals who previously couldn't afford necessities to balance their consumption curve through savings accumulation. Additionally, analysis of higher-income countries reveals a tendency for the population to save more, as Edwards (1996) noted.

Regarding the impact of the **income or productivity growth rate**, the life cycle model suggests that increases in this factor are more likely to influence the behaviour of actively employed individuals than that of retirees. Kolasa and Liberda (2014) stress that productivity growth can positively affect household savings by enabling individuals to save larger amounts. However, if the growth in income or productivity sets the expectation for higher future income, it might lead to a

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decrease in savings among employed individuals, according to Hernando et al. (2018). This expectation could also lead to increased debt among these individuals, resulting in lower overall savings.

An improvement in the **terms of trade**, characterised by an increase in the relative price of goods exports versus goods imports, leads to a bolstered trade balance. This can be viewed as an influx of foreign money positively impacting income. Hernando et al. (2018) suggest that a permanent change in this area could shift the potential positive effect on savings towards consumption. Nonetheless, a rise in savings might be anticipated in the face of an economic shock. Grigoli, Herman and Schmidt-Hebbel (2016) find that improved terms of trade correlate with heightened savings, particularly when the improvement pertains to the transitory component of income. Additionally, the Harberger-Laursen-Metzler effect indicates that a worsening of the terms of trade can reduce savings due to a fall in disposable income, especially if the marginal propensity to consume is below one, as Kolasa and Liberda (2014) noted.

In the realm of **demography**, various determinants have been identified as significant in prior research, including the proportions of the elderly and young populations, life expectancy, and urbanization rates. According to life cycle models of consumer behaviour, savings are markedly lower among the relatively young and the elderly, the shares of the younger and older population thus having a negative effect on overall household savings. However, Modigliani (1986) notes that the actual life cycle behaviour patterns derived from micro-level data often deviate from the standard model's predictions and vary widely across different countries. Generally, an increase in the proportion of young and elderly individuals tends to diminish the portion of financial assets used to sustain consumption levels, thereby reducing savings, as observed by Hernando et al. (2018). However, a rise in life expectancy tends to boost savings at all ages due to precautionary motives, as shown by Bloom, Canning and Graham (2003). Conversely, heightened urbanization may lead to lower savings through two pathways: by broadening consumer choices and by diminishing the necessity for precautionary savings.

The real interest rate, or **rate of return**, has a multifaceted impact on savings, mediated through several distinct channels. The substitution effect suggests that when interest rates rise, the cost of current consumption increases relative to future consumption, thus incentivizing individuals to save more. This effect is counterbalanced by the income effect, which diminishes the urge to save by allowing individuals to save less today yet still achieve the same future value due to increased interest earnings. The overall influence of interest rates on savings is therefore complex and ambiguous, a finding echoed in a variety of empirical studies, including those by Loayza, Schmidt-Hebbel and Servén (2000b), Grigoli, Herman and Schmidt-Hebbel (2014), Hernando et al. (2018), and Aghion et al. (2016), which also highlighted the often statistically insignificant relationship between interest rates and savings in certain contexts.

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Financial development, or the liberalization of financial markets, presents a nuanced picture regarding its effects on private savings. Edwards (1995) and Jappelli and Pagano (1994) argue that financial integration can expand saving opportunities, yet simultaneously diminish the need for precautionary savings by providing more effective insurance mechanisms. The impact of financial liberalization is not uniform, as evidenced by studies such as Loayza, Schmidt-Hebbel and Servén (2000a) and Beck, Demirgüç-Kunt and Levine (2007), which show that the easing of credit constraints may lead to a decrease in savings rates. Key indicators used to assess the impact of financial development on savings include the private sector's indebtedness (% of GDP) and the monetary aggregate M2 (% of GDP), where a negative coefficient suggests a reduced need for savings.

The effects of **fiscal policy** on savings are informed by the anticipation of future tax obligations due to current government borrowing, as postulated by Ricardo's equivalence hypothesis. This perspective is supported by research from Schrooten and Stephan (2004) and Rocher and Stierle (2015), which indicates that public sector savings can substantially offset private savings in both the short and long term. Additionally, a fiscal deficit's negative influence on savings, where an increase in the deficit due to tax cuts or higher government spending encourages individuals to save rather than spend, is corroborated by studies from Afonso and Jalles (2013) and Bernheim (1989). This body of research underscores the complex interplay between fiscal policy and private savings behaviour.

Uncertainty plays a pivotal role in shaping the saving decisions of individuals, often assessed through indicators such as inflation and unemployment rates. Inflationary conditions typically prompt individuals to increase their savings as a precautionary measure to safeguard their future financial well-being, leading to a widely observed positive correlation between inflation and savings levels, as evidenced by studies like Aizenman and Marion (1993) and Bandiera et al. (2000). Similarly, the unemployment rate serves as another barometer of economic uncertainty. An uptick in unemployment can initially lead to a surge in savings as individuals curtail consumption to buffer against potential job loss, a phenomenon explored in depth by Lusardi, Schneider and Tufano (2011) and Mody, Ohnsorge and Sandri (2012). However, this boost in savings may proveshort-lived over the long haul. Extended periods of unemployment might force individuals to deplete their savings to meet essential living costs, a scenario detailed in Pitonakova (2017) and further analysed by Chetty and Szeidl (2007).

In recent years, researchers have made significant efforts to contribute to a better understanding of the determinants of saving. Thus, numerous studies have been conducted on the determinants that influence savings at the level of individual countries or at the level of groups of countries. The table 1 presents a summary of individual determinants, examples of specific indicators, the sources from which they were taken, as well as the expected mode of action.

Table 1
Determinants of household savings in empirical findings

Category	Determinant	Expected sign	Empirical findings
Income	Disposable income: level	+	(0) 5, 6; (+) 1, 2, 3, 7, 12, 13, 15, 16, 17, 19
	Disposable income: temporary/permanent	+/0 or -/0	(0) 7, 15 / (0) 7 (+) 15
	GDP/disposable income growth	Ambiguous	(-) 11, 13, 16; (0) 5, 6; (+) 2, 3, 4, 7, 10, 12, 15, 19, 22
	Terms of trade index: level	Ambiguous	(0) 15, 16; (+) 2, 6, 7, 8, 17, 19, 22
	Terms of trade index: temporary/permanent	+/0 or -/0	(+) 7, 15 / (+) 7, 15
	Income inequality	Ambiguous	(0) 3, 15
	Tourism revenues	Ambiguous	
	Personal remittances	Ambiguous	(0) 16
Wealth	Household wealth	-	(0) 2, 6; (-) 17
	Home ownership	-	(0) 16
Rate of return	Real interest rate	Ambiguous	(-) 7, 8; (0) 1, 2, 4, 5, 6, 9, 14, 19; (+) 11, 15, 18
	Government bond yield	Ambiguous	(-) 16
Uncertainty	Inflation	Ambiguous	(-) 16; (0) 1, 2, 3, 8; 14, 16, 19; (+) 4, 7, 11, 13, 15, 17, 18
	Unemployment rate	+	(0) 18; (+) 13, 16, 21
	GDP volatility	+	(0) 17
	Real oil price	-	(-) 15; (0) 19
	Consumer confidence	-	(-) 23
Financial liberalization	Loans to households	-	(-) 3, 5, 7, 9, 12, 17, 19; (0) 15
	Market capitalization	Ambiguous	
	Flow of loans to households	-	(-) 15
Foreign borrowing constraints	Capital account deficit	-	(-) 1, 2, 3, 10; (+) 18
	Capital flow restrictions	+	(0) 7, 15
Demography	Young age dependency (a)	-	(-) 7, 12
	Old age dependency (b)	-	(-) 4, 7, 13, 14, 15, 19, 20; (0) 8, 11, 12, 21
	Age dependency (a+b)	-	(-) 2, 3, 10; (0) 5, 6, 16
	Prime savers	+	
	Urbanization rate	-	(-) 3, 7, 11, 12, 15; (0) 19; (+) 17
	Life expectancy	+	(0) 16; (+) 19
	Participation of +65 in labour market	-	(+) 21

Category	Determinant	Expected sign	Empirical findings
Fiscal policy	Budget balance	-	(-) 2, 5, 6, 13, 16, 18, 19, 22
	Public saving	-	(-) 1, 3, 4, 7, 8, 10, 14, 17; (0) 15
	Public debt	-	(-) 2, 6, 13, 16
Government expenditure	Welfare expenditures	Ambiguous	(-) 2, 6, 13, 16
	Health expenditures	Ambiguous	(-) 19; (0) 15
	Education expenditures	Ambiguous	(0) 15
	Social protection expenditures	Ambiguous	(-) 3, 4, 5, 16, 21

Notes: (1) Corbo and Schmidt-Hebbel (1991), (2) Masson, Bayoumi and Samiei (1995), (3) Edwards (1996), (4) Callen and Thimann (1997), (5) Baillu and Reisen (1998), (6) Haque, Pesaran and Sharma (1999), (7) Loayza, Schmidt-Hebbel and Servén (2000), (8) de Serres and Pelgrin (2003), (9) Bandiera et al. (2000), (10) Schrooten and Stephan (2005), (11) Niculescu-Aron and Mihaescu (2012), (12) Samwick (2000), (13) Kessler, Perelman and Pestieau (1993), (14) OECD (2001), (15) Grigoli, Herman and Schmidt-Hebbel (2014), (16) Rocher and Stierle (2015), (17) Kolasa and Liberda (2015), (18) Kukk and Staehr (2015), (19) Hernando et al. (2018), (20) Kharazi et al. (2022), (21) Fredriksson and Staal (2021), (22) Oinonen and Viren (2022), (23) Vanlaer, Bielen and Marneffe (2020).

3 EMPIRICAL STRATEGY

Empirical analysis of the determinants of household savings was conducted on a panel dataset of 26[1] EU member states covering the period from 2000 to 2021 based on annual data. The approach based on the reduced form of linear equations allows for a wider range of savings determinants. Thus, the balanced set of panel data consists of 535 observations.

3.1 DATA AND STYLIZED FACTS

The household savings rate, serving as the dependent variable in the cross-country panel analysis, is defined in accordance with Eurostat's standards to ensure international comparability. According to this definition, gross household savings are identified as the excess of gross disposable income over final consumption expenditure, with adjustments made for variations in households' net equity in pension fund reserves. Consequently, the household savings rate is derived by calculating the proportion of these gross savings to the adjusted gross disposable income, incorporating adjustments for changes in the net equity of households in pension fund reserves[2].

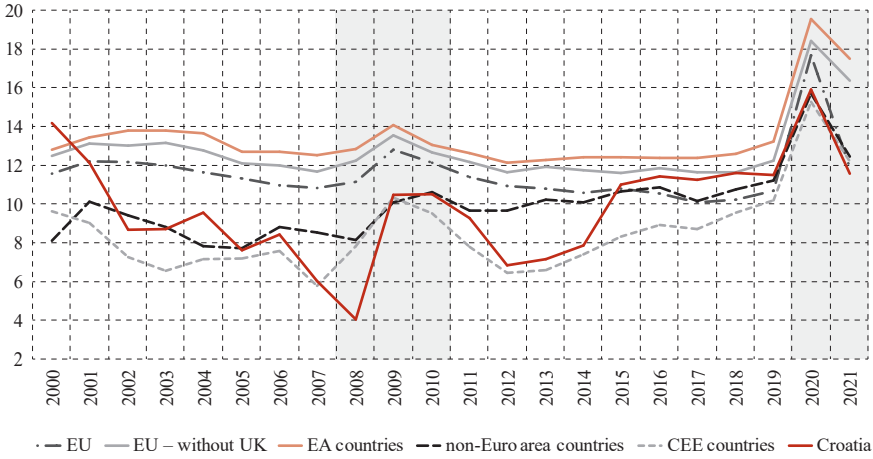
While a standardised definition of household savings is employed to facilitate comparison, notable differences across countries may persist, largely attributed to institutional variations. Such disparities can mask the fundamental similarities in savings behaviour across nations, leading to significantly divergent savings rates. Key institutional factors contributing to these differences include the scale of the shadow economy, variances in pension systems, the provision of social services in kind, and the flow of remittances.

[1] EU member states that are not included in the panel analysis are Cyprus and Malta due to the limited and insufficient data for most of the variables included in the empirical analysis. Despite Brexit, the United Kingdom is included in the performed estimation given the fact that the UK was, for the most part of the considered time frame, the EU member state. The same estimation was performed, excluding the UK, and the results did not differ much from the ones presented in this paper. Analysis without the UK is available upon request.
[2] Since the national accounts correct gross household savings for the net equity changes in pension fund reserves, the latter is added to the denominator of the household saving rate.

Figure 1 illustrates the household saving trends across various country groups and at an aggregate level. It is generally observed that nations or groups characterised by a higher disposable income per capita tend to exhibit greater levels of savings. The observed discrepancy in savings rates between the EA and the wider EU, with CEE countries demonstrating the lowest rate of savings, can be elucidated through the interaction between institutional factors and levels of disposable income. Increased disposable income, which acts as a buffer during periods of economic difficulty, could potentially account for the more significant fluctuations in the savings rate that are observed in CEE countries and Croatia.

Figure 1

Household savings (in % of household disposable income)



Note: The periods marked in light grey indicate periods of structural changes in household savings (periods of financial crisis and pandemics).

Source: Eurostat, author's calculations.

Following the Global Financial Crisis, saving rates markedly changed, including a notable increase in savings accumulation triggered by the pandemic. These trends reflect the long-lasting influence of the financial uncertainty that began in 2008. In the EU and EA, the rebound from the GFC was evident by 2010, with household savings reverting to levels seen before the crisis. However, in CEE countries and Croatia, the repercussions of the GFC persisted longer, with savings rates not returning to their pre-crisis state until 2012.

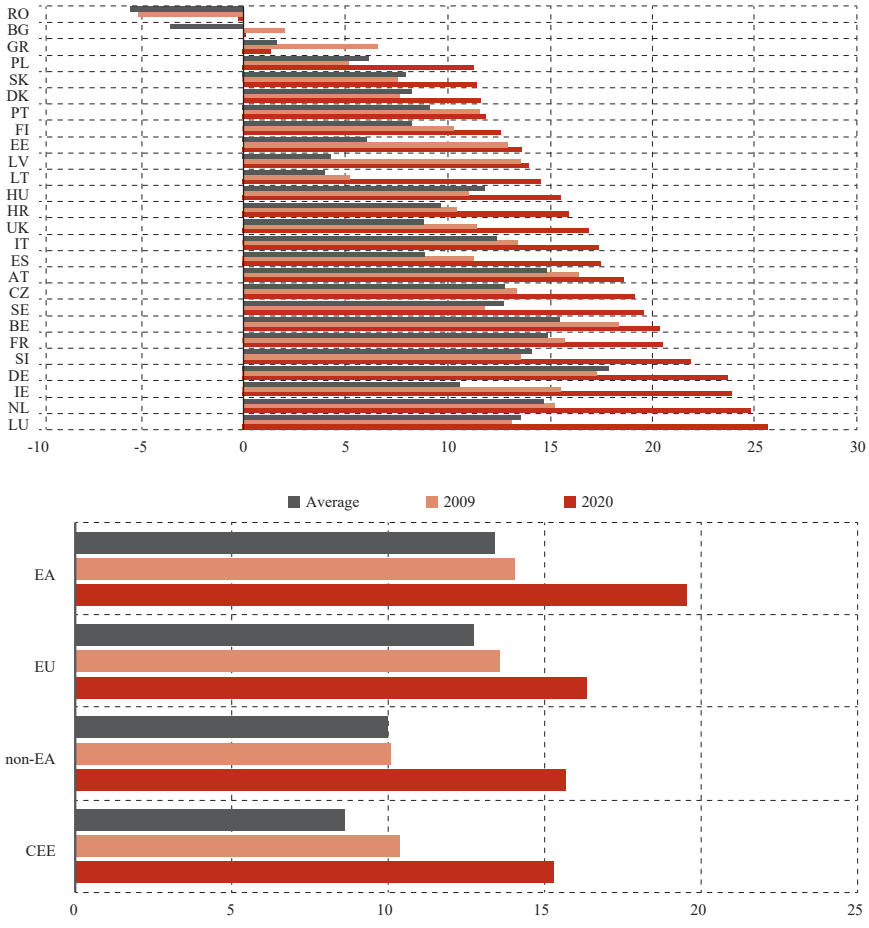
The motivations behind the increase in savings during the pandemic differed significantly from those observed during the GFC, where precautionary saving was predominant. During the pandemic, lockdowns and restrictions on movement, coupled with limited access to goods and services due to stringent epidemiological measures, reduced household consumption. At the same time, fiscal support measures effectively sustained household incomes. As a result, the notable rise in savings during this period was primarily due to "forced" savings, driven by constraints on spending opportunities rather than purely by precautionary motives.

Over the period from 2000 to 2021, households in the EU saved, on average, 12.7% of their disposable income. In the wake of the financial crisis in 2009, this saving rate saw an uptick of 0.8 percentage points, with households in CEE experiencing a more excessive increase of 1.7 percentage points. This variation largely stems from the differing effects of the GFC, which exacerbated the financial pressures on households in regions with lower disposable incomes and higher unemployment rates, particularly in comparison to those in higher-income areas.

The onset of the pandemic marked a significant turning point, leading to a widespread surge in savings across all the regions under study. This increase, depicted in figure 2, amounted to approximately 5.5 percentage points of disposable income, reflecting the broad economic impact of the pandemic on household saving behaviours.

FIGURE 2

Household savings rate across countries and country groups (in % of household disposable income)



Notes: Average refers to the average household saving rate for the time period from 2000 until 2021.
Source: Eurostat, author's calculations.

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The core explanatory variables chosen for the empirical analysis cover the main determinants that seem to be most prevalent in savings literature. Thus, the baseline specification includes nine variables that cover various categories of saving determinants: *income*, *demographics*, *financial variables*, *macroeconomic uncertainty* and *fiscal policy*. Given the importance of income in determining savings, there are three variables from the income category – namely, real disposable income ("household disposable income"), real income growth (proxied by "real GDP growth") and the terms of trade index. Age dependency over working age population (including both young and old-age dependency) represents the demographic factor in explaining households' motives to save. A financial sector development factor is reflected in the stock of domestic credit to the household sector as a proportion of GDP ("loans to households"), while the real interest rate on deposits ("real interest rate") presents the rate of return category. Government surplus as a share of GDP ("budget balance") represents the fiscal policy measure to check for the Ricardian equivalence. Considering recent trends in saving rates, two variables are specifically included to address macroeconomic uncertainty: inflation, serving as a conventional indicator of macroeconomic instability, and consumer confidence, an underexplored variable that captures a critical aspect of household savings behaviour. Both variables are assessed as deviations from their long-term averages to gauge their impact on savings.

Table 2 showcases the pairwise correlations among these fundamental determinants of household savings, providing an empirical foundation for analysing the intricate relationships influencing savings behaviours.

The model's initial core variables are expanded to encompass a wider range of factors that influence household savings, addressing the complexity of savings behaviour and the ambiguous or underexplored effects identified in prior research. The baseline model now integrates novel variables such as the Chinn-Ito index, market capitalisation, and the proportion of prime savers, which have not traditionally been analysed in savings studies.

Table 2

Correlation matrix of core household saving determinants

	Household saving	Household disposable income	Real GDP growth	Terms of trade index	Age dependency	Real interest rate	Loans to households	Budget balance	Inflation	Consumer confidence
Household saving	1.00	0.54	-0.43	0.51	0.10	0.20	0.38	0.12	-0.41	0.25
Household disposable income	0.45	1.00	-0.29	0.36	0.36	0.11	0.33	0.25	-0.54	-0.05
Real GDP growth	-0.30	-0.39	1.00	-0.34	-0.17	-0.30	-0.39	0.12	0.41	0.24
Terms of trade index	0.43	0.42	-0.18	1.00	-0.14	0.10	0.08	0.08	-0.32	0.40
Age dependency	0.11	0.29	-0.05	0.02	1.00	-0.08	0.48	0.18	-0.01	-0.14
Real interest rate	0.06	-0.22	-0.28	-0.15	-0.17	1.00	0.03	-0.32	-0.31	0.00
Loans to households	0.31	0.42	-0.38	0.11	0.31	-0.03	1.00	0.25	-0.43	-0.24
Budget balance	-0.09	0.07	0.32	0.01	0.07	-0.18	0.00	1.00	0.05	0.21
Inflation	-0.05	-0.17	0.04	-0.20	-0.08	0.06	-0.09	0.10	1.00	-0.15
Consumer confidence	-0.08	-0.01	0.54	0.00	0.08	-0.28	-0.15	0.43	-0.04	1.00

Note: Panel sample in lower triangle, cross section in upper triangle. Household saving refers to household saving in % of household disposable income. Household disposable income and real GDP growth as per capita. Loans to households and governments' budget balance in % of GDP.

Further dissection of key baseline variables enriches the understanding of savings dynamics. Real household disposable income and the terms of trade index, for example, are segmented into permanent and temporary components, as suggested by Grigoli, Herman and Schmidt-Hebbel (2014). The age dependency ratio is refined to include separate measures for young (ages 15-24) and old-age (ages 65+) dependency, in addition to the proportion of prime savers (ages 45-65), offering a more nuanced view of demographic impacts on savings. The analysis extends to additional income-related variables, including personal remittances, tourism revenue, the Gini index, and net changes in pension funds, acknowledging income's pivotal role in savings. The exploration of wealth effects incorporates variables like household net wealth and home ownership. The yield on government bonds is examined as another aspect of the rate of return category. Uncertainty's influence on savings is probed through the unemployment rate, GDP volatility, and real oil price fluctuations. Financial variables, critical to savings theories, are examined from various perspectives, including domestic and foreign borrowing constraints, financial liberalization, and market depth. This leads to credit flows being included in households and market capitalization alongside the baseline's domestic credit stock. International financial integration is assessed through the capital account balance and Chin-Ito and Quinn indices. Demographic structure variables, such as urbanization rate, life expectancy, and the participation rate of the +65 population, are also considered for their potential impact on savings changes. Finally, the model examines additional fiscal policy variables, including public savings, public debt, and expenditures on education, healthcare, social protection, and overall welfare spending, to provide a comprehensive view of the multifaceted determinants of household savings.

For a full list of variables included in the empirical analysis, along with their definitions, measures, descriptive statistics, and sources, see table A1 in appendix.

3.2 MODEL AND ESTIMATION METHODOLOGY

This section presents the estimation strategy and reasoning behind the choice of the estimator in which the saving rate of household sector is regressed on its lagged value, explanatory variables (both endogenous and exogenous) discussed in previous section as well as time and country fixed effects. Given the theory on personal savings and the characteristics of the variables entering the model it is important to keep in mind several specifications that a model needs to address among which are (i) persistence of the dependent variable of interest (household saving rate), and (ii) endogeneity present among couple of regressors.

Since it is a dynamic panel model, the dependent variable with a lag of one or more time periods (lagged dependent variable) depends on the properties of the dependent variable itself. The use of internal instruments controls common endogeneity, that is, the instrumental variables of the endogenous variables are the same endogenous variables but with a time shift. A dynamic panel containing a dependent variable with one time lag has the form:

$$y_{i,t} = \gamma y_{i,t-1} + \beta X_{i,t} + \delta Z_{i,t} + c_i + \tau_t + u_{it} \qquad (1)$$

where $y_{i,t-1}$ is a lagged dependent variable, $X_{i,t}$ is a covariance matrix of endogenous (as well as predetermined) variables while $Z_{i,t}$ presents a matrix of strictly exogenous variables for country i at time t. $u_{i,t}$ implies relational errors of independently and identically distributed random variables. Key variables such as real disposable income per capita, real GDP growth per capita, real interest rate, household loans, government budget balance, and consumer confidence form the matrix of endogenous variables $X_{i,t}$, while variables like age dependency, terms of trade, and inflation are considered strictly exogenous. Given the potential simultaneous determination of certain explanatory variables with the dependent variable, the model includes the dimension of common endogeneity among regressors. Furthermore, the model accounts for possible unobserved country-specific (c_i) and time effects (τ_t) correlated with the regressors.

The model, as presented in equation (1), adopts a framework akin to those in the studies by Loayza, Schmidt-Hebbel and Servén (2000a), Grigoli, Herman and Schmidt-Hebbel (2014), and Kukk and Staehr (2015), utilizing the differenced Arellano-Bond generalized method of moments (AB GMM) estimation strategy, originally formulated by Arellano and Bond (1991). This estimator is particularly valued, as noted by Roodman (2006), for its efficacy in dynamic panel models, which are often characterized by a limited number of time periods and an extensive number of observational units. The AB GMM estimator is adept at addressing several econometric challenges inherent in such models, such as endogeneity, serial correlation, panel specificity and dynamic dependencies. As for endogeneity, it effectively handles endogenous regressors by using lagged values of the variables as instruments, thus mitigating bias that arises from the correlation between the regressors and the error term. The estimator is designed to counteract the issue of serial correlation in the error terms, a common problem in time series data, ensuring that the estimations remain consistent. Furthermore, it accommodates the panel nature of the data, acknowledging the individual heterogeneity across cross-sectional units by differencing, which helps in eliminating unobserved fixed effects that could confound the model's estimations. Lastly, the method is particularly suited for models where current outcomes are influenced by past values, allowing for the inclusion of lagged dependent variables as regressors while addressing the potential biases they introduce. By employing this methodology, the model is robustly equipped to navigate the complexities and intricacies associated with dynamic panel data analysis, providing reliable and insightful results that contribute to our understanding of the underlying phenomena.

On the other hand, as Kukk and Staehr (2015) note, the AB GMM estimator and other GMM estimators developed for dynamic panels may provide biased coefficient estimates in panels with a small number of cross-sections. The differenced AB GMM estimator is as a result supplemented with standard fixed effect estimations (LSDV) as well as with the bias-corrected LSDV estimations. However, these supplemented estimators do not address the problems highlighted in the beginning of this section. Namely, the inclusion of the lagged dependent variable as a regressor means that the estimators with fixed effects least squares could

potentially suffer from the Nickell bias which can result in the coefficient of the lagged dependent variable being downward bias (Nickell, 1981). Secondly, there is a possible reverse causality in which personal savings may affect other determinants entering the model, leading to a rising complexity in the identification of cause and effect. As a result, these alternative specifications are part of the robustness and sensitivity check.

With the aim of investigating household savings' determinants during specific periods of time or for selected groups of countries in comparison with a model based on a complete sample, the specified equation under (1) can be expanded as follows:

$$y_{i,t} = \gamma y_{i,t-1} + \beta X_{i,t} + \delta Z_{i,t} + \xi D_{i,t} y_{i,t-1} + \varphi D_{i,t} X_{i,t} + \omega D_{i,t} Z_{i,t} + c_i + \tau_i + u_{it} \quad (2)$$

where ξ, φ i ω represent coefficients of interactive effects. Dummy variable, $D_{i,t}$, is not included as a specific independent variable since it would be perfectly correlated with time fixed effects τ_i or with country fixed effects (c_i).

Observing the effect of variable $X_{i,t}$ from a specific time period or country group $D_{i,t}$, on the dependent variable $y_{i,t}$, involves considering the combined influence of coefficients β and φ. Similarly, incorporating the impact of variable $Z_{i,t}$ within the $D_{i,t}$ group on the dependent variable entails examining the aggregate effect of δ and ω.

4 ESTIMATION RESULTS

4.1 BASELINE SPECIFICATION

This section presents the results of estimations in which the saving rate of the household sector is regressed on its lagged value, explanatory macroeconomic variables (both endogenous and exogenous) discussed in section 3.1 as well as time and country fixed effects.

Table 3 gives the results of various estimators. In all regressions, the dependent variable is the household saving rate as defined in section 3.1. Thus, columns (1) and (2) present estimations of OLS with fixed effects (or LSDV), while columns (3), (4) and (5) are the result of three types of the bias-corrected LSDV (or LSDVc) – Arellano-Bond, Anderson-Hsiao and Blundell-Bond. Finally, column (6) is the preferred baseline specification performed with AB GMM estimator. As elaborated in the previous section, the differenced AB GMM estimator should be preferred since it allows dynamic panel specification with addressed endogeneity issues.

Results are robust across different estimation methodologies. The introduction of fixed-time effects has not resulted in significant alterations. All statistically significant variables show the same signs of coefficients across estimations. Moreover, most variables show similar coefficient magnitudes as well.

TABLE 3

Determinants of household saving; different estimators

	(1)	(2)	(3)	(4)	(5)	(6)
	OLS FE		LSDVc			GMM
	with country effects	with time and country effects	Arellano-Bond	Anderson-Hsiao	Blundell-Bond	Arellano-Bond GMM
Lag dependent variable	0.605***	0.726***	0.647***	0.649***	0.675***	0.569***
	(-0.060)	(-0.057)	(-0.034)	(-0.037)	(-0.032)	(-0.055)
Household disposable income	0.073***	0.057***	0.071***	0.075***	0.070***	0.072***
	(-0.086)	(-0.013)	(-0.079)	(-0.091)	(-0.076)	(-0.094)
Real GDP growth	0.407***	0.473***	0.415***	0.418***	0.425***	0.377***
	(-0.042)	(-0.040)	(-0.043)	(-0.047)	(-0.040)	(-0.044)
Terms of trade index	0.021	0.019	0.013	0.009	0.017	0.026
	(-0.027)	(-0.019)	(-0.028)	(-0.031)	(-0.027)	(-0.029)
Age dependency	0.067	-0.034	0.061	0.065	0.053	0.072
	(-0.046)	(-0.042)	(-0.041)	(-0.048)	(-0.040)	(-0.049)
Real interest rate	0.360***	0.396***	0.356***	0.360***	0.360***	0.337***
	(-0.064)	(-0.056)	(-0.050)	(-0.054)	(-0.047)	(-0.063)
Loans to households	-0.052**	-0.023**	-0.048***	-0.054***	-0.049***	-0.055***
	(-0.019)	(-0.015)	(-0.013)	(-0.014)	(-0.012)	(-0.019)
Budget balance	-0.254***	-0.107***	-0.241***	-0.243***	-0.237***	-0.285***
	(-0.059)	(-0.036)	(-0.040)	(-0.044)	(-0.038)	(-0.061)
Inflation	-0.424	-0.560	-0.467	-0.289	-0.333	-0.293
	(-0.020)	(-0.014)	(-0.015)	(-0.012)	(-0.011)	(-0.012)
Consumer confidence	-0.071***	-0.067***	-0.072***	-0.072***	-0.074***	-0.068***
	(-0.019)	(-0.016)	(-0.015)	(-0.017)	(-0.014)	(-0.020)
Time fixed effects	No	Yes	No	No	No	No
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
N	535	535	535	535	535	509
r2	0.674	0.793	.	.	.	.

*Notes: Standard errors in parentheses are corrected for heteroskedasticity and autocorrelation of error effects. These estimations include the Windmeijer's correction of the covariance matrix. All estimates include a constant effect. ***, **, * next to the coefficients indicate a 1, 5 and 10% significance level. The lagged dependent variable (i.e., household saving rate) refers to the lagged rate by one time period (year). Coefficients of log-transformed variables (household disposable income, terms of trade index, inflation and consumer confidence) have already been divided by 100.*

In the preferred analysis detailed in column (6), the model examines nine variables, identifying seven with significant effects at the one per cent level, resonating with established savings behaviour literature. The persistence of the lagged savings rate, with a coefficient of 0.57, underscores its enduring impact, echoing findings by Loayza, Grigoli, and Kukk, and highlighting a gradual adjustment in household savings accumulation. The role of income is pronounced; a one percentage point increase in real household disposable income per capita leads to a 0.07 percentage point rise in the savings rate, a finding that aligns with the research of Corbo and Schmidt-Hebbel (1991) and Edwards (1996), among others. Similarly, real GDP growth's positive impact on savings rates, increasing them by 0.38 percentage points for every percentage point rise, supports the conclusions of Oinonen and Viren (2022) and contrasts with the views of Niculescu-Aron and Mihaescu (2012).

While real interest rates often yield ambiguous results in literature, in this model, a one percentage point increase translates to a 0.34 percentage point increase in the savings rate, aligning with the positive findings of Grigoli, Herman and Schmidt-Hebbel (2014) and diverging from the typical consensus of insignificance noted by Bandiera et al. (2000). The negative impact of household loans, decreasing savings rates by 0.06 percentage points per percentage point increase, and the positive effect of government budget balance, enhancing savings rates by 0.29 percentage points per percentage point increase, are consistent with broader empirical evidence, albeit with magnitudes that challenge the rational expectations hypothesis. Consumer confidence reduces the savings rate by 0.07 percentage points per percentage point increase, which highlights the precautionary saving motive in uncertain times, in alignment with the findings of Vanlaer, Bielen and Marneffe (2020).

4.2 ADDITIONAL HOUSEHOLD SAVING DETERMINANTS

Delving deeper into the determinants of savings, as discussed in section 3.1, the analysis further dissects core variables to uncover the primary factors influencing savings behaviour.[3] Thus, the differentiation between permanent and temporary components in income and terms of trade provides an insightful lens through which to understand savings behaviours. According to the permanent income hypothesis (PIH) and life cycle hypothesis (LCH), individuals treat income perceived as permanent differently from temporary income fluctuations. The tendency to consume rather than save from permanent increases in income and terms of trade is rooted in the PIH, which posits that consumers plan their consumption based on their long-term income expectations. This theory is exemplified by the work of Corbo and Schmidt-Hebbel (1991), who found that households are more likely to adjust their consumption patterns rather than their savings in response to permanent income changes. Similarly, the LCH suggests that individuals aim to smooth consumption over their lifetime, leading to higher consumption from permanent income increases, as supported by Loayza, Schmidt-Hebbel and Servén (2000).

[3] Complete results of all estimations with additional determinants are available upon request.

On the other hand, the propensity to save temporary fluctuations in these variables aligns with precautionary saving motives, where individuals save temporary income boosts to hedge against future uncertainties. This behaviour is consistent with Edwards (1996) and Hernando et al. (2018), who observed an increase in savings rates in response to temporary income changes, reflecting a safeguard against future income volatility.

Tourism revenues and personal remittances offer unique insights into the dynamics of savings. The negative impact of tourism revenues on savings rates may be attributed to the perception of tourism as a stable, permanent source of income for economies heavily reliant on this sector, encouraging more consumption as posited by the PIH. Conversely, personal remittances often represent a temporary, albeit substantial, boost to household income in recipient countries. This temporary nature likely encourages saving, as households may view remittances as non-recurring windfalls to be saved for future needs or investment opportunities, an observation that finds resonance in the analysis by Rocher and Stierle (2015) regarding remittance behaviours.

The "wealth effect," as confirmed within the wealth category, reflects a fundamental economic principle where increased wealth leads to higher consumption. This effect is grounded in both the PIH and LCH, as wealthier households are presumed to have reached a level of financial security that enables higher current consumption, sacrificing savings in the process. The empirical findings by Rocher and Stierle (2015) further substantiate this, highlighting how wealth accumulation influences saving and consumption decisions.

Macroeconomic uncertainty's significant role in influencing savings behaviour underscores the importance of precautionary savings in economic theory. The positive relationship between unemployment rate, GDP volatility, and savings rates can be explained by the precautionary saving motive, where individuals increase their savings in response to economic uncertainty to protect against potential future income losses or adverse economic conditions. This behaviour is emblematically illustrated in the works of Kessler, Perelman and Pestieau (1993) and Kukk and Staehr (2015), which delve into how uncertainty propels individuals towards more conservative financial behaviours, notably increased savings. Conversely, a rise in real oil prices, serving as a proxy for global events, tends to lower savings rates, possibly due to households utilising savings to stabilise consumption, which aligns with results found in Grigoli, Herman and Schmidt-Hebbel (2014).

The Chinn-Ito index, indicative of a country's openness to international financial transactions, positively influences savings rates by enhancing domestic financial market efficiency and broadening access to diverse investment opportunities. Greater capital account openness can lead to potentially higher and more stable investment returns, encouraging individuals to save more. This openness also facilitates the global exchange of financial knowledge and practices, potentially fostering a savings-oriented culture domestically.

While age dependency did not significantly impact the baseline model, a deeper analysis reveals intricate dynamics. Consistent with the life cycle hypothesis (LCH), which posits that individuals accumulate savings primarily during their working years to fund retirement, an increase in the proportion of prime-age savers (typically defined as those in their most productive working years) positively influences the overall savings rate. This observation aligns with empirical findings from Samwick (2000), who highlighted the critical role of working-age populations in national savings rates. Conversely, a larger elderly population, particularly of the over-65s, tends to reduce personal savings rates, reflecting the consumption phase of the LCH where retirees spend their accumulated savings. However, interestingly, an extension in life expectancy at 65 and higher labour market participation among the elderly positively contribute to savings rates.

Transitioning to fiscal policy impacts, the interplay between public savings, government debt, and personal savings rates presents a complex picture. As noted earlier, the theory of Ricardian equivalence suggests that individuals perceive public savings and government debt as future tax liabilities, leading to an offset in private savings as individuals save less in anticipation of future tax burdens. This nuanced relationship is evidenced by the partial offset seen with changes in government budget balances, a phenomenon explored in the research of Masson, Bayoumi and Samiei (1995), who discuss the intricate effects of fiscal policy on private saving behaviours.

Furthermore, the influence of government spending, particularly on welfare, illustrates the multifaceted role of fiscal policy in shaping savings rates. An increase in welfare expenditure, especially on education, can decrease personal savings rates by reducing precautionary saving motives. This is in line with the Permanent Income Hypothesis (PIH), where individuals adjust their savings based on expected future income, which, in this case, is influenced by government spending patterns. The decrease in savings in response to increased welfare spending, driven by educational expenditures, resonates with the findings of Edwards (1996), who delves into the impact of government expenditure on consumer savings and spending behaviours, highlighting the significant role of social welfare policies in shaping economic outcomes at the household level.

4.3 TIME AND COUNTRY GROUP INTERACTIVE EFFECTS

In this section, differential effects in households' savings behaviour across diverse country groups and time periods are analysed. As explained in section 3.2, this is done by generating interaction terms between a dummy variable indicating a specific country group or time period and core variables from the baseline specification.

As highlighted earlier, it is important to investigate the driving force behind savings during the crisis's times. Although these challenging times might display similar levels of heightened uncertainty, loss of consumer confidence and overall

rising need for precautionary savings, the GFC and the pandemic crisis are, in fact, much more different than they may look at first glance. Moreover, even when the focus is solely on Covid-19, the years 2020 and 2021 show different saving effects.

The results in table 4 suggest that the 2008-2010 period of the GFC had a significant impact on some coefficients of household saving determinants. For instance, the persistence of the lagged dependent variable fell with a point estimate reduced from 0.57 to 0.52. According to Grigoli, Herman and Schmidt-Hebbel (2014) this could reflect a temporary decline in consumption and saving inertia. Along with that, the effect of the income level, GDP growth, and real interest rate fell significantly during the GFC period. At the same time, the terms of trade index and age dependency are significant in the crisis period compared to the non-crisis times, while consumer confidence and, especially, government budget balance increased their effect on the savings rate. For comparison, a one pp increase in government budget balance led to an increase in the savings rate of 0.48 during 2008-2010, as against the 0.35 during the non-crisis times. At the same time, the worsening of consumer confidence led to an increase of 0.14 pp in saving rate (compared to 0.06 during the non-crisis times).

During the Covid-19 pandemic, i.e. 2020-2021, the lagged household rate's persistence fell significantly to a point estimate of 0.42. At the same time, the positive impact of disposable income fell slightly by 0.05. The government budget balance increased its magnitude to a point estimate of -0.19 as against the non-pandemic time's estimated -0.17, reflecting the fiscal stimulus support to the economy, which, however, was not as great as that provided during the GFC. However, looking solely at 2020, it is possible to see that the effect of government support was, in fact, much closer to that provided during the GFC (point estimate of -0.47). Inflation also gained significance during this period, where a one-pp increase in inflation led to a 0.05 pp decrease in the savings rate. Looking at the further breakdown, it is notable that inflation started to make an impact during 2021 when there was an overlap of supply bottleneck disruptions and increased consumption. Out of other variables, it is important to emphasise the significance of consumer confidence, whose magnitude reached a point estimate of -0.13 (compared to -0.05 in other years), the effect of which was also noticeable during the aggregate period of 2020-2021.

Moving on to country groups, EA countries show an increased positive impact on household disposable income and real GDP growth. Thus, in EA countries, one pp increase in income level leads to a 0.1 pp increase in the saving rate (compared to the point estimate of 0.08 pp in non-EA countries). Additionally, a one pp increase in GDP growth results in 0.48 pp increase in saving rate (compared to 0.36 pp increase in non-EA). Given the higher income levels and more stable GDP growth rates in Euro area, these results are as expected.

In the CEE region, the persistence of the lagged saving rate is notably lower (with a point estimate of 0.53) compared to non-CEE countries (0.65), suggesting a more flexible savings behaviour, potentially due to varying economic structures or fiscal policies (Schrooten and Stephan, 2004). A substantial impact of the real interest rate on savings indicates a strong response of household saving rates to changes in returns on deposits, with a one percentage point increase in the real deposit interest rate corresponding to a 0.45 percentage point increase in the saving rate, compared to just 0.10 in non-CEE countries. This pronounced effect may be associated with the less developed financial markets in CEE countries, where savings predominantly take the form of bank deposits (Grigoli, Herman and Schmidt-Hebbel, 2014). Furthermore, age dependency has a marked positive effect (0.18 percentage points) on the saving rate in CEE, which could reflect the socioeconomic challenges posed by an ageing population (Ostry and Reinhardt, 1992). The higher sensitivity to macroeconomic uncertainty in CEE is evidenced by the more substantial negative impact of enhanced inflation and consumer confidence on savings rates. A one percentage point increase in inflation and consumer confidence leads to a decrease in the household saving rate by 0.06 and 0.11 percentage points, respectively, underlining the importance of stable macroeconomic conditions for household financial behaviour in these countries (Oinonen and Viren, 2022; Ozcan, Gunay and Ertac, 2003).

Lastly, Croatia has many similarities with CEE countries. As is the case in CEE, the persistence of the lagged dependent variable is somewhat lower (0.51) than in the other countries (0.57). This could indicate a more volatile savings behaviour among Croatian households. This volatility might suggest that Croatian households are quicker to adjust their savings in response to economic changes, which could be due to several factors such as a less stable income environment, greater reliance on tourism, which is seasonal, or less confidence in long-term financial planning. Despite this, there is a still notable persistence in savings, in line with findings by Bađun and Franić (2015). Contrary to Dumičić and Čibarić (2010), the real interest rate indicates that bank deposits have been the major form of saving, with its point estimate increasing up to 0.41 (compared to 0.33 in other countries, which finds a negative correlation between real interest rate and bank deposits). Both inflation and consumer confidence play an important role in household saving in Croatia, where one pp increase in those variables negatively affects saving rates by 0.07 and 0.13 pp, respectively. This shows that in the Croatian case, the uncertainty has a stronger effect than in the case of CEE. This larger negative effect of inflation and consumer confidence on savings could imply a higher sensitivity to economic uncertainty, possibly exacerbated by Croatia's tourism-dependent economy. Another driver that is significant in the case of Croatia is the terms of trade index, which has a positive impact on the savings rate (0.07 pp), indicating a prevailing temporary component of the index. Given Croatia's high tourism dependence, this result is not surprising.

Table 4

Alternative estimations including interactive effects for defined crisis times (GFC and Covid-19) and country groups (EA, CEE and Croatia)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Baseline	**X=2020**	**X=2021**	**X=2020-2021**	**X=2008-2010**	**X=EA**	**X=CEE**	**X=Croatia**
Lag dependent variable	0.569***	0.693***	0.637***	0.682***	0.592***	0.507***	0.645***	0.574***
	(-0.055)	(-0.051)	(-0.062)	(-0.052)	(-0.054)	(-0.102)	(-0.076)	(-0.056)
Disposable household income	0.072***	0.058***	0.076***	0.063***	0.074***	0.075***	0.071***	0.072***
	(-0.094)	(-0.077)	(-0.083)	(-0.070)	(-0.093)	(-0.247)	(-0.177)	(-0.194)
Real growth of GDP	0.377***	0.415***	0.427***	0.422***	0.419***	0.363***	0.414***	0.385***
	(-0.044)	(-0.050)	(-0.050)	(-0.053)	(-0.064)	(-0.069)	(-0.081)	(-0.044)
Terms of trade index	0.026	0.013	0.037	0.014	0.010	-0.042	0.082	0.025
	(-0.029)	(-0.020)	(-0.033)	(-0.021)	(-0.027)	(-0.061)	(-0.050)	(-0.030)
Age dependency	0.072	-0.003	0.135***	0.015	0.049	0.144	-0.037	0.072
	(-0.049)	(-0.038)	(-0.050)	(-0.040)	(-0.052)	(-0.100)	(-0.069)	(-0.048)
Real interest rate	0.337***	0.383***	0.342***	0.391***	0.339***	0.373***	0.096***	0.333***
	(-0.063)	(-0.059)	(-0.059)	(-0.061)	(-0.077)	(-0.124)	(-0.103)	(-0.063)
Loans to households	-0.055***	-0.027*	-0.055***	-0.034**	-0.059***	-0.016	-0.059***	-0.055***
	(-0.019)	(-0.016)	(-0.017)	(-0.014)	(-0.017)	(-0.043)	(-0.019)	(-0.019)
Budget balance	-0.285***	-0.141***	-0.312***	-0.168***	-0.347***	-0.394***	-0.272***	-0.285***
	(-0.061)	(-0.038)	(-0.069)	(-0.044)	(-0.050)	(-0.073)	(-0.062)	(-0.062)
Inflation	-0.003	0.018	0.008	0.019***	-0.012	-0.033***	-0.014**	-0.016**
	(-0.011)	(-0.011)	(-0.012)	(-0.012)	(-0.012)	(-0.018)	(-0.008)	(-0.003)
Consumer confidence	-0.068***	-0.052***	-0.069***	-0.053***	-0.064***	-0.063**	-0.069***	-0.076***
	(-0.197)	(-0.167)	(-0.208)	(-0.163)	(-0.181)	(-0.254)	(-0.228)	(-0.197)
X*Lag dependent variable		-0.065*		-0.262***	-0.070***	0.09	-0.117***	-0.061***
		(-0.035)		(-0.065)	(-0.023)	(-0.118)	(-0.106)	(-0.056)

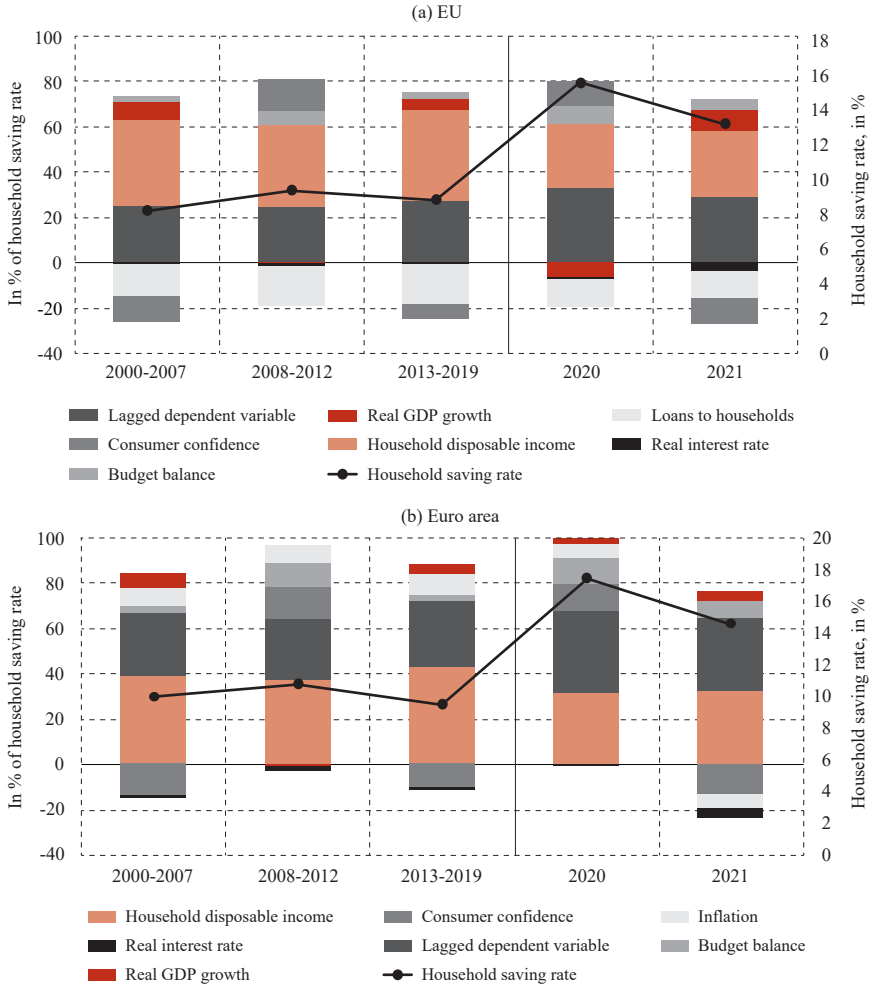
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Baseline	**X=2020**	**X=2021**	**X=2020-2021**	**X=2008-2010**	**X=EA**	**X=CEE**	**X=Croatia**
X*Disposable household income		0.004	0.024	0.0547***	-0.053***	0.023***	0.006	0.065
		(-0.024)	(-0.027)	(-0.021)	(-0.008)	(-0.026)	(-0.020)	(-0.009)
X*Real growth of GDP		0.132	0.008	-0.225	-0.162**	0.059***	-0.005	-0.005
		(-0.225)	(-0.216)	(-0.204)	(-0.082)	(-0.092)	(-0.104)	(-0.044)
X*Terms of trade index		0.365	-0.119	-0.014	0.095***	0.132	-0.077	0.067***
		(-0.209)	(-0.111)	(-0.083)	(-0.033)	(-0.083)	(-0.060)	(-0.030)
X*Age dependency		-0.078	-0.115	-0.072	0.186***	-0.112	0.182**	0.164***
		(-0.072)	(-0.061)	(-0.063)	(-0.043)	(-0.116)	(-0.081)	(-0.048)
X*Real interest rate		0.079	-0.072	0.217	-0.218***	-0.028	0.353***	0.028***
		(-0.451)	(-0.257)	(-0.273)	(-0.076)	(-0.143)	(-0.129)	(-0.063)
X*Loans to households		0.016	0.001	-0.024	0.006	-0.045	0.045	-0.078
		(-0.037)	(-0.024)	(-0.027)	(-0.008)	(-0.047)	(-0.037)	(-0.019)
X*Budget balance		-0.305***	0.149	-0.017***	-0.133***	0.134	0.031	-0.037
		(-0.174)	(-0.149)	(-0.143)	(-0.076)	(-0.099)	(-0.090)	(-0.062)
X*Inflation		-0.061	-0.006***	-0.064***	0.001	0.036	-0.046***	-0.055***
		(-0.076)	(-0.084)	(-0.056)	(-0.033)	(-0.025)	(-0.026)	(-0.011)
X*Consumer confidence		-0.075***	0.014	-0.017***	-0.080***	-0.082	-0.043***	-0.049***
		(-0.094)	(-0.074)	(-0.057)	(-0.023)	(-0.037)	(-0.038)	(-0.097)
Observations	509	509	509	509	509	509	509	509
AR(1) *p*-val	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000
AR(2) *p*-val	0.354	0.405	0.400	0.364	0.231	0.325	0.398	0.351
Sargan *p*-val	0.436	0.447	0.277	0.362	0.370	0.309	0.350	0.320

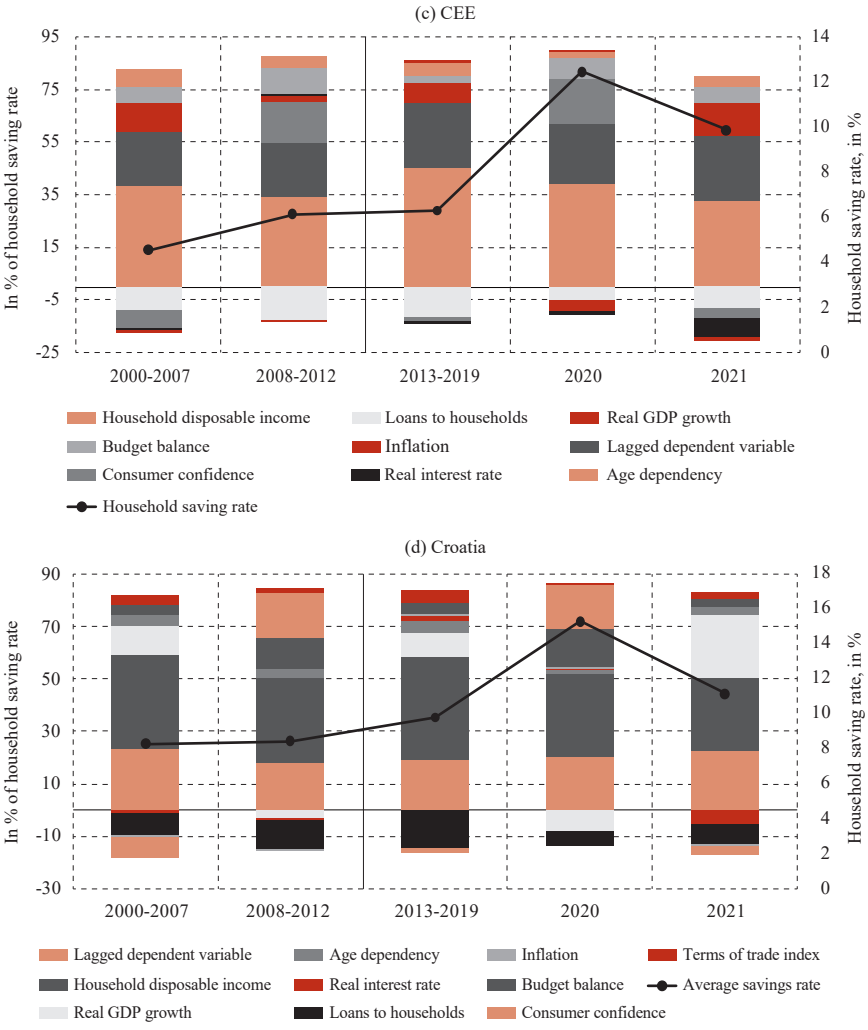
*Notes: Standard errors in parentheses are corrected for heteroskedasticity and autocorrelation of error effects. These estimations include the Windmeijer's correction of the covariance matrix. All estimates include a constant effect. ***, **, * next to the coefficients indicate a 1, 5 and 10% significance level. The lagged dependent variable (i.e., household saving rate) refers to the lagged rate by one time period (year). Coefficients of log-transformed variables (household disposable income, terms of trade index, inflation and consumer confidence) have already been divided by 100.*

Figure 3 shows the contributions to the fitted values of significant variables in the preferred specifications for the household saving rate of EU (table 3, column 6), as well as for EA, CEE and Croatia (table 4, columns 6-8). One of the most notable changes that took place across time periods is consumer confidence, which contributed negatively during 2000-2007, 2013-2019 and 2021 but positively during the crisis periods of GFC and the first year of the breakout of a pandemic. Another interesting impact is the notion of the government's budget balance, whose increased spending contributed to supporting the savings.

FIGURE 3

Average contributions to the fitted values





Source: Author's calculations.

In summarising the findings, it is evident that the conventional determinants influencing household savings behaviours retain their significance and warrant careful consideration. However, an in-depth analysis reveals that certain variables, initially deemed negligible within the baseline model, like age dependency, the terms of trade index, and inflation, may play roles different than previously thought. By dissecting income into its permanent and temporary components and scrutinising various age demographics within the dependency ratios, subtle yet potentially impactful factors emerge. Although statistically subtle, the influence of prime savers and the old-age dependency ratio may significantly affect savings trends. This shows the complexity of savings determinants, suggesting that even insignificant variables can have underlying influences worthy of further exploration. Beyond these conventional factors, consumer confidence has emerged as a crucial element, underscoring

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its substantial impact on savings behaviours. Moreover, it highlights the importance of psychological and behavioural factors in shaping savings decisions, adding a rich layer of complexity to the traditional economic perspective on savings. This comprehensive view encourages a broader consideration of both established and emerging factors in understanding and influencing household savings habits.

5 FINAL COMMENTS

The paper analyses the household savings drivers in EU countries. The determinants of savings are defined according to economic theory and available empirical research. Thus, the main factors of savings can be divided into income variables, demographic variables, financial variables, and variables of fiscal policy and macroeconomic uncertainty. Alongside these conventional variables, consumer confidence enters the baseline model as a less traditional determinant.

The paper uses annual panel data from 2000 to 2021, thus covering two periods of prominent structural changes that took place (GFC and the recent breakout of Covid-19). The household saving rate is regressed on its lagged value, dummies and several key macroeconomic variables. To add to the robustness check, the analyses are carried out using Arellano-Bond GMM estimation, LSDV estimation and bias-corrected LSDV estimation. However, the results are, in almost all cases, quite similar across the three performed estimation methods.

The baseline analysis includes a selection of important determinants that have been repeatedly found in empirical research and are relevant to consumption theory in order to identify a wide range of factors influencing household savings behaviour. This initial model finds statistically significant effects on the household savings rate for seven of the nine theoretically informed variables. It emphasises how the real GDP growth rate, real household disposable income, and lagged savings rate all favourably impact savings. These conclusions are consistent with the larger empirical storyline supported by studies such as those by Edwards (1996) and Corbo and Schmidt-Hebbel (1991), who also emphasised the importance of income and economic growth factors. On the other hand, household loans, government budget balance, and consumer confidence are seen to detract from savings accumulation, a dynamic reflected in the cautious saving behaviours during uncertain times noted by Vanlaer, Bielen and Marneffe (2020).

As against the widely held assumption that real interest rates have little effect on savings, as Bandiera et al. (2000) and Baillu and Reisen (1998) proposed, this study shows a substantial beneficial effect. This result suggests a reevaluation of the real interest rate's impact on household savings and is consistent with the more positive results noted by Niculescu-Aron and Mihaescu (2012), Grigoli, Herman and Schmidt-Hebbel (2014), and Kukk and Staehr (2015).

The terms of trade index, which is a variable expected to have a significant positive influence based on much of the existing literature, did not exhibit

notable effects in this model. This presented a departure from expectations raised by studies such as those by Hernando et al. (2018) and Oinonen and Viren (2022). Age dependency is often expected to have a detrimental effect on savings but, this study found no significant impact, opposing earlier findings by Masson, Bayoumi and Samiei (1995), Edwards (1996), and Schrooten and Stephan (2005). These results support the viewpoints of Rocher and Stierle (2015), which point to a more complex interaction between age dependency and savings than previously thought.

The extended empirical analysis looked at twenty-four more variables and broke down the concepts of age dependency and trade index into more detailed components. Adding to the many specifications of the baseline model, this thorough sensitivity analysis examined variables individually. Reminiscent of results by Corbo and Schmidt-Hebbel (1991) and Loayza, Schmidt-Hebbel and Servén (2000a; 2000b), the different effects of permanent and temporary income components, in line with the permanent income hypothesis (PIH) and life cycle hypothesis (LCH), provide insights into savings dynamics. Personal remittances boost savings, reflecting their temporary nature, a phenomenon supported by Rocher and Stierle (2015), whereas tourism revenues, often seen as stable, lead to higher consumption. Additionally, in line with their findings, the "wealth effect" is clearly visible in the negative correlation between household wealth, home ownership and savings. Savings as preventive measures are usually increased by the unemployment rate and GDP volatility, but, as Grigoli, Herman and Schmidt-Hebbel (2014) found, an increase in real oil prices dampens savings because of higher living expenses. Market capitalization and the Chinn-Ito index, which measure financial development and international integration, increase investment opportunities and so enrich savings. Reflecting the complex dynamics investigated in the studies by Masson, Bayoumi and Samiei (1995) and Edwards (1996), this overview emphasizes the intricate interaction of economic conditions, demographic trends, and fiscal policies affecting savings.

The study unveiled distinct savings behaviour patterns across different EU regions and during periods of economic turmoil (GFC and Covid-19). Consumer confidence and the government budget balance became more prominent savings drivers during the financial and pandemic crises. On the other hand, the impact of savings persistence, disposable income and real interest rates declined. Economic stability was indicated by a stronger correlation between income, GDP growth, and savings in EA countries. Conversely, the CEE region demonstrated a flexible stance towards savings that was significantly impacted by fluctuations in real interest rates; this indicates that the influence of less developed financial markets was perceived. Like the CEE countries, Croatia demonstrated a heightened vulnerability to economic uncertainties, including inflation and consumer confidence. This vulnerability was further intensified by the nation's economy being predominantly dependent on tourism.

The findings show the resilience and adaptability of household saving behaviours in response to varying economic climates. It also highlights key areas for policy intervention and household financial planning. The impact of disposable income and GDP growth on savings highlights the potential of pro-growth and income-enhancing policies, such as labour market improvements and wage growth support, to boost savings rates. Financial advisors could use these insights to offer products that align with savers' needs, recognising the positive influence of real interest rates on savings by potentially offering more attractive rates on savings accounts. The study also suggests that consumer confidence affects saving behaviours, indicating a demand for financial products that ensure security, especially during economic downturns. The research underscores the need to adjust saving strategies based on economic conditions, emphasising the importance of saving during growth and downturns to build financial resilience for the general population.

Although this research makes significant contributions to the understanding of the factors that influence household savings throughout the EU, it is crucial to acknowledge certain constraints. To begin with, while the analysis is exhaustive, it may obscure more subtle economic fluctuations that can potentially influence savings behaviour. Another potential limitation is the presumption that the determinants of savings are uniform throughout various EU regions. This may lead to a failure to consider unique cultural or economic elements that are prevalent in specific countries.

There is still more room for additional research, even though this study aims to analyse persistent differences in household saving rates among EU nations. Future research could address the earlier limitations by incorporating more high-frequency data to capture short-term economic dynamics. Furthermore, using machine learning methods to find non-linear correlations between variables might yield important information. Knowledge of household financial behaviour may also be enhanced by looking into the influence of individual psychological factors and cultural variations in saving decisions. Moreover, the conduct of long-term studies would make it possible to examine how economic policies affect savings rates over time, giving more information about successful policy changes. Future studies may expand on the results of this study to provide a more sophisticated understanding of household savings behaviour, guiding more focused and successful economic and financial policies by addressing these limitations and investigating the suggested areas.

Disclosure statement

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APPENDIX

TABLE A1

Descriptive statistics, definitions and sources of variables

Category	Variable	Description	No. of observations	Mean	St. dev.	Min	Max	Main source for variable construction
Dependent variable	Household saving rate	Household saving to disposable income adjusted for pension funds	572	9.1	6.6	-20.7	25.2	Eurostat; estimate for Croatia
Income	Household disposable income	Real household disposable income (in PPS) per capita	572	17,724.5	6,128.5	4,137.8	35,607.4	Eurostat; estimate for Croatia
	Real GDP growth	Real GDP per capita growth rate	572	2.2	3.6	-13.8	18.2	Eurostat
	Terms of trade	Terms of trade index	572	98.6	5.3	64.4	113.8	Ameco
	Gini index	Index of the distribution of income across a population	504	29.7	4.1	20.9	40.8	Eurostat
	Tourism	Contribution of tourism to the GDP (% of GDP)	572	9.9	4.5	1.2	25.0	WTTC
	Remittances	Personal remittances from abroad (% of GDP)	520	1.3	1.4	0.1	8.2	World Bank
	Pension	Net equity changes in pension fund reserves	572	1.0	1.3	-0.3	5.0	Eurostat
Wealth	Household wealth	Net household wealth (% of GDP)	571	106.0	58.9	20.4	325.0	Eurostat; calculations
	Home ownership	Percentage of population owning a home	425	75.7	10.6	49.5	97.6	Eurostat
Rate of return	Real interest rate	Real short term interest rate on deposits adjusted with GDP deflator	561	-0.3	2.8	-9.5	25.2	Ameco
	Bond yield	The yield spread of the government bond and 10-year German bond	551	1.3	1.9	-4.0	21.0	Eurostat; calculations
Uncertainty	Inflation	Deviation of inflation in relation to the historical average	572	100.0	9.8	79.6	132.8	Eurostat; calculations
	Unemployment rate	Unemployment rate in % of the total labour force; ILO	572	8.6	4.4	1.8	27.5	World Bank
	GDP volatility	Volatility of real GDP growth using the GARCH method	569	0.0	1.0	-3.7	3.1	Eurostat; calculations
	Real oil price	The real price of oil as a proxy of global events	572	78.8	31.8	37.2	136.6	EIA
	Consumer confidence	Deviation of consumer confidence in relation to the historical average	572	98.2	16.4	70.0	125.2	DG ECFIN survey; calculations

Category	Variable	Description	No. of observations	Mean	St. dev.	Min	Max	Main source for variable construction
Financial liberalization	Loans to households	Share of domestic credit to households (% of GDP)	572	49.2	29.2	0.9	141.6	Eurostat
	Flow of credit to households	Household loans based on transactions (% of GDP)	572	2.7	3.3	-5.9	18.3	Eurostat
	Market capitalization	Share of market capitalization (% of GDP)	572	49.9	43.6	0.6	326.4	World Bank, World Foreign Exchanges
International financial integration	Capital account balance	Capital account balance (% of GDP)	544	-0.8	5.6	-23.9	14.4	World Bank
	Chinn-Ito index	A measure of financial openness	569	0.9	0.2	0.2	1.0	Portland State University[1]
	Quinn index	Capital account openness index	520	0.1	0.2	0.0	1.0	Columbia University[2]
Demographics	Young-age dependency ratio	Share of young people aged 15-24 relative to working population (a)	569	12.2	1.7	8.8	17.1	Eurostat; calculations
	Old-age dependency ratio	Share of +65 aged relative to working population (b)	572	31.5	5.2	10.8	44.7	Eurostat; calculations
	Prime savers	Share of the population aged 45-54 in relation to the total population	572	26.2	2.1	20.7	30.5	Eurostat; calculations
	Age dependency	a+b	572	64.4	5.8	52.3	80.4	Eurostat
	Participation of +65	Share of the population over 65 years of age that is in labour market	559	5.6	4.0	0.9	34.1	Eurostat; calculations
	Life expectancy	Life expectancy at 65 years of age	565	15.4	6.0	2.0	22.0	Eurostat
	Urbanization rate	Share of the population living in urban areas of the country	572	71.8	12.2	50.8	98.1	World Bank
Fiscal policy	Budget balance	Government surplus/deficit (% of GDP)	572	-2.6	3.6	-32.1	6.9	Eurostat
	Public saving	Public savings (% of GDP)	571	1.6	3.2	-10.0	10.4	Eurostat
	Public debt	Consolidated gross government debt (% of GDP)	570	58.9	35.9	3.8	206.3	Eurostat
	Welfare	Government expenditures for social protection, education and health (% of GDP)	526	27.8	5.4	16.6	41.8	Eurostat; calculations
	Public health expenditure	Government expenditures for healthcare (% of GDP)	526	6.2	1.3	3.2	10.1	Eurostat
	Public education expenditure	Government expenditures for education (% of GDP)	526	5.1	1.0	2.8	7.1	Eurostat
	Social protection	Government expenditures for social protection (% of GDP)	565	17.0	4.4	7.9	28.6	Eurostat

[1] *Chinn and Ito (2006).*

[2] *Fernandez et al. (2016).*

How compliant are state-owned enterprises in Austria and Slovenia with regard to their sustainability reports?

TATJANA STANIMIROVIĆ, Assoc. Prof.*
PHILUMENA BAUER, Ph.D.*
DOROTHEA GREILING, Prof.*

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Tatjana STANIMIROVIĆ
University of Ljubljana, Faculty of Administration, Gosarjeva ulica 5, 1000 Ljubljana, Slovenia
e-mail: tatjana.stanimirovic@fu.uni-lj.si
ORCiD: 0000-0001-7407-7121

Philumena BAUER
Johannes Kepler University Linz, Altenberger Straße 69, 4040 Linz, Austria
e-mail: philumena.bauer@jku.at
ORCiD: 0009-0002-8905-8155

Dorothea GREILING
Johannes Kepler University Linz, Altenberger Straße 69, 4040 Linz, Austria
e-mail: dorothea.greiling@jku.at
ORCiD: 0000-0001-8096-6945

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Abstract

In recent years, the integration of corporate, environmental and social factors into the management of business has been intensively promoted. Our paper focuses on the quality of the sustainability reports (SR) of state-owned enterprises (SOEs). The methodological approach is based on the framework for content analysis provided by Global Reporting Initiative (GRI) standards and Sustainable Development Goals (SDGs) disclosure in non-financial/SR, using the translation table for linking SDGs and GRI Standards to evaluate the status of SDG compliance. The results reveal that companies in both countries generally report most intensively in the economic segment, as far as GRI standards and SDGs are concerned, exposing the economic value in the Benington (2011) theoretical model. Comparatively, Slovenian SOEs' SRs disclose on average a lower percentage of GRI standards in all four segments (general, economic, environmental, and social) than Austrian SOEs, while more than 70% of SDG 4 is reported in Slovenia.

Keywords: sustainability reporting, SDG reporting, state-owned enterprises, public value theory, Slovenia, Austria

1 INTRODUCTION

SOEs[1] are by no means a thing of the past. Emerging crises in the last couple of years (financial crisis, Covid-19, and now the Ukraine war) have put the state at the heart of the strategies for public and private sector problem resolution. The importance of the state to the economy increased greatly throughout the 20th century despite the intermediate trend of privatisation in the 1980s. Today's SOEs operate in a very different world – one in which they have a public mission, although they are often profitable and have new governance mechanisms. Consequently, they contribute 5 to 10% of the world's GDP, with an even greater share of asset value and investment, employing more than 60 million people globally. Of the top 500 giant corporations in the world, 25% are SOEs. In EU member countries, there is a long tradition of SOEs (Bernier, Bance and Florio, 2020).

The OECD (2015) defines SOEs as "enterprises where the state, regional governments, or cities have significant control, through full, majority, or significant minority ownership". Holding a major part of the subscribed capital, controlling the majority of the votes, or having the ability to appoint more than half of the managerial or supervisory body members implies the dominant influence of public authorities on the organization, regardless of its public or private legal form (European Commission, 2012). Governance, whether political, administrative, or economic, includes different meanings and perceptions. From corporate governance, which refers to systems by which companies are directed and controlled, to public governance, which concerns accountability in relation to specific public goals, such as service delivery or the impact of public policies on society. Public governance concerns accountability, as highlighted in the 11 Principles of Effective

[1] The definition of SOEs might be very simple "those that are wholly or partially owned and controlled by the state" (OECD, 2015; Peng et al., 2016) or quite complex organizations a) directly producing public services, either through liberalized market arrangements or under franchised monopoly, b) ultimately owned or de facto controlled by public sector entities, c) with public missions, d) whose ownership in principle can be shifted to the private sector, e) with budgetary autonomy and managerial discretion (Bernier with CIRIEC, 2015).

Governance for Sustainable Development by UNCEPA (2018). These principles emphasize effectiveness, accountability and inclusiveness and align with the goal of SDG 16 to create effective, accountable, and inclusive public institutions. The issues of corporate and public governance have recently been integrated with an emerging trend, hybrid governance, which seems to be market-oriented, providing public services with public funding, and politically governed, although those hybrid organisations can differ from one another in terms of financing, ownership, and organisational structure (Grossi, Papenfuß and Tremblay, 2015).

All the references resented above prove that SOEs have adapted to modern business models, consequently facing several socio-economic challenges assembled under the umbrella of sustainable development (SD). The SD concept has evolved through several phases, documented from the Brundtland Report in 1987 to the 2030 Agenda for Sustainable Development in 2015 with its 17 SDGs (UN, 2015; 2017). Even more, the operationalization of the SD idea has embraced numerous legal and other acts (Acquis Communautaire) including the Non-Financial Information Directive (NFI Directive 2014/95/EU), under which 3,000 public SOEs are required to prepare non-financial reports on economic, environmental, and human resources issues, among others. Most SOEs are lagging in their SR practices compared to large stock-exchange-listed, shareholder-orientated, for-profit enterprises. Studies confirmed that if SOEs are providing sustainability reports or integrated reports (IR), this is mostly done on a voluntary basis (Uyar, Kuzey and Kilic, 2021). With this slow adoption (Goswami and Lodhia, 2014; Greiling, Traxler and Stötzer, 2015), SOEs are wasting the chance to report in a concise way on the triple bottom line dimensions in line with their public missions. Consequently, their key stakeholders and society at large are not sufficiently informed about their public value (PV) creation (Traxler and Greiling, 2018).

In the context of insufficient awareness of PV creation and the reporting of it, our paper focuses on the SR of the SOEs in Austria and Slovenia managed by umbrella organisations. In Slovenia this is the Slovenian State Holding (SDH – Slovenski državni holding) and in Austria the ÖBAG (Österreichische Beteiligungs – AG), which share similarities in their portfolios, including strategic companies in which public ownership varies between 30% and 100%. In exploring SD reporting, our paper addresses two main research questions: (1) How intensively do the public companies of the SDH and the ÖBAG comply with GRI standards? and (2) to what extent do these companies report on their contributions to sustainable development goals (SDG)? In addition, the article reviews the degree to which companies follow the reporting guidelines to preserve and disseminate PV, gain legitimacy and support from stakeholders, and build operational capacity in their reporting.

This paper is divided into the following sections: after the Introduction, the section 2 presents a systematic review of academic papers considering sustainability and SDG reporting and explain the conceptual background as well as the theoretical focus of the paper. The section 3 focuses on Slovenian and Austrian SOEs and their reporting requirements. The final section is dedicated to the presentation of results, while the sixth section focuses on the discussion and conclusion.

2 PRIOR RESEARCH, CONCEPTUAL BACKGROUND AND THEORETICAL DISCOURSE

2.1 PRIOR RESEARCH

While sustainability is now a widely discussed topic in academia, the focus on non-financial/SR in Slovenia and Austria is limited. In Slovenia, Ermenc, Klemenčič and Rejc Buhovac (2017) investigated the relationship between SR and financial performance, and Redmayne, Vašiček and Čičak (2022) compared the SR of SOEs in Slovenia, Croatia and Serbia. For Austria, Greiling and Grüb (2014) and Greiling, Traxler and Stötzer (2015) examined the SR of the public sector, while Slacik and Greiling (2019) and Lebelhuber and Greiling (2022) focused on the sustainability reports of the Austrian electricity sector.

Recent studies on SR practices (Fusco and Ricci, 2019; Manes-Rossi, Nicolò and Argento, 2020) indicate a growing interest in SR, although the topic has not yet been sufficiently researched scientifically. The quantity and quality of SOE reporting have improved over the last decade (e.g., Manes-Rossi et al., 2021; Montecalvo, Farneti and Villiers, 2018). The main drivers for disclosure vary, with size (Andrades Pena and Jorge, 2019; Argento et al., 2019) and years of operation (Garde Sánchez, Rodríguez Bolívar and López Hernández, 2017; Orazalin and Mahmood, 2018) being important and isomorphism prevailing in the literature. Stakeholder pressure (De Lima Voss, Wanderley and Bernardi, 2013; Garde Sánchez, Rodríguez Bolívar and López Hernández, 2017; Masoud and Vij, 2021) and legislative pressure (Larrinaga-Gonzélez, Luque-Vilchez and Fernández, 2018), particularly through the GRI and the IR standard, are referred to as normative isomorphism. In addition, the pressure on SOEs from private, profit-oriented organizations, internal dynamics and different leadership styles of executives or sustainability managers have also been highlighted (Kumasaka et al., 2022; Domingues et al., 2017).

Studies show the predominance of the GRI Standards and the IR Framework (Cohen and Karatzimas, 2015; Manes-Rossi, 2019). Several authors (Manes-Rossi et al., 2021; Massoud and Vij, 2021; Traxler and Greiling, 2018) report a global acceptance of the GRI Standards, some in a pan-European context (Badia, Bracci and Tallaki, 2020; Slacik and Greiling, 2020; Traxler and Greiling, 2018), others in specific countries (Greiling and Grüb, 2014; Greiling, Traxler and Stötzer, 2015; Nicolò et al., 2021) or individual countries (Badia, Bracci and Tallaki, 2020; Braga, Da Silva and Dos Santos, 2014). The IR Framework, which is less researched (Manes-Rossi, 2019; Montecalvo, Farneti and Villiers, 2018; Nicolò et al., 2020), is promoted for SOEs (Manes-Rossi, 2019; Montecalvo, Farneti and Villiers, 2018). This framework supports better legitimization and disclosure of social issues (Farneti and Dumay, 2014; Montecalvo, Farneti and Villiers, 2018; Nicolò et al., 2021).

SDG reporting is a topic that is just emerging and developing within the SR practice of SOEs, and is not uniform (Bauer and Greiling, 2023; Krantz and Gustafsson, 2021; Kumasaka et al., 2022; Manes-Rossi et al., 2021; Nicolò et al., 2020).

The overall assessment is that the potential of SR or IR for stakeholder communication and legitimation purposes could be used much more by SOEs then it actually is (e.g., Greiling, Traxler and Stötzer, 2015; Montecalvo, Farneti and Villiers, 2018, Manes-Rossi et al., 2021). Traxler and Greiling (2018) have exposed a contradictory effect of SD reporting on public sector organisations, which are expected to report more intensively regarding the sector specifics, but the reporting rates are significantly lower than those for private sector organisations.

2.2 CONCEPTUAL BACKGROUND

SOEs have a crucial role in the provision and development of utilities and infrastructural industries (energy, transport, and telecommunications) (Chen, 2016; OECD, 2015). Their organisational profile is considered a mixture of public and private sector elements (Greiling, Traxler and Stötzer, 2015; Swiatczak, Morner and Finkbeiner, 2015), classifying SOEs as hybrid organisations[2] (Grossi, Papenfuß and Tremblay, 2015). SOEs are often related to the terms "public mission" and "PV" (Bernier and CIRIEC, 2015; Moore, 2013), and even "sustainable value" (Dumay, Guthrie and Farneti, 2010), which refer to the contribution of organisations to sustainability (Farneti and Dumay, 2014: 377). The accountability of public sector organisations (stakeholder theory) is different to the accountability of private companies (agency and legitimacy theory). Public organisations are accountable to a great number and wide variety of stakeholders (citizens), whose involvement is strongly associated with SD. Consequently, the implementation of socially and environmentally responsible practices, as well as the reporting of them, is of high importance (Uyar, Kuzey and Kilic, 2021; Hege, Brimont and Pagnon, 2019). Moreover, with reference to the public policy cycle, which consists of five stages (Howlett and Godwin, 2009), namely: a) agenda-setting, b) public policy formulation, c) public policy decision-making, d) public policy implementation, and e) public policy evaluation – SR is the foundation of the fifth stage, providing a feedback loop to public policy makers and national political bodies.

2.3 THEORETICAL DISCOURSE

This paper uses PV theory (Moore, 2013), as PV is created by the managers of public sector organisations for the citizens (Hartley et al., 2017), while government bodies have the role of PV authorising agencies. Regardless of the widespread policy trend of privatising services of public interest in recent decades in many countries, SOEs are intensively used for public services and PV delivery. Due to the fact that the measurement, conceptualization, and reporting of PV has been neglected in the scientific research (Meynhardt and Bäro, 2019), and because

[2] A hybrid organisation is said to be market-oriented and operates in a business-like manner to provide public services with public funding, and is politically governed (Grossi, Papenfuß and Tremblay, 2015: 275).

public utilities contribute considerably to economic development in coordination with social and environmental needs (Valenza and Daminao, 2023), the aim of our paper is to fill this gap by evaluating the sustainability reports of Austrian and Slovenian SOEs according to GRI standards and SDG goals, and translating the results into the Public Value Account framework as a practical and useful framework for measuring PV performance.

SOEs create the PV connected to the capability of activating production processes able to satisfy individual and collective needs at the same time. Since they are expected to meet the accountability demands of a broader set of stakeholders, financial information alone is no longer sufficient. Since SOEs' performance (or survival) deeply depends on the quality of corporate governance, which is measured by the satisfaction (or dissatisfaction) of the stakeholders (Bruton and Peng, 2015; Umar et al., 2018), SR provides information on this performance, which is measured and communicated from economic, environmental and social perspectives (Tommasetti et al., 2020).

Table 1
Methodological and theoretical framework

Theoretical framework	Pillars	Research purposes – to understand how SOEs
	Defining PV outcomes	Preserve and disseminate PV
Strategic Triangle of PV	Gaining authorisation	Gain legitimacy and support from stakeholders
	Building operational capacity	Build operational capacity

Source: Adopted according to Valenza and Damiano (2023).

3 SUSTAINABILITY REPORTING REQUIREMENTS IN AUSTRIA AND SLOVENIA

A GRI & CSR Europe (2017) working paper presented a comprehensive overview of how member states have implemented the "groundbreaking" EU Directive on Non-financial and Diversity Information in their national legislation since 6 December 2016. The Non-Financial-Information (NFI) Directive (2014/95/EU) requires that public-interest entities with at least 500 employees include in their management reports a non-financial statement containing the performance, position, and impact of its activities relating to environmental, social and employee matters, as well as matters of respect for human rights, anti-corruption, and bribery. It lists the obligatory components as well stating that if the company does not pursue policies in relation to one or more of the listed matters, the non-financial statement must provide a clear and reasoned explanation for not doing so. The obligation of non-financial reporting refers also to those public-interest entities which are part of a large group and fulfil, on a consolidated basis, the criterion of an average number of 500 employees.

The NFI Directive has been implemented in Slovenian legislation within general statutory law, which enacted the Non-financial Reporting in Companies Act (Article 70c). The transposition into Slovenian national law is very direct, using the same terminology and conceptual ideas outlined in the NFI Directive. The definition of the companies included in obligatory non-financial reporting in Slovenian law corresponds to that in the NFI Directive, explicitly excluding mandatory reporting for those companies that are included in the consolidated business report of a parent company, or other company that needs to prepare a non-financial report. The definition of a public-interest entity in Slovene legislation is a company listed on the stock exchange, a credit institution, insurance company, or a pension company. A public-interest entity is also a medium or large company in which the state or municipalities, jointly or independently, directly or indirectly, have a majority ownership share. The reporting requirements can be disclosed in a consolidated business report, or a separate report published alongside the business report or within 6 months of the balance sheet date, made available on the company's website and referenced in the business report.

In Austria, NFID was implemented by the Sustainability and Diversity Improvement Act (NaDiVeG, Act 257/ME). The transposition is also quite direct, and mandatory reporting can be fulfilled either within the annual management report or in a separate sustainability report. According to a study by the Vienna Chamber of Labour (2019), which evaluated the implementation of the NaDiVeG, half of Austrian companies report in the form of a separate sustainability report, while another half publish integrated non-financial reports. This study also revealed that between 80 and 100 companies are required to report according to the NFI Directive.

There are also a few very important regulations that must be fully implemented in the coming years, although in all likelihood there are already rudiments of their implementation in current sustainability reports. EU Taxonomy entered into force on 12 July 2020, and its individual articles are thereby applicable from 2022 or 2023. It establishes a classification system for environmentally sustainable economic activities with the aims of increasing sustainable investments and combating greenwashing. Companies complying with the NFI Directive are required to disclose certain indicators of their business activities' environmental sustainability. The EU Parliament recently adopted the Corporate Sustainability Reporting Directive (CSRD) in November 2022. From 2025, it will also cover large SOEs that meet two of the following criteria: 250 employees, EUR 20 million turnover or EUR 40 million balance sheet total.

4 METHODOLOGY

4.1 DOCUMENTARY ANALYSES

Our paper presents a qualitative exploratory study directed from the theoretical perspective of addressing, comprehending, and communicating the PV of two countries' strategic SOEs through SR. The main objective of this study was to uncover the PV creation conceptualized by Moore (1995) using information from

the sustainability reports of SOEs and to support the findings with four expert interviews. Our research methodology framework was developed with reference to Moore's (2013) strategic triangle for imagining and testing PV propositions. Since GRI Standards "enable an organization to publicly disclose its most significant impacts on the economy, environment, and people" and that "this enhances transparency on the organization's impacts and increases organizational accountability" (GRI Standards, 2020: 4), we have adapted the foundations of PV theory to SR compliance according to the elaboration of Valenza and Damiano (2023).

The paper employs a qualitative content analysis method based on the GRI standards. Sixty-four reports from 2018-2021 were examined, i.e. 32 reports from 8 SOEs in Austria and 32 reports from 8 SOEs in Slovenia. Each SR is scored 0, 1, or 2 for each standard. The assessment involves a two-step review of non-financial/sustainability reports: first, evaluating the general structure and GRI content table, and second, assessing the content. Reporting compliance scores are: 0 for no/almost no disclosure, 1 for partial disclosure, and 2 for more than partial disclosure.

In order to identify the status of SDG reporting, the translation table "Linking SDGs and GRI Standards" (2021) is used. In this linkage table, the 17 SDGs are assigned to the respective topic-related GRI indicators (table 2) by assuming that all GRI indicators are equally weighted.

Table 2

Linking table GRI & SDGs

SDG	GRI
1	202-1, 203-2, 207-1, 2, 3, 4, 413-2
2	411-1, 413-2
3	203-2, 305-1, 2, 3, 6, 7, 306-1, 2, 3, 4, 5, 401-2, 403-6, 9, 10
4	404-1
5	102-22, 24, 202-1, 203-1, 401-1, 2, 3, 4041, 3, 405-1, 2, 406-1, 408-1, 409-1, 414-1, 2
6	303-1, 2, 3, 4, 5, 304-1, 2, 3, 4, 306-1, 2, 5
7	302-1, 2, 3, 4, 5
8	102-8, 41, 201-1, 202-1, 2, 203-2, 204-1, 301-1, 2, 3, 302-1, 2, 3, 4, 5, 306-2, 401-1, 2, 3, 402-1, 403-1, 2, 3, 4, 5, 7, 403-8, 9, 10, 404-1, 2, 3, 405-2, 408-1, 409-1, 414-1, 2
9	201-1, 203-1
10	102-8, 207-1, 2, 3, 4, 401-1, 404-1, 404-3, 405-2
11	203-1, 306-1, 2, 3, 4, 5
12	301-1, 2, 3, 302-1, 2, 3, 4, 5, 303-1, 305-1, 2, 3, 6, 7, 306-1, 2, 3, 4, 5, 417-1
13	201-2, 302-1, 2, 3, 4, 5, 305-1, 2, 3, 4, 5
14	304-1, 2, 3, 4, 305-1, 2, 3, 4, 5, 7
15	304-1, 2, 3, 4, 306-3, 5, 305-1, 2, 3, 4, 5, 7
16	102-16, 17, 21, 22, 23, 24, 25, 29, 37, 205-1, 2, 3, 206-1, 307-1, 403-4, 9, 10, 408-1, 410-1, 414-1, 414-2, 415-1, 416-2, 417-2, 417-3, 418-1, 419-1
17	207-1, 2, 3, 4

Source: Linking the SDGs and the GRI Standards, 2021.

4.2 SAMPLE

The analysis includes the 8 largest Slovenian companies owned by the state and managed under the SDH, and the 8 largest Austrian federal-owned SOEs, 6 of which are managed by ÖBAG. Among the eight Austrian companies, two (Verbund and Casino) did not prepare a separate sustainability report, while for Slovenia only three (among ten) did prepare separate sustainability reports.

In order to provide a more comprehensive and clearer overview of the sample, table 3 for Slovenia and table 4 for Austria present company-specific information such as the type of company, the percentage of state ownership, the book value and the share of the total investment portfolio held by SDH or ÖBAG.

Table 3

The eight largest SOEs of the Republic of Austria

Company/Holding	Business	State ownership (in %)	Book value of ownership interest (in mn)*	Share in total portfolio (in %)
Verbund AG (A1)	Energy	51.00	17,523	50.52
OMG AG (A2)	Energy	31.50	5,149	14.84
A1 Telekom Austria AG (A3)	Telecommunications	28.42	1,439	4.15
Post AG (A4)	Traffic	52.85	1,349	3.89
Bundesimmobiliengesellschaft (BIG) (A5)	Infrastructure	100.00	9,054	26.10
Casinos Austria (A6)	Gambling	33.24	135	0.39
ÖBAG total			**34,649**	**99.89**
Autobahnen- und Schnellstraßen-Finanzierungs-AG (A7)	Traffic	100.00	24,267	–
Österreichische Bundesbahnen (ÖBB) (A8)	Traffic	100.00	2,528	–

* *In terms of book value of ownership share (on 31 December 2022).*

Source: Own, 2023 (according to ÖBAG webpage).

Table 4
The eight largest SOEs of the Republic of Slovenia

Company/Holding	Business	State ownership (in %)	Book value of ownership interest (in mn)*	Share in total portfolio (in %)
Dars d.d. (S1)	Traffic	100.00	3,042	29.6
GEN energija d.o.o. (S2)	Energy	100.00	1,005	9.8
HSE d.o.o. (S3)	Energy	100.00	830	8.1
Zavarovalnica Triglav d.d. (S4)	Finance	63.53	584	5.7
Slovenske železnice d.o.o. (S5)	Traffic	100.00	576	5.6
Telekom Slovenije d.d. (S6)	Telecommunications	72.89	399	3.9
Pošta Slovenije (S7)	Traffic	100.00	341	3.3
Krka d.d. (S8)	Pharmacy	29.87	311	3.0
Total			**8**	**79.2**

* *In terms of book value of ownership share (on 31 December 2022).*
Source: Own, 2023 (according to SDH webpage).

4.3 INTERVIEWS

In addition to the document analysis elaborated above, four interviews, with four companies of the sample, were conducted to gain insights into the current focus on SDGs. Two interviews were held with representatives from Austria (A1, A2) and two from Slovenia (S1, S5). The interview guide contained open-ended questions that primarily focused on how the companies preserve and disseminate PV, gain legitimacy and support from stakeholders, and build operational capacity, based on table 1. The interview questions are as follows:

1. How does your company preserve and disseminate public value?
2. How do your company gain legitimacy and support from stakeholders?
3. How does your company build operational capacity?

The interviews, which were conducted via zoom in German and Slovenian, lasted between 20-30 minutes. These sessions were recorded and transcribed. According to exact and relatively short answers, the complete content was translated into English and presented in the results.

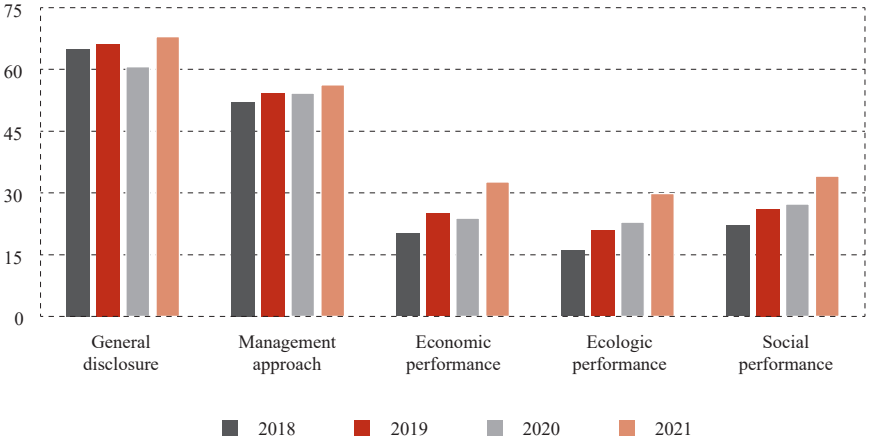
5 FINDINGS

5.1 REPORTING ACCORDING TO GRI STANDARDS

The results of the analysis have revealed that there has been definite development during the four-year period, as far as the range and the quality of SR according to GRI standards are concerned. In Austria (graph 1), the companies in our sample have increased the reporting quality of ecological performance (14 percent points), economic performance (almost 13 percent points), and social performance (almost 12 percent points) standards in the largest percentages.

Graph 1

Share of the entire disclosure of the SR of Austrian companies, 2018-2021 (in %)

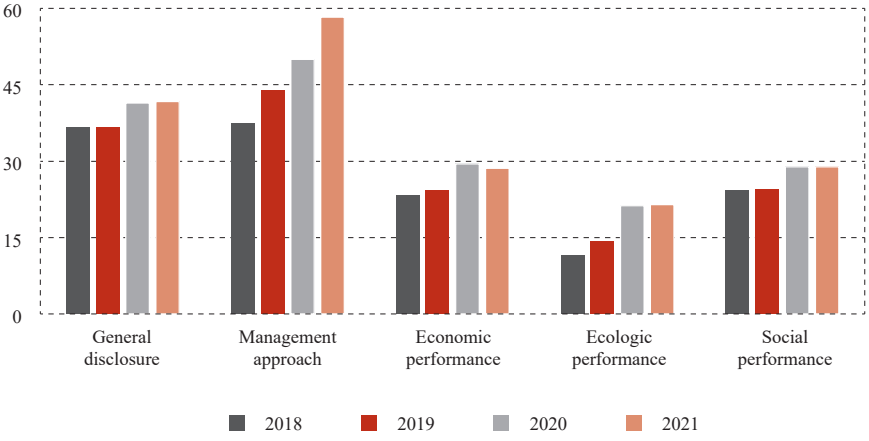


Source: Own, 2023.

The findings are different for the Slovenian sample. Comparison of the two countries reveals that the share of reported GRI standards in the general disclosures part is much smaller than that of the Austrian companies, although the share in Slovenia has significantly increased during the observed period. The other three reporting parts (economic, ecological, and social) were not much better reported, according to shares of around 25%, with slightly higher share for Austrian companies.

Graph 2

Share of the entire disclosure of the SR of Slovenian companies, 2018-2021 (in %)



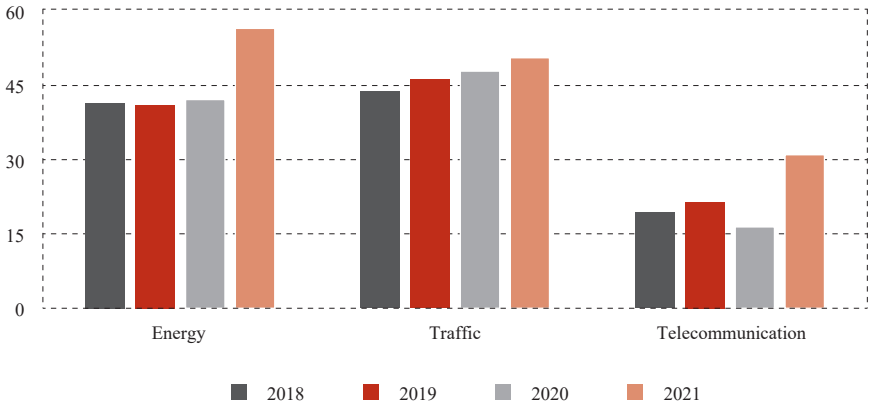
Source: Own, 2023.

The comparison of the countries' results according to the economic activity reveals that the average share of reported GRI standards for companies in energy

and traffic business is much smaller in Slovenian than in Austrian companies except for telecommunication company (graphs 3 and 4). Nevertheless, the Slovenian companies in energy and traffic business have significantly improved their SR in the years 2020 and 2021 since the years 2018 and 2019.

Graph 3

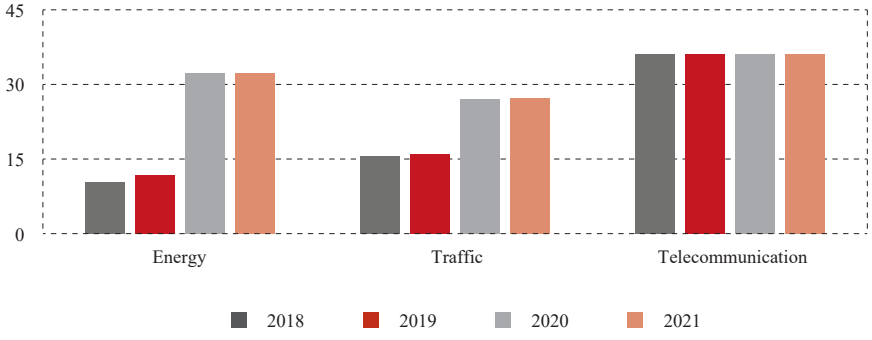
Share of the entire disclosure of the SR of Austrian companies according to economic activity, 2018-2021 (in %)



Source: Own, 2023.

Graph 4

Share of the entire disclosure of the SR of Slovenian companies according to economic activity, 2018-2021 (in %)



Source: Own, 2023.

5.2 FINDINGS ON GRI SUB-INDICATORS

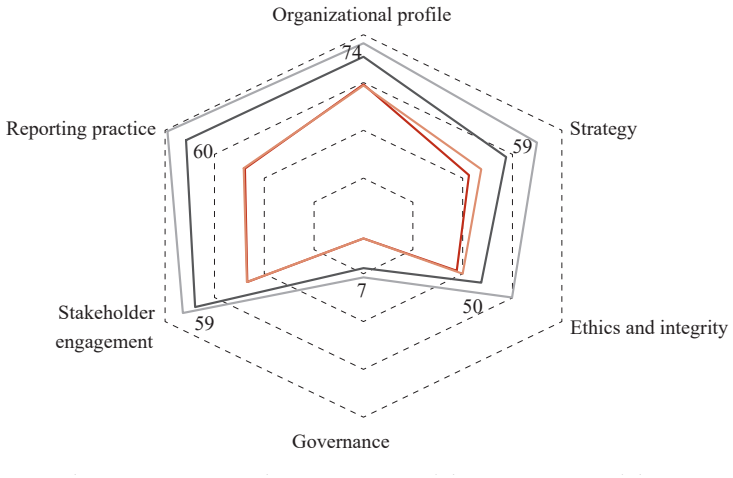
Since each of the main GRI standards consists of several sub-indicators an in-depth analysis has been conducted. The results reveal several differences between the two countries. Due to the large amount of data collected, and for the sake of clarity, the following graphs 5 to 8 show data for the last two years (2020 and 2021).

Content analysis of the aforementioned SOE reports, based on evaluation framework results, confirmed that Slovenian SOEs disclose on average, for the years 2020 and 2021, a lower percentage of sustainability issues (26.7%) than Austrian SOEs (37.3%), as far as all GRI standards are concerned. A breakdown of the main indicators (excluding management approach) into the sub-indicators is presented in graphs 5 to 8, which reveal that there are definite differences, on average, between the two different countries in all four categories.

Within the main indicator of general disclosures (graph 5), it can be seen that in all sub-indicators, Austrian SOEs comply on average much more (higher %) than Slovenian SOEs. Additionally, the biggest differences between the countries can be observed for indicators covering "reporting practices" and "stakeholder engagement".

Graph 5

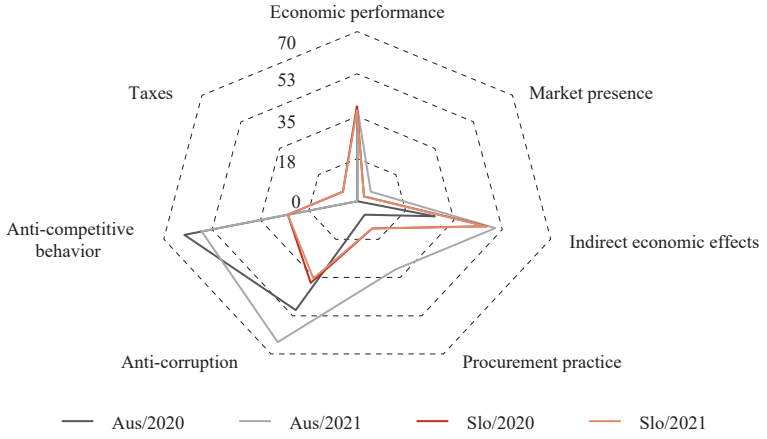
Percentage of general disclosures for Austria and Slovenia (2020 and 2021)



Source: Own, 2023.

Graph 6

Percentage of economic performance disclosures for Austria and Slovenia (2020 and 2021)

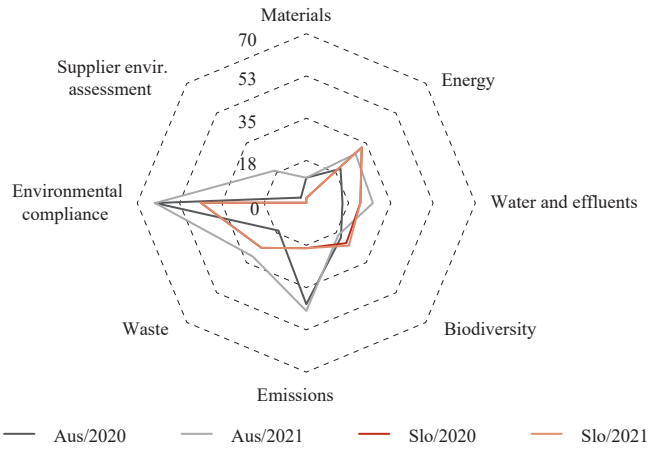


Source: Own, 2023.

Graph 6 shows the percentage of all GRI standards in the economic performance subsection that Slovenian and Austrian SOEs comply with in their reports for the years 2020 and 2021. The fact is that in both countries, those disclosures (considering economic performance) are on average less compliant than those for general disclosures. Additionally, graph 6 shows that the differences between the countries are negligible. Nevertheless, the anti-competitive behaviour and anti-corruption categories are much better reported in the Austrian reports than in the Slovenian reports.

Graph 7

Percentage of ecological performance disclosures for Austria and Slovenia (2020 and 2021)

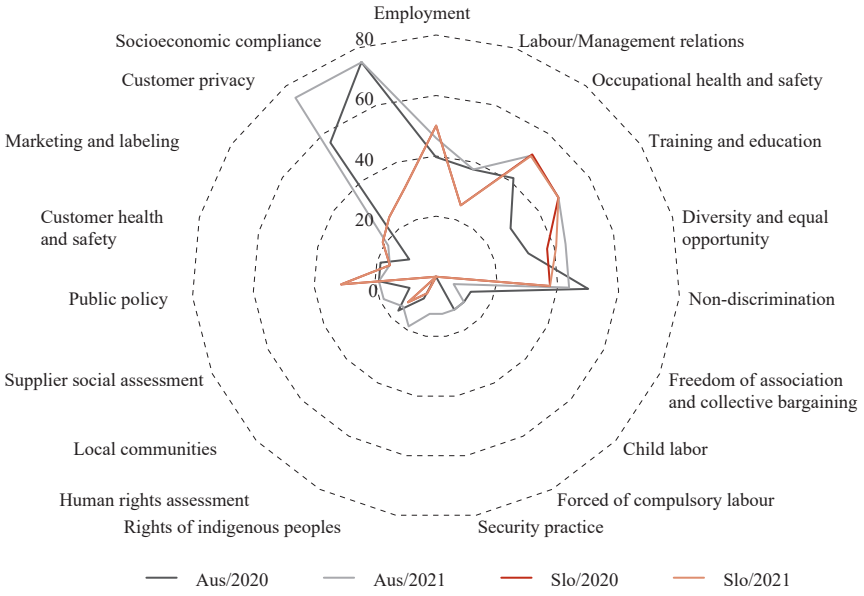


Source: Own, 2023.

Very similar observations can be made for graph 7, which reveals the percentage of all GRI sub-standards in the ecological performance that Slovenian and Austrian SOEs comply with in their reports for the years 2020 and 2021. The ecological performance GRI standards on average for both countries were complied with at a similar percentage as for economic performance. Interestingly, the GRI 302 – Energy standard is on average much better complied with by Slovenian companies than by Austrian companies, while the inverse situation hold true as far as GRI 305 – Emissions standard is concerned.

Graph 8

Percentage of social performance disclosures for Austria and Slovenia (2020 and 2021)



Source: Own, 2023.

Finally, graph 8 reveals the percentage of social performance disclosures on average. It can be observed that except for a few GRI sub-standards, the compliance in this subsection does not exceed 40%, and that there are some differences between countries. Slovenian SOEs better comply with the "Occupational Health and Safety" standard (GRI 403), as well as with the "Training and Education" standard (GRI 404), while Austrian SOEs are on average almost 80% compliant with the "Socioeconomic" standard (GRI 419).

5.3 REPORTING ACCORDING TO THE SDGs

Besides GRI standards compliance, the purpose of the paper has been to analyse the SDGs compliance of companies in the sample. In this manner, the translation table "Linking SDGs and GRI Standards" (2021) has been used. The results are presented in table 5.

Table 5

SDG compliance of Austrian and Slovenian SOEs in the period 2018-2021 (in %)

	Austria				Slovenia			
	2018	**2019**	**2020**	**2021**	**2018**	**2019**	**2020**	**2021**
SDG 1	4.46	7.14	4.46	8.04	4.02	3.57	3.57	3.57
SDG 2	12.50	6.25	6.25	9.38	3.52	3.13	3.13	3.13
SDG 3	19.64	28.13	36.61	42.86	16.19	19.17	26.67	26.67
SDG 4	0.00	0.00	0.00	0.00	75.00	75.00	81.25	81.25
SDG 5	26.95	28.91	25.78	34.38	26.17	26.95	30.47	30.86
SDG 6	9.13	16.35	17.79	26.92	9.62	15.87	25.00	25.48
SDG 7	23.75	27.50	20.00	28.75	26.25	26.25	32.50	32.50
SDG 8	24.34	29.77	27.63	38.49	28.62	29.11	33.88	33.72
SDG 9	43.75	62.50	53.13	78.13	78.13	78.13	84.38	81.25
SDG 10	18.75	25.00	20.14	27.78	25.69	26.39	29.86	29.86
SDG 11	11.46	14.58	19.79	36.46	21.88	23.96	36.46	36.46
SDG 12	16.25	20.00	24.06	30.94	15.94	17.19	23.44	23.44
SDG 13	26.14	30.11	35.80	40.91	21.59	22.16	26.70	26.70
SDG 14	19.38	28.13	36.25	38.13	15.00	17.50	22.50	23.13
SDG 15	19.27	26.56	32.81	36.46	13.02	16.15	24.48	25.00
SDG 16	34.26	35.42	34.49	41.67	15.74	16.44	22.69	22.69
SDG 17	0.00	0.00	0.00	1.56	0.00	0.00	1.56	1.56

Source: Own, 2023.

With SDG compliance rates for 2021 divided into three groups: (1) Lowest intensity up to 30%, (2) Medium intensity up to 60%, and (3) Highest intensity over 60%) it can be seen that SDG 1, 2, 6, 10 and 17 fall into the first group, while SDG 3, 4, 5, 7, 8, 11, 12, 13, 14, 15 and 16 fall into the second. In both countries, the highest average level of SDG compliance is for SDG 9, while SDG 4 is reported on average very intensively in Slovenia (from 75% in 2018 to 81.25% in 2021), but not in Austria. SDG 17 (which regards global partnership) is reported the least intensively for both countries in this period.

5.4 INTERVIEWS

5.4.1 PRESERVING AND DISSEMINATING PUBLIC VALUE

In Austria, there are two SOEs (A1; A2) that actively preserve and disseminate PV through strategic measures. Ensuring the development and maintenance of high-quality road infrastructure is crucial for economic development, regional connectivity, and public safety (A1). By investing in sustainable technologies and practices, environmental impacts are minimized and environmentally friendly transportation solutions are promoted. In addition, advances in traffic management systems improve road safety and traffic efficiency by providing real-time traffic information and automated control measures, contributing to a reliable, safe and

sustainable transportation network that benefits the Austrian population. Sustainability is also being addressed in energy production, with a focus on renewable energy sources to reduce carbon emissions and protect the environment (A2). In addition, community programs and transparent communication will promote energy efficiency and align operations with societal needs and expectations, fostering a culture of responsibility and innovation in the preservation and dissemination of public values (A2). A major focus is the integration of the SDGs into the organization's sustainability strategy, particularly SDG 7 (clean energy), SDG 13 (climate action), and SDG 15 (life on land). These goals are central to their strategy, as reflected in their annual reports (A1). Another organization has also embedded sustainability and the SDGs into its corporate strategy and policy, aiming for CO_2-neutral usage of their network and promoting multimodality and sustainability (A2).

Both Slovenian state-owned companies (S11, S5) are 100% state-owned and provide strategic infrastructure capacities for the Republic of Slovenia, one in the field of motorways and the other in the field of rail transport. As such, they are directly committed to creating public value. In fulfilling its public interest mission, the company (S1) places a strong emphasis on energy efficiency and environmental protection where public value is concerned, which is why one of its strategic objectives is to develop sustainable infrastructure and a circular economy. The monitoring of the latter is based on the indicator of reducing energy consumption by 9% per kilometre of the motorway network by 2025 compared to 2019, and reducing CO_2 emissions per kilometre of the motorway network by 15% by 2025 compared to 2019. Company (S5) also provides strategic infrastructure capacity for the country. As one of its key founding objectives, the company has set itself the strategic goal of creating a multimodal offer of mobility services at the national level by linking and building on the State's activities in establishing a unified, accessible, and efficient public passenger transport and the development of railway stations and stop areas by integrating different modes of transport and accompanying transport services into a range of mobility services.

5.4.2 LEGITIMACY AND STAKEHOLDER SUPPORT

The main stakeholder groups include employees, customers, suppliers, residents, environmental NGOs, authorities, investors, political stakeholders, regulators, as well as district administrators and mayors (A1; A2). SOEs gain legitimacy and support from stakeholders by prioritizing transparency, ethical practices, and responsiveness (A1; A2), safety, efficiency, and sustainability (A2). They engage stakeholders through open communication channels, intranet or workshops, actively seeking feedback and addressing concerns (A1; A2). Demonstrating a commitment to sustainability and social responsibility fosters credibility, especially among environmentally conscious stakeholders. Investing in community development and fostering partnerships further solidifies support. By aligning corporate actions with stakeholder values and consistently delivering on promises, organizations build trust and legitimacy, earning support from investors,

customers, employees, and the broader public (A1). Additionally, prioritizing customer satisfaction through smooth traffic flow and quality services builds trust (A2). One organization has developed various levels and structures aligned with international standards like the GRI standards, facilitating successful integration of sustainability practices (A1). Another organization's commitment to sustainability dates back to 2006, with their first sustainability report, followed by annual reports from 2010, including the SDGs, to gain legitimacy (A2).

In Slovenia, the company (S1) is aware of its responsibility towards people, the environment and society. As a result, it pursues social responsibility in a sustainable manner in all projects and long-term plans and at all levels. Ambitious and clearly defined objectives ensure that the public recognises the company as a responsible and forward-looking company. In this way, the company engages with its stakeholders in a fair and balanced way, communicating with them in a two-way manner and, above all, identifying and monitoring stakeholder needs and interests through a web of interactions at both strategic and operational levels. The company's stakeholders (S1) are identified and defined on the basis of one of the EFQM self-assessment measures. Stakeholder involvement and management is based on the impact that a particular stakeholder has on the company and the impact that the company has on a particular group of stakeholders. For company (S5), the implementation of sustainable business is crucial for long-term success and socially responsible operations. Additionally, the company (S5) has started to develop a sustainable business strategy that will include a sustainable vision, mission and values, an analysis of the internal and external environment, strategic goals and priorities, sustainable business models and activities for the company, as well as performance indicators and plans for monitoring and reporting. The objective is to ensure sustainable financial performance while taking into account the environmental, social and economic aspects of sustainability. Integrated, strategic and effective sustainability management is key to managing sustainability risks, identifying sustainability impacts, and detecting sustainability trends and opportunities for responsible management of the natural and social environment and for coherent and transparent corporate governance. Therefore, the company is committed to spreading the principles of socially responsible behaviour in the business and social environment it actively co-creates. It participates in the development of professional solutions in the field of mobility and logistics, and raises environmental awareness of rail transport as the most sustainable mode of passenger and freight transport. It also supports the activities of various organisations. The support is not limited to professional organisations but is extended to a wider range of stakeholders who have an impact on the development and on the progress of society as a whole.

5.4.3 OPERATIONAL CAPACITY

In Austria, two SOEs are expanding their operational capacity through strategic investments in infrastructure, technology, and employees (A1; A2). The freeways and expressways are continuously modernized to increase efficiency and safety,

using state-of-the-art construction methods and materials (A1). One SOE is continuously modernizing its power generation facilities, relying on innovative technologies such as hydropower and renewable energy sources to increase efficiency and sustainability (A2). The integration of technologies, such as intelligent traffic management systems and digital communication platforms, optimizes operations and facilitates real-time monitoring (A1). The integration of advanced monitoring systems and digital solutions optimizes operational processes and ensures a reliable supply of electricity (A2). Furthermore, the focus is on the development of employees, offering training programs and fostering a culture of innovation and collaboration (A1; A2). Efforts to promote sustainability within corporate culture include updates through intranet and social media, sustainable training sessions, and initiatives like Climate Ranger training to educate and engage employees (A2).

The company (S5) will strengthen its operational capacity by investing in infrastructure, technology and employees. The development of mobility coincides with planned investments in the purchase of new passenger trains and locomotives and other machinery with the aim of reducing transport bottlenecks and increasing the throughput of the rail network. In addition, digitisation will increase the operational capacity and efficiency of the company. All the measures are linked to compliance with legal regulations on environmental protection and efficient use of energy on the one hand and their implementation in practice on the other (efficient use of energy and other natural resources, prevention of pollution of the natural environment, achieving appropriate technical and technological solutions to reduce environmental pollution). Operational performance is described by the company (S1) with three key strategic orientations, namely (1) long-term business stability and environmental sustainability, (2) ensuring safety, fluidity, and reliable and timely services for users on the motorway network, and (3) committed and competent employees.

5.4.4 COMPARISON BETWEEN AUSTRIA AND SLOVENIA

The comparison of the interview results has revealed that the PV concepts in the SOEs of both countries are very similarly treated. The sample of two companies in the energy sector (Austria) and two companies in the transportation sector (Slovenia) has shown that PV is being reflected in energy production, which is focusing mainly on renewable sources and environmentally friendly transportation. The companies have emphasized the importance of aligning corporate projects with stakeholder attitudes towards sustainability, which builds trust and from investors, customers, employees, and the broader public, enhancing legitimacy. The operational capacity should increase the PV based on innovative technologies, renewable energy sources and digitalization.

6 DISCUSSION

The scarcity of exploratory literature on SOE governance and SR motivated our research, which evaluates the contribution of SOEs, as hybrid organisations, to PV creation. The reason for the lack and fragmentation of literature in the field might be found in the hybridity of SOEs, but also in the ambivalence surrounding notions of governance (Grossi, Papenfuß and Tremblay, 2015). Although the SR process seems a very narrow or partial segment of the concept of sustainability, its function is invaluable. On the one hand, a precisely structured and comprehensively defined reporting concept provides clear development directions for SOEs, and on the other hand, it can be included in the monitoring of progress in the achievement of SDG goals for stakeholders, decision-makers, and political institutions that support PV creation for society. Since the main objective of our research has been to explore the SR compliance of the 16 largest SOEs in two adjacent countries during the period between 2018 and 2021, 64 SRs have been evaluated according to GRI standards. Although an upward trend in reporting on sustainability issues has been confirmed in both countries during the observed period, there are some differences in certain segments (social, environmental and economic). These differences could be explained from the historical point of view that has determined economic and social policy. Austria belonged to the Western capitalistic bloc following World War II, while Slovenia was part of Yugoslavia, with its socialist system dictating common social ownership. Since the year 1991 and its declaration of independence, Slovenia has gone through an intensive process of transition, during which much social property has been privatised. Still, some property has not been privatised, which is why in both countries (Austria and Slovenia) companies with public missions and strategic business (like telecommunications, traffic, energy, etc.) are at least 25% under state ownership. The results of our content analysis study revealed that Slovenian SOE sustainability or integrated reports comply on average with the GRI standards at a lower percentage than those of Austrian SOEs regarding general disclosures, economic disclosures and ecological disclosures. A more mixed picture emerges regarding the many items of the social disclosures.

Based on the theoretical perspective of public value theory, our results should be evaluated according to the framework proposed by Valenza and Damiano (2023) and Coffey (2021), which emphasize economic, social and cultural, political, and ecological aspects and dimensions. SRs are considered a critical managerial tool in understanding organisations' attitudes regarding sustainability issues (Geerts and Dooms, 2020). It might be concluded that our results mainly refer to the definition of PV outcomes, predominantly the economic value (consumer privacy, socioeconomic compliance), although ecological and social value is also created to a certain extent (referring to GRI standards compliance). SOEs' preservation and dissemination of PV can be observed in the general disclosure (graph 5) of the SOEs in our sample, where there is intensive reporting on stakeholder engagement (in defining materiality topics), ethics and integrity (explaining the high moral values of the company), anti-competitive behaviour and anti-corruption

(reporting the firm's internal rules and statistics), and finally consumer privacy and socioeconomic compliance (reporting mainly on the protection of consumer privacy and other social issues) for both countries.

As far as SDGs are concerned, the SDG 9 (industry, innovation and infrastructure) result supports the predominance of economic value creation (more than 70% compliant) and the limited creation of social and ecologic value under GRI. Since SOEs are governmentally influenced (Bernier, Bance and Florio, 2020), their PV is cocreated along with the government interventions that make functional operations possible, especially in capital-intensive industries essential to the economy, investment in which requires long gestation, imported equipment, and large lump-sum funding that cannot be achieved by the market alone. On the other hand, governments see SOEs as the second best way to maintain social stability, and without them economies cannot function properly (when social stability is low, SOEs are useful for hiring excess labour and for the investment of people's retirement benefits, while privatised firms have a reduced number of employees after privatisation) (Lin et al., 2020). Those findings were confirmed by the interview methodology. The interview results emphasize the operational capacity with a strong focus on the sustainability aspect of investments in infrastructure and technology. The reason for this could be in the fact that SOEs are of direct importance to the national development agenda and for PV creation since they play an important role in a country's infrastructure, industry and innovation sectors.

Studies indicate that ownership concentration impairs corporate transparency in SOEs (Argento et al., 2019; Khlif, Ahmed and Souissi, 2017; Raimo et al., 2020). Slovenian SOEs have a higher level of state ownership than Austrian. The research interest lies in investigating SOEs' motivation for disclosure, which is inversely related to state ownership (Dragomir, Dumitru and Feleaga, 2022). The results show that compliance is significantly higher for highway operators (Asfinag and Dars) and large hydropower plants (Verbund and Gen Energija) in both countries, while compliance is very different for railroad companies. In Austria, ÖBB is more than 27 percentage points more compliant than Slovenian railways (Slovenske železnice). Further research into the motivations for disclosure is warranted, as certain sectors are important drivers of sustainability disclosure (Uyar, Kuzey and Kilic, 2021; Garde Sánchez, Rodríguez Bolívar and López Hernández, 2017).

The hybridity of SOEs in our sample indicates a spill-over effect in the dissemination of societal information and underlines the importance of the transparency and accountability of the public sector in sustainability issues (Raffer, Scheller and Peters, 2022). Hybrid organizations manage stakeholder expectations through sustainability reporting (Christensen, 2017). Institutional pressure leads to the adoption of different disclosure tools, reflecting isomorphic processes (Nicolo et al., 2021; Maine, Florin Samuelsson and Uman, 2022; Shabana, Buchholtz and Carroll, 2017).

7 CONCLUSION

Our results demonstrated a slightly better SR practice in Austrian SOEs than in their Slovenian counterparts. Although there has been an upward trend in the disclosure practices of both countries, the situation of a less than 50% compliance with all GRI standards is unsatisfactory. Companies in our sample are far from being well-prepared for the much broader reporting focus of the CSRD and EU Taxonomy. The transition to a greener and more sustainable economy has become a priority for the EU; not just from an operational perspective, but also from that of financial resources. The EU is influencing financial markets by promoting and including ESG factors in market operations, which might be very challenging for financial supervisors and regulators. It is clear that the EU needs a firmer legislative framework as far as sustainability issues are concerned, while the current situation has been described as "problematic" (The ATVP, 2021).

There are some limitations of our paper, as with many studies on SR practice. Firstly, there might be some subjectivity in the compliance assessment of companies in our sample. Secondly, the assessment has been made on documentary analysis excluding any other data-obtaining strategy. As the upcoming CSRD includes elements from the GRI and IR frameworks, both major existing non-financial reporting standards need to be adjusted to be aligned with the requirements of European Sustainability Reporting Guidelines (ESRS) requirements. As the next step, the requirements of the sector-agnostic ESRS could serve as an input for constructing an ESG-disclosure index.

Disclosure statement

The authors have no potential conflict of interest to report.

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Unsolicited versus solicited public partnership proposals: is there a trade-off between innovation and competition?

GONZALO RUIZ DIAZ, Ph.D.*

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Gonzalo RUIZ DIAZ
Pontifical Catholic University of Peru, Department of Economics, Av Universitaria 1801, San Miguel, 15088 Lima, Peru
e-mail: gruiz@pucp.edu.pe
ORCiD: 0000-0001-9972-9181

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Abstract

Unsolicited proposals (UPs) are a modality of public private partnership (PPP) that is increasingly being used to attract private investors and operators to provide innovative solutions to public projects, notably in infrastructure. In most countries that expressly regulate UPs, the PPP tenders establish asymmetric conditions that favour UP proponents over other potential participants, with the aim of incentivising the presentation of innovative project solutions. The present study formally evaluates the conditions under which a competition/innovation trade-off may arise. We find that UPs can offer welfare-improving solutions compared with solicited proposals (SPs) only in exceptional circumstances. In addition, we find no robust evidence to either confirm the trade-off between innovation and competition in PPP tenders, or to indicate that UPs lead to welfare-enhancing solutions that could not be achieved under conventional SPs.

Keywords: unsolicited proposals, public-private partnerships, innovation, competition

1 INTRODUCTION

Public private partnership (PPP) contracts encompass a broad scope of arrangements between private and public sector aimed at delivering public services and infrastructure. Depending on the characteristics of the projects, the informational restrictions faced by the public sector, and the need to attract innovative solutions in project design, PPP schemes can consider different levels of private party involvement in the project (Bhattacharya, Openheim and Stern, 2016; Ahmad, Vinella and Xiao, 2017).

Under a solicited proposal (SP), a government agency invites private investors to submit proposals to execute a PPP. Under an unsolicited proposal (UP), a private company (the proponent) typically submits on its own initiative a project proposal to a government agency. In recent decades, a growing number of countries have considered UPs to attract private investors and operators to provide innovative solutions for public sector projects, including in public infrastructure. In a sample of 140 countries, more than 60% have adopted an explicit regulatory framework for UPs, and 9% have allowed privately originated PPPs even if not institutionally formalised (World Bank, 2020).

The rationale behind UPs relies, among other notions, on the idea that this mechanism may attract certain private sector skills and experience to the design and development of public projects that are unavailable in government organisations (Bederman and Trebilcock, 1994). Yet scholars have pointed out a possible tension between that objective and the need to ensure a reasonable degree of competition in procurement, given that preparing proposals on own initiative is costly and risky when there are many potential bidders (Hodges and Delacha, 2007: 14). One could also distinguish between proposals that involve the use of new concepts or technologies to address a given project specification, and those that

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address public sector needs not yet identified by the contracting authority. The case for UPs could be stronger for the latter type of project (UNCITRAL, 2001). Some countries therefore admit as UPs only "truly innovative" or "unique proposals" that receive exceptional treatment, including through direct negotiation (World Bank, 2017a: 63).

The widespread use of UPs despite these concerns raises the question of the nature and extent of the trade-off between innovation and competition in attracting public project proposals, and whether UPs are welfare-enhancing compared with conventional, government-solicited proposals. The trade-off between innovation and competition is not new in the industrial organisation literature (see, for instance, Gilbert, 2006; or Aghion et al., 2005). However, attempts to explore the scope and relevance of this trade-off for different modalities of PPPs are still scarce.

In this study, we formally examine the conditions under which UPs can offer welfare-improving solutions for government projects compared with SPs. We find that any welfare superiority of UPs can only be observed in exceptional circumstances of asymmetric information on potential project solutions between the government and the project proponent. That superiority depends on the relative effects of reduced competition versus the quality of the technical solution provided by the UP.

To formalise these arguments, we build a model in which the UP proponent acts as the principal and the government acts as the agent, thus inverting the traditional view adopted in the literature (Tirole and Laffont, 1993; Baron and Myerson, 1982). We derive conditions under which unsolicited proposals can be welfare-improving compared with solicited proposals. A striking result is that no welfare-improving solution can be obtained from UPs when the project is awarded through direct negotiation. We also provide empirical insights on recent international experience with UPs.

Section 2 reviews the literature on UP processes. Section 3 formally describes UP and SP problems using the principal-agent model and derives conditions under which the former can be welfare-improving. Section 4 discusses the results, contrasting them with findings in the literature and the World Bank's PPI database.[1] Section 5 concludes.

2 UNSOLICITED PROPOSALS, INNOVATION AND COMPETITION

In recent years several countries have begun to consider privately originated PPPs to attract private investment in the provision of public services and infrastructure, with UPs being one of the most frequently used modalities. According to the World Bank (2017a: 9-10), the motivations for considering UPs include the wish to make up for the lack of governmental technical and financial capacity to identify, develop and implement projects; the wish to harness private sector innovation

[1] See https://ppi.worldbank.org/en/ppi.

and creativity; and, to a lesser extent, the desire to reduce the length of the project-awarding process and to increase the possibility of access to private sector finance.[2]

UP processes typically comprise five stages. In the inception phase the proponent identifies a project and provides a preliminary proposal to the government. Governments can set minimum requirements regarding studies and information for the admission of proposals. In the second phase, the government assesses the proposals, including their match with public policy objectives and their potential for obtaining value for money. The third phase consists of project development, including the financial structure, engineering studies, risk allocation analysis, and contract drafting. The fourth phase includes the process of awarding the project, which could be competitive or negotiated depending on the regulatory framework. As described below, even in the context of competitive procurement, UP tenders generally tend to establish asymmetric conditions that favour the proponents. Finally, once the PPP contract is signed, the project execution is initiated.

The rationale behind the use of UPs is closely related to failures in government procurement procedures. Bederman and Trebilcock (1994) note that conventional procurement practices fail to exploit the potential efficiencies that could be achieved in contracting with private parties. This failure may result from government's informational restrictions, search costs, and the failure to provide effective incentives. The authors argue that opening the possibility for private companies to submit unsolicited proposals to government can serve as a mechanism that allows the exploration of opportunities for overcoming these failures. In this context, the private sector would be better suited not only to identify but also to develop and implement such projects. Hodges and Dellacha (2007) and Osei-Kyei et al. (2018a) also argue that UPs can help to remedy the government's low technical and financial capacity through competitive and transparent bidding processes.

On the other hand, UPs have been criticised for lack of competition and transparency compared with SP award processes (World Bank, 2014; Zawawi, Kulatunga and Tayapharan, 2016; Takano, 2021; Marques, 2018; Camacho, Rodriguez and Vieira, 2017). The main concern relates to the advantages provided to those submitting UPs during the tendering stage. For example, some countries do not organise an open tender and negotiate directly with the UP proponent (see, for instance, Yun et al., 2015). Others organise a competitive tender, but provide certain advantages to UP proponents, such as a bonus system, the right to match the better bid (also referred to as a Swiss challenge), and allowing multistage offers (Osei-Kyei et al., 2018b).

The evidence from country case studies suggests that standards of competition applied to UP tenders are lower than those applied to SP tenders (table 1). Most studies (Zawawi, Kulatunga and Tayapharan, 2016; Takano, 2021; Marques,

[2] According to the World Bank (2017a), the evidence on reducing award times is inconclusive because transaction costs of UP processes were previously higher than those of SPs.

2018; and Camacho, Rodriguez and Vieira, 2017) emphasise the obstacles that UPs create to competitive tenders. Even when tenders are allowed, the limited time provided to potential competitors for submitting their bids implies an asymmetric treatment in favour of UP proponents. The World Bank (2017a: 45) found that UPs generally provided too short periods for competing bidders to submit bids, offering a significant strategic advantage to UP proponents. A key side-effect of the lack of competition and transparency in tenders, as highlighted by Bullock (2019), is that such processes are vulnerable to corruption risks.

Table 1

Country case studies on unsolicited proposals

Author	Country	Findings
Zawawi, Kulatunga and Tayapharan (2016)	Malaysia	**Lack of competition** in UP processes.
Mallisetti, Dolla and Laishram (2021)	India	Several flaws in their policies regarding implementation features across the stages of UPs, such as defined objectives, absence of fees and review timeframes in the submission, time frame and guidance on benchmarking and market testing in the evaluation and development stages, and the **time frame for bidding and access to information in the procurement stages**.
Takano (2021)	Peru	**Lack of competition** in UP processes particularly at the subnational government level.
Marques (2018)	Brazil, USA, Korea	Success factors for UP programs: commitment and mutual help are central to the process, robust and well-developed UP frameworks, **competitive tenders**, sound governance practices and leadership of PPP units.
Camacho, Rodriguez and Vieira (2017)	Brazil, Chile	**Difficulties in fostering competition** (very few winners that are not proponents).

Expert surveys on the effectiveness of UPs agree on the importance of promoting competition in UP tenders. In a survey of academics and practitioners, Osei-Kyei et al. (2018a) found that the strategies contributing to successful development and implementation of UPs were thorough assessment of the value for money; of the innovativeness, cost, and risks of proposals; as well as a competitive, fair, and transparent tendering process.

Recognising the tension between the objectives of innovation and competition, UNCITRAL's Legislative Guide for Privately Financed Infrastructure Projects distinguishes the cases in which proposals involve or do not involve novel concepts or technologies to address government infrastructure needs, justifying in the former case the establishment of exceptional negotiated selection procedures:

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> *"(...) a somewhat different situation may arise if the uniqueness of the proposal or its innovative aspects are such that it would not be possible to implement the project without using a process, design, methodology or engineering concept for which the proponent or its partners possess exclusive rights, either worldwide or regionally (...) In such a case, it would be appropriate to authorize the contracting authority to negotiate the execution of the project directly with the proponent of the unsolicited proposal."* (UNCITRAL, 2001: 93).

Intellectual property rights of proponents may clearly pose a serious obstacle to a fair tender for UP projects. Victoria Partnership (2001) suggests that in such cases the government could negotiate with the proponent on aspects of the proposal that could be considered confidential. The government could acquire the rights on information that could be considered crucial for the project, and then procure it on a competitive basis while not disclosing sensitive information. However, even in that case competition conditions may be asymmetric.

Hodges and Delacha (2007) noted that it is difficult to find a fair balance between private incentives to submit proposals and providing a reasonable likelihood of success to other parties challenging the unsolicited proposal. Increasing the challenger's probability of winning would discourage the participation of potential UP proponents, while providing incentives for UP proponents would introduce some type of asymmetric treatment that would place other competitors at a disadvantage. They argued that the Swiss challenge and bonus systems provided challengers a reasonable probability of winning such bids.

A relatively new mechanism used by governments to overcome the failures of traditional public works and PPP procurement mechanisms is the competitive dialogue. These procedures seek to allow more communication between the bidders and the contracting authority in the context of complex and innovative projects (see Buccino et al., 2019; Hoezen, Voordijk and Dewulf, 2012). Competitive dialogues are not yet widely used, however, and will not be analysed in this study.

3 FORMALISATION OF ARGUMENTS

The interaction between regulators and private concessionaires in the context of government-initiated PPPs (or solicited proposals, SPs) has been traditionally characterised with the use of the principal-agent (P-A) paradigm (classic references of that approach are Baron and Myerson, 1982; and Tirole and Laffont, 1993). Under this model, the regulator offers a "regulatory" contract to a prospective concessionaire whose decision must satisfy some participation and incentive compatibility conditions. Accordingly, regulatory contracts are designed to ensure that the private company's incentives are aligned with the regulator's public policy objectives. Under this approach, the regulator enjoys a "first mover advantage" (see Sappington, 1991) whenever they have the capacity to anticipate the agent's possible decisions. This capacity can in turn be used by the principal not only for achieving a more efficient allocation of resources but also for maximising their participation in the results of the exchange.

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Public projects are generally conceived as a manner of providing a solution to a public policy problem or an infrastructure need. There can be different technical options or potential solutions oriented to resolving a public policy problem. For example, a public policy problem can be defined as the absence of connection between a rural town and the rest of a country. One alternative for dealing with that public problem can be to build a road between the town and the country's road network. Other possible solutions could consist of the use of alternative technologies, such as trolley cars or railways, to connect the town with other transport networks. Some solutions can be technically more efficient than others, which can be analysed on a case-by-case basis. The superiority of some solutions versus others, could be based not only on the design or construction dimension of the project but also on their operational quality or maintenance requirements.

Let us assume that there exist n possible solutions for solving a public problem P that can be described by the vector $S = (s_1,s_2,..., s_n)$. For notational convenience, we will consider that S components are ordered downwards from high to low technically efficient solutions. Thus, a low level of s_i indicates that the solution proposed for P has a high degree of "innovativeness" or technical efficiency.

Typically, under the P-A model, the regulator seeks to maximise a welfare function. Let us denotate this welfare function as W. Following Tirole and Laffont (1993), we consider a situation in which the government uses a cost-reimbursement rule to compensate the private concessionaire in exchange for the service provided. Thus, welfare will depend negatively on a net transfer (t) collected by the government from users (given that this reduces the consumer surplus) and on the cost of the service (C) (because of the effect on productive efficiency).[3]

Costs and net transfers would in turn depend additionally on the level of competition faced by the concessionaire during the award process. Depending on the institutional arrangement, an SP or UP can attract more or fewer bidders to a tender process. We will consider a parameter r that denotates the level of "rivalry" or "competitive intensity" faced by bidders during the tender process, where a larger r implies a higher number of competitors.

Using the above-defined parameters, we can express the welfare function as follows:

$$W = W\,(t(r),\, c(s,r)), \tag{1}$$

where $W_t < 0$, $W_c < 0$. Additionally, $t_r < 0$, given that competition during the tender obligates bidders to offer reduced levels of t. Finally, costs relate positively with s as solutions become technically less efficient ($c_s < 0$) while they will tend to decrease as competition grows ($c_r < 0$). We assume that W (...) is first degree homogeneous in s and r.

[3] For simplicity, we will base our analysis in cost reimbursement rules rather in the regulated firm model developed by Tirole and Laffont (1993) chapter 2.

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Assuming that welfare achievable under a traditional public work contract is $W(t(r^{PW}), c(s^{PW}, r^{PW}))$, where r^{PW} and s^{PW} are competition and innovation levels that can be reached by this project implementation model; an SP or UP will only be justified when the level of welfare achieved satisfies $W(t(r), c(s, r)) \geq W(t(r^{PW}), c(s^{PW}, r^{PW}))$. The eligibility criteria and value for money assessment made by the government must ensure that the SP or UP provides a welfare-improving solution compared to the public works model of implementation.

Similarly, the benefit of the private company (B) can also be described as a function of the net transfer and costs of the project, as follows:

$$B = B(t(r), c(s, r)), \tag{2}$$

where (B) will depend positively on net transfers, $B_t > 0$. Given that, under a cost reimbursement scheme, lower costs are typically associated with the company's benefit, B will depend positively on their declared costs (c) (Tirole and Laffont, 1993), $B_c > 0$.

In the absence of informational asymmetries between regulator and concessionaire, the contractual design of a SP would be oriented to maximise (1) subject to a participation condition $B(t(r), c(s, r)) \geq B_0$, where B_0 is the reserve benefit of the private concessionaire.

The solution of this problem is composed of an allocative efficiency condition, as follows:

$$\left.\frac{W_t}{W_c}\right|_{SP} = \left.\frac{B_t}{B_c}\right|_{SP}, \tag{3}$$

and by the following participation condition, which sets the distribution of the results of the exchange:

$$B(t(r^{SP}), c(s^{SP}, r^{SP})) \geq B_0 \tag{4}$$

where r^{SP} and s^{SP} are the optimal levels of competitive intensity and innovativeness, respectively, under the SP problem. Condition (3) means that in the optimum allocation, both the regulator and concessionaire rates of substitution between net transfers and cost are equal.

Condition (4) ensures that society's welfare under SP (W^{SP}) is the maximum attainable provided that the regulated company is remunerated by their opportunity cost. This distribution of the results of the exchange, by construction, is a consequence of the regulator's "first mover advantage". It is important to note, however, that under conditions of informational asymmetry regarding the cost or technology of the concessionaire, only second-best solutions could be achieved

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considering an informational rent (*IR*) as a necessary condition for complying with the participation condition, as follows:

$$B(t(r^{SP}), c(s^{SP}, r^{SP})) - IR \geq B_0 \quad (4')$$

Conversely, a UP can be conceived as a game where the private proponent plays first, submitting to the government a technical solution for a public problem.[4] Assume that in the context of the *P-A* model, regulator-concessionaire roles are inverted. The latter will now enjoy a "first mover advantage" when seeking to maximise their private benefit (Equation (2)) subject to the government's participation condition of $W(t(r), c(s, r)) \geq W_0$. This participation condition could be more complex than the private concessionaire's participation condition. As mentioned above, the eligible solutions for public problems must satisfy not only minimum thresholds of social profitability but also some criteria for risk allocation and value for money. These eligibility criteria, in contrast with the preferences or benefits of the private concessionaire, are generally made public through guidelines or regulations.

The solution of the UP problem can be characterised by its corresponding efficiency condition, as follows:

$$\left.\frac{W_t}{W_c}\right|_{UP} = \left.\frac{B_t}{B_c}\right|_{UP} \quad (5)$$

Equation (5) shows optimality conditions valuated at s^{UP} and r^{UP}.

With respect to the participation condition, international experience shows that the approval of an UP could take time and may involve a complex process of interaction (or negotiation) between the government and the proponent. The participation condition under the UP problem will be as follows:

$$W(t(r^{UP}), c(s^{UP}, r^{UP})) \geq W_0 \quad (6)$$

Given the structure of the P-A optimisation problems described above, it seems unlikely that welfare obtained under the UP problem ($W(t(r^{UP}), c(s^{UP}, r^{UP})) = W_0$) will be superior to the welfare resulting from optimised welfare under an SP procedure ($W(t(r^{SP}), c(s^{SP}, r^{SP}))$). In the first case, the proponent's first mover advantage limits the government welfare at reservation levels, while in the second, in contrast, concessionaire benefits are bounded, and welfare is maximised. In this context, what would be the conditions under which an UP could be preferable to an SP from a welfare perspective?

[4] An exception to this rule could be the case of countries like Brazil (see Fernandez Moreira and Sombra, 2019), that among the modalities of UP, considers the possibility that once the government identifies a public problem, it can publicly request proposals for elaborating feasibility or engineering studies.

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To answer this question, we will consider two groups of scenarios:

1) Let us assume that the government can either possess complete or incomplete[5] information on the set S of possible solutions for P. In the first case, the government knows the n solutions available for solving the public problem, while in the second, the government only knows a subset $k < n$ of the total solutions. At the limit, the government could not have identified any solution for a public policy problem ($k = 0$).
2) Let us distinguish those SP processes where concessionaires have some freedom to participate in the design of the project from those in which design risk is retained by the government. In the first case, the government can incorporate into the project technical elements that can be welfare-improving, while in the second, it cannot.

Taking into account the different scenarios that arise from (1) and (2), we derive some results regarding the conditions under which a UP may allow superior levels of welfare compared to an SP.

Let us first consider the situation where the set of S solutions for P is known by the government. In this case, condition (6) of participation for the government under the UP problem will consider as the reservation level of welfare the result expected from public works ($W_0 = W(t(r^{PW}), c(s^{PW}, r^{PW}))$), as follows:

$$W(t(r^{UP}), c(s^{UP}, r^{UP})) = W(t(r^{PW}), c(s^{PW}, r^{PW})) \quad (6')$$

In this case, the authority has the capacity to assess the value for money and other characteristics of the proposal.

However, compared to the solution that could be obtained from an SP procedure (i.e., $W(t(r^{SP}), c(s^{SP}, r^{SP}))$), as mentioned above, under the government's perfect information regarding potential technical solutions S to P, it is not possible that the welfare obtained from this optimisation process to be lower than reservation welfare levels.[6]

3.1 INCOMPLETE INFORMATION WITH RESPECT TO TECHNICAL SOLUTIONS *S* TO *P*

Under the scenario where the government possesses incomplete information regarding the n technical S solutions available for P, it is possible that a proponent of a UP can submit a novel and innovative proposal to the government.

[5] Harsanyi (1995: 293) defines games with incomplete information generically as those in which "*(...) the players, or at least some of them, lack full information about the basic mathematical structure of the game as defined by its normal form (or by its extensive form)*."

[6] Eventually, additional efficiencies could be captured by an SP if competition levels are superior to those achieved under PW processes; however, there is no reason *a priori* for assuming such a situation.

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Considering first the extreme case in which the government has no information on possible solutions to P, the only reference available for the government to compare the optimal welfare obtained under SP ($W(t(r^{UP}), c(s^{UP}, r^{UP}))$) is the level of welfare without a project (let us denote it as $\underline{W}$). Given that the government's information is incomplete, under this scenario, the proponent can enjoy informational rents (Baron and Myerson, 1982; and Tirole and Laffont, 1993). Cova and Salle (2011) detail the ways through which proponents can make use of their private information to shape projects without revealing all the relevant data and the background of the project. In the context of an UP, the proponent can offer a solution with respect to the status quo if $W(t(r^{UP}), c(s^{UP}, r^{UP})) \geq \underline{W}$. This case corresponds to the scenario described by UNCITRAL (2001), where the proponent submits a novel and unique solution that is unknown to the government. However, to the extent that the proponent enjoys a "first player" advantage and information on their own costs is not known to the government, improvements in welfare derived from a low s^{UP}, in the context of a directly negotiated process can be easily offset by an increase in net transfers, keeping this participation condition as an equality. This result can be different, as explained below, when competition is allowed as a part of the UP process and the proponent has no control over r^{UP}.

In an intermediate case, we can express $S = (s_1, s_2, ..., s_k, ..., s_{n-1}, s_n)$, where the government only knows a subset $S_k = (s_k, ..., s_{n-1}, s_n)$, and only the proponent possesses information on the more efficient potential solutions to P. In this context, government observes a subset $k < n$ of the S solutions, and welfare levels under a UP can be compared with solutions provided by an SP, taking into account the different technical solutions provided by both systems (s^{UP} and s^{SP}).

Prior to continuing with the analysis, it is important to determine the conditions under which optimal SP levels of welfare ($W(t(r^{SP}), c(s^{SP}, r^{SP}))$) could be lower than those achieved under a UP. Considering (6), given that the government only possesses knowledge on a subset of S, its participation condition is $W(t(r^{UP}), c(s^{UP}, r^{UP})) \geq W(t(r^{PW}), c(s^{PW}, r^{PW}))$, i.e., welfare under a UP must be superior to or equal to that under public works (where the technical solution known by the government is s^{PW}). To ensure that the optimal welfare solution under a SP is lower than the welfare under an UP, the participation condition for this last problem should hold as a strict inequality ($W^{UP} > W^{PW}$).

Why may this condition hold as a strict inequality? A plausible answer to this question relates to the discontinuous character of technical solutions S to public problems P. Technological change typically tends to be discontinuous and indivisible (see, for instance, Romer, 1990; or Lissoni, 2005). Thus, in the case of the introduction of a disruptive technology as a part of a solution to P in an UP procedure, the difference between s^{UP} and s^{PW} could cause the reservation condition to convert into a nonbinding restriction. Similarly, provided that s^{P} is higher than s^{UP}, *ceteris paribus*, W^{UP} can also be superior to W^{SP}.

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It is important to stress that this result is conditional on the assumption that the proponent does not have control over the parameter r (competition intensity) and therefore cannot offset the welfare-increasing effect of a disruptive level of s^{UP} with a higher transfer derived from a lower competition intensity. This could be achieved when the proponent faces some degree of competition. Otherwise, i.e., in a direct negotiation scenario, the welfare gained by society derived from a higher s^{UP} could be totally offset by an increase in the net transfer collected from users ($t(r^{SP})$). In other words, directly negotiated awards in UP processes will never lead to welfare allocations that are superior to those in SP processes.

To determine the conditions under which the welfare achieved under a UP can be superior to the welfare obtained in an SP, we can totally differentiate W^{SP} and W^{UP}, which reflect the welfare changes of SP and UP, respectively, when r and s change. Using the property of first-degree homogeneity in s and r of W and rearranging both expressions, we find that the condition needed for a UP to produce a higher welfare than SP ($\Delta W^{SP} < \Delta W^{UP}$) is as follows (for simplicity we assume that $\Delta IR = 0$):

$$r^{SP} - r^{UP} < \frac{W_c c_s}{\left(W_t t_r + W_c c_r\right)}\left[s^{UP} - s^{SP}\right] \tag{7}$$

It is expected that the left-hand side of (7) will be non-negative whenever, as mentioned, according to the literature and the experience reviewed above, the competition intensity under SP processes would be generally higher than in the case of UP processes, so $r^{SP} > r^{UP}$. In this context, when the government possesses complete information on the universe of possible solutions, the UP cannot provide a novel or innovative alternative (i.e., $s^{UP} = s^{SP}$) and (7) does not hold.

In the presence of incomplete government information, there exists the possibility that the solution provided by the UP will be superior to the SP solution ($s^{UP} < s^{SP}$). The more significant the innovations provided by the UP are, the higher the difference between ($s^{UP} - s^{SP}$) (given that $s^{UP} < s^{SP}$ and $\frac{W_c c_s}{\left(W_t t_r + W_c c_r\right)} < 0$, and the product of both is positive) and the greater the probability that (7) holds. The satisfaction of (7), however, must be subject to some additional conditions. First, the differences in the degree of competitive intensity between the SP and UP must not be significant. The poorer the competition conditions offered by UP tenders are, the higher the degree of innovativeness needed by the private proposals to achieve higher welfare results compared to the SP. In addition, as the marginal effects of costs on welfare relative to the effects of competition (i.e., the multiplier $\frac{W_c c_s}{\left(W_t t_r + W_c c_r\right)}$) grow, a lower level of innovativeness is needed to satisfy (7).

3.2 SOLICITED PROPOSALS THAT ALLOW BIDDERS TO PARTICIPATE IN THE DESIGN OF PROJECTS

In some SP projects, governments allow private concessionaires to incorporate design efficiencies into the project; a notable example is the case of beauty contests (see Janssen, 2002). In these cases, when the design risks are partially transferred to concessionaires, the difference between the degree of innovativeness between a UP and an SP will tend to be minor. Given that the difference between s^{UP} and s^{SP} would decrease in absolute terms compared to situations where SP projects do not transfer design risks, it would be least likely that the UP welfare is higher than the SP welfare.

Table 2 sketches the different scenarios that may arise under the different assumptions made regarding the SP and UP processes. The scenarios are divided according to whether the government possesses complete or incomplete information. With respect to SP processes, for simplicity, we assume that as a general rule, all processes are competitively tendered, but in some cases, the design risk can be transferred to the concessionaires. In the case of UP processes, we assume that tenders could be either competitive or directly negotiated.

In the scenario in which the government has complete information regarding all the technical solutions to P, no efficiency can arise from the risk of design transference, and the only source of efficiency could be competition during the tender. Thus, the UP can only produce an efficient result when the project is allocated competitively. However, as demonstrated above, in this case, a UP cannot provide any advantage over an SP.

In the context in which the government has incomplete information, the SP process can capture efficiencies both from competitive tenders and from the transfer of design risks to private concessionaires. Similarly, in UP processes, society can benefit from competitive tenders (if implemented) and innovative proposals. It is interesting to observe that innovations attracted through directly negotiated UPs could also be incentivised, at least partially, through an SP, where design risks are transferred to the private concessionaire. Nevertheless, UPs may exhibit a higher potential for attracting innovative proposals than SPs ($s^{UP} < s^{SP}$) whenever, under a competitive tender, private competitors do not have all the incentives to reveal their private information regarding potential improvements to projects.

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TABLE 2

Results under solicited and unsolicited proposal processes with transfer design risk and competitive and non-competitive tenders

Government's knowledge of *S* (all technical solutions)	Modality of the PPP	Scenarios	Results
Complete information	SP	Transfer design risk	No new technical solution can be offered by the proponent. Unique source of efficiency is competition.
		No transfer design risk	No new technical solution can be offered by the proponent. Unique source of efficiency is competition.
	UP	Competitive tender	No new technical solution can be offered by the proponent. Unique source of efficiency is competition.
		Directly negotiated	Null increase in welfare.
Incomplete information	SP	Transfer design risk	Both competition and a technical solution can be a source of efficiency.
		No transfer design risk	Unique source of efficiency is competition.
	UP	Competitive tender	Both competition and a technical solution can be a source of efficiency.
		Directly negotiated	Welfare enhancing effect of technical solutions is offset with higher tariffs applied by the proponent.

4 DISCUSSION

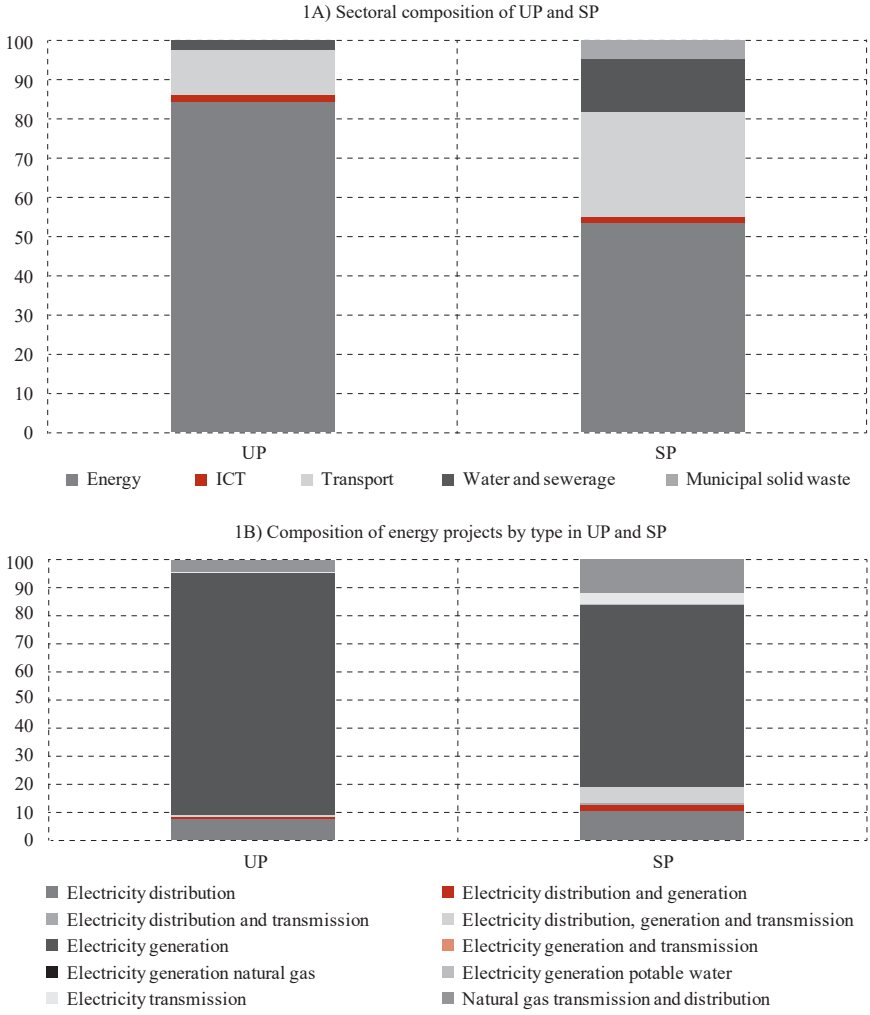
Because of the lack of detailed data on individual UP projects, their characteristics and impact, the empirical literature on PPPs is mostly based on case studies rather than cross-section or panel analysis. In particular, there are no official statistics on the number of UPs and the amount of investment involved in these projects worldwide. Estimates taken from the PPI database, which covers only low- and middle-income countries, show that in 2022, from a total of 9,093 PPP projects, 262 (2.9%) were UPs, 71% of which were initiated since 2010.[7] We can use this information to obtain some insights on the type of projects awarded under UPs and their degree of innovativeness.

Graph 1 shows similarities in the sectoral composition of SPs and UPs. Both SPs and UPs concentrate on energy and transport, followed by water and sewerage and information and communications technology (ICT). A higher proportion of UPs compared with SPs focus on energy projects, notably electricity generation followed by electricity distribution.

[7] At: https://ppi.worldbank.org/en/ppi (accessed in August 2022).

Graph 1

UP and SP distribution by sector (in %)



Source: PPI Database.

Among UPs, a much greater share can be found for renewable than conventional energy projects (graph 2A). However, most renewable energy projects were implemented through SPs, notably in the late 1990s and the second half of the 2000s (graph 2B). Figure A4 in the appendix shows a sharp increase in the number of patents related to non-renewable technologies since 2005, which suggests that this sector is relatively intensive in innovation. However, there has been no corresponding increase in UPs in this sector.

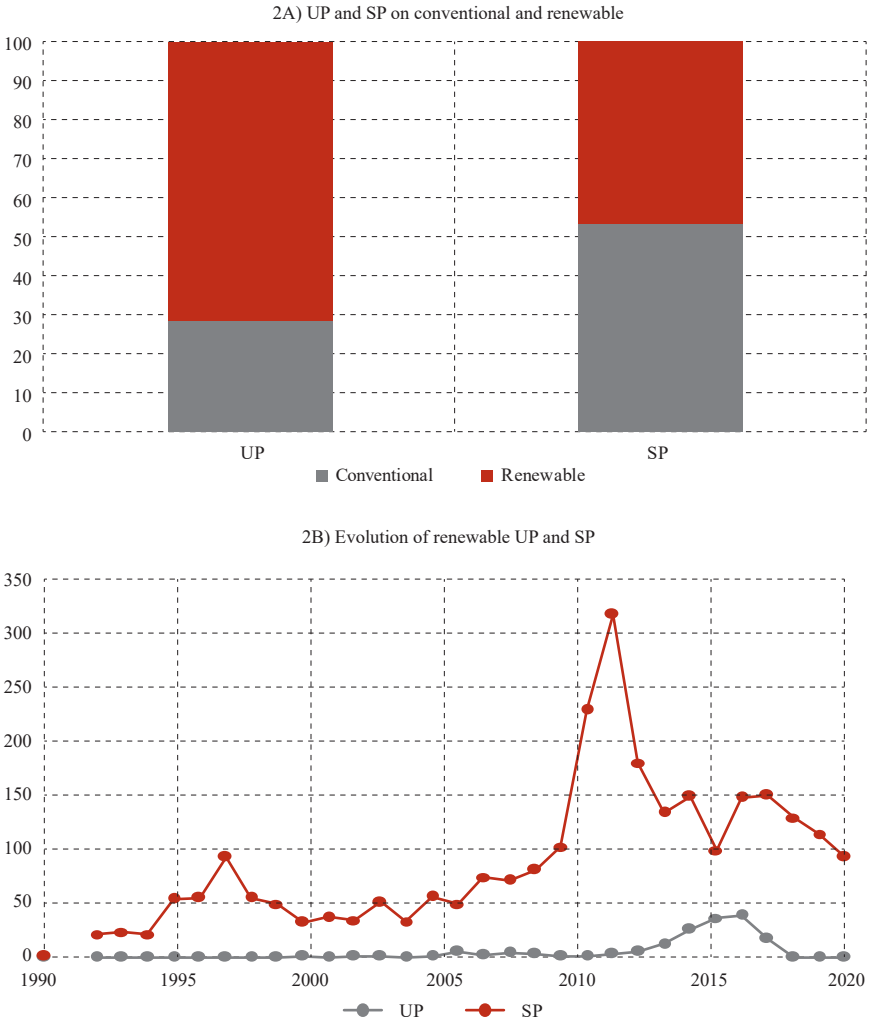
Latin America has been at the forefront of promoting UPs, with Brazil on the top (40%) followed by Colombia (5%), Peru (4%) and Mexico (3%). Other countries

with somewhat higher shares of UPs are India (6%), Turkey (3%), Jordan and Indonesia (3% each) (see table A1 in appendix).

In a case study of Brazil and Chile, Camacho, Rodriguez and Vieira (2017) conclude that UPs "work better in sectors where the government has developed in-house expertise and in projects that were previously evaluated." This suggests that institutional or technical difficulties related to low skills and lack of expert knowledge in public organisations may indeed present an obstacle to governments interested in developing novel and innovative projects.

Graph 2

UPs and SPs on renewable energy projects (in %)



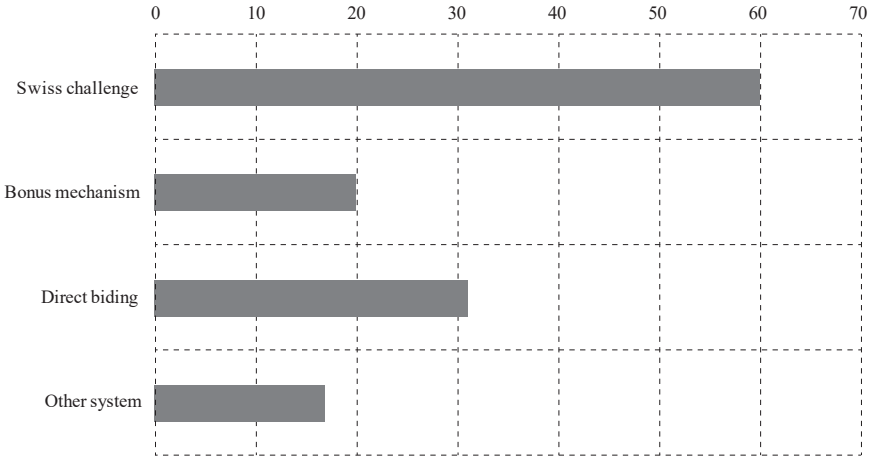
Source: PPI Database.

A benchmark study on competition in PPP projects for a sample of 97 countries found that 22% had not established explicit requirements for awarding UPs through competitive tender (World Bank, 2020). Among countries with regulations that expressly referred to competitive award processes, 22% did not grant potential bidders a minimum time to prepare and present their proposals, 61% provided the same time to UP and SP bidders, 14% provided more time to UP bidders, and only 3% provided more time to SP bidders. Details on the modality of tenders implemented under UP processes were not provided.

In another study for a sample of 17 countries, World Bank (2014) found that tenders in general established asymmetric rules favouring UP proponents through modalities such as the Swiss challenge, bonuses or multistage offers (graph 3). These findings support the case studies referred to earlier that identified the lack of competitive tenders as one of the main weaknesses of UP processes.

Graph 3

Main mechanisms for awarding unsolicited proposals (in %)



Source: World Bank (2014).

In sum, the available information on the degree of novelty and innovativeness in projects awarded through UPs is unconvincing. There is no systematic difference between the sectoral and other characteristics of projects awarded through UPs and SPs. In recent years, UPs could be found in the same sectors and types of projects as SPs. Even in those sectors where the importance of innovative projects *ex ante* was clear, such as renewable energy generation, fewer projects were awarded through UPs compared to SPs. This suggests that, compounding the distortions associated with restrictions on competition, there is no clear evidence that UP tenders have attracted novel and innovative project proposals.

5 CONCLUDING REMARKS

This study formalises the essential characteristics of SPs and UPs, assessing for the first time the common assertion in the literature that UPs have the advantage of attracting innovative and novel projects and providing a welfare-enhancing alternative to conventional methods of tendering. Our analysis concludes that there are no convincing welfare-founded arguments for preferring UP over SP processes, except in very exceptional circumstances. There is no clear evidence, either, that restrictions to competitive tenders through UPs incentivised the submission of innovative and novel project solutions.

Although UPs can in theory produce welfare-superior results, the available empirical evidence cannot confirm such cases or demonstrate that conventional solicited proposals could not achieve the same results. Under asymmetric information, welfare-improving results could be achieved only in the context of competitive tenders: directly negotiated proposals could never lead to superior welfare outcomes compared with solicited proposals. This suggests that UPs can only be advocated when competitive tenders are part of the procurement process.

Another result of our study is that technical upgrades to public projects could be achieved by transferring parts of design risk. Mechanisms such as competitive dialogue (World Bank, 2017b; EPEC, 2011) are promising avenues for seeking innovative projects without restricting the benefits of competition. Analysis of the effectiveness of these mechanisms, together with the collection of more systematic data on unsolicited and solicited proposals, is part of the current research agenda.

Disclosure statement

The author has no potential conflict of interest to report.

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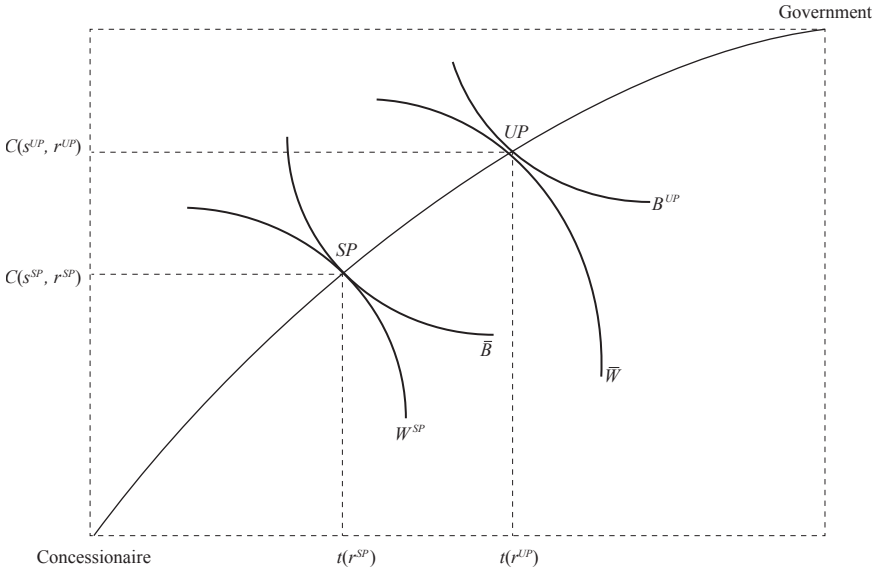
APPENDIX

Figure A1 uses an Edgeworth box to show the interchange relationship between government and concessionaire. In the horizontal axis the net transfer t is measured while the vertical depicts the concessionaire cost function. As can be seen, proponent's utility B depends positively on both t and c while the inverse occurs with welfare function W. With perfect information of government regarding the potential solutions S to P, SP equilibrium is reached in the allocation $(t(r^{SP}), c(s^{SP}, r^{SP}))$ which maximises welfare subject to a reservation utility for the proponent of $\bar{B}$.

Equilibrium under UP is depicted with higher levels of t and c, in the point $(t(r^{UP}), c(r^{UP}, s^{UP}))$. UP allocation represents the proponent maximisation of B subject to welfare reservation levels $\bar{W}$.

FIGURE A1

SP and UP equilibrium with government's perfect information on S



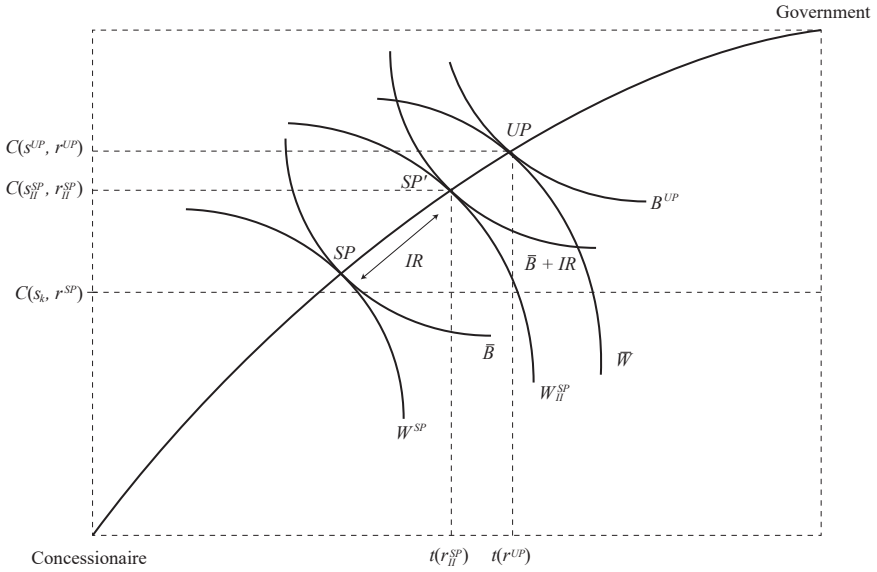
This figure illustrates clearly that if government possess perfect information on the S potential solutions to P, the UP solution will never be superior to SP. The opposite would imply that government maximises W in a point below their reservation levels which would be an irrational behavior or contrary to non-satiation traditional axioms. It is important to notice $r^{SP} > r^{UP}$ which is consistent with the evidence that competition under UP is lower compared to SP. As well, $s^{SP} > s^{UP}$, implies that solution provided by the UP is more efficient than that obtained through SP.

Figure A2 shows the equilibrium under informational asymmetry. Under SP equilibrium where concessionaire enjoys an informational rent (IR). Compared to the equilibrium with perfect information (SP), SP' locates under higher levels of t and c: $t(r_{II}^{SP})$ and $c\left(s_{II}^{SP}, r_{II}^{SP}\right)$. In this figure A2, also is shown $c(sk, r^{UP})$ in the vertical

axis, as the lower limit level where SP solutions can fall, given the incomplete information of government on S solutions to P.

FIGURE A2

SP and UP equilibrium under informational asymmetry



Finally, figure A3 depicts the effect of a reduction in s from s^{UP} to s_{II}^{UP}. Cost reduction from $c(s^{UP}, r^{UP})$ to $c(s_{II}^{UP}, r^{UP})$ which allow an increase in welfare from $\bar{W}$ to W_{II}^{UP}, moving UP equilibrium from UP to UP'. Is important to notice this solution assumes that the level of competition r^{UP} keeps constant. The assumption that the proponent has no control on the level of competition faced under the tender, is critical for achieving the result where UP is a welfare superior solution with compared to SP. Otherwise, the proponent will increase their private rent increasing the net transfer from $t(s_{II}^{UP})$ to $t(s_{II}^{DN})$ (direct negotiated tender); which would lead again to a welfare inferior solution UP''.

Is important to stress that equilibrium UP' falls in a point located below $c(s_K^{UP}, r^{UP})$, a level unattainable for government because it possesses incomplete information on S.

FIGURE A3

The effect of an increase on s, from s^{UP} to s_{II}^{UP}

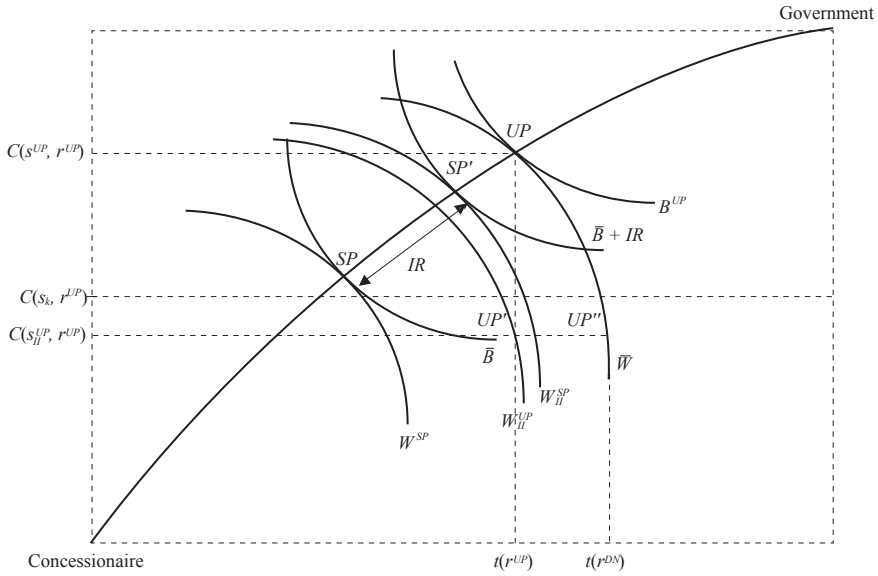
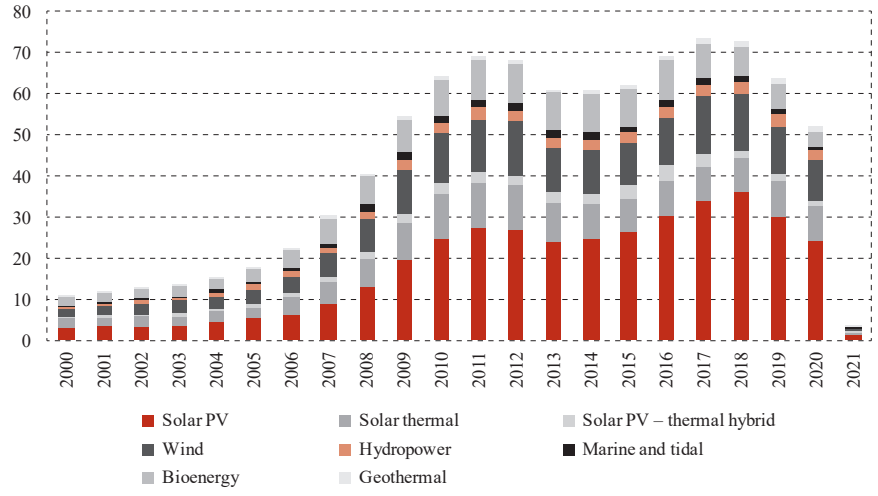


FIGURE A4

Number of patents filed globally for renewable energy technologies (in millions)



Source: International Renewable Energy Agency (IRENA).

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Table A1
UPs awarded by country

Country	Number of unsolicited proposals	Percentage
Brazil	105	40.1
India	17	6.5
Colombia	13	5.0
Peru	10	3.8
Turkey	9	3.4
Mexico	8	3.1
Indonesia	7	2.7
Jordan	7	2.7
Honduras	6	2.3
Philippines	5	1.9
Russian Federation	5	1.9
Bangladesh	4	1.5
Dominican Republic	4	1.5
Malaysia	4	1.5
Pakistan	4	1.5
Others	54	20.6
Total	**262**	**100.0**

Source: PPI World Bank.

How does ownership structure affect the profitability of Turkish banks? A comparative analysis of determinants

AHSEN EMIR BULUT, Ph.D. candidate, Res. Asst.*
NILGUN ACAR BALAYLAR, Prof. Dr.*
TURAN KARIMLI, Ph.D. candidate*

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Ahsen Emir BULUT
Dokuz Eylül University, Graduate School of Social Sciences, Department of Economics, Kuruçeşme, Doğuş Cd. 207V, Buca, 35160 Izmir, Turkiye
e-mail: ahsenemir.bulut@deu.edu.tr
ORCiD: 0000-0003-3475-9456

Nilgün Acar BALAYLAR
Dokuz Eylül University, Faculty of Business Administration and Economics, Department of Economics, Dokuzçeşmeler Kampüsü 24 Sokak No:2, Buca, 35160 Izmir, Turkiye
e-mail: nilgun.balaylar@deu.edu.tr
ORCiD: 0000-0002-7024-5279

Turan KARIMLI
Azerbaijan State Economic University, Hasan Aliyev 135, Narimanov, Baku, AZ1007, Azerbaijan
Western Caspian University, 31 Istiglaliyyat, 1001 Baku, Azerbaijan
e-mail: turan.karimli@ogr.iu.edu.tr
ORCiD: 0000-0001-7023-0854

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Abstract

This study examines the determinants of profitability of deposit banks in Turkiye taking into account differences in the ownership structures of public, private domestic and foreign-owned banks. The aim of the study is to analyse whether the factors determining profitability change depending on the managerial differences that the ownership structure may entail. A seemingly unrelated regression method with monthly data from 2010 to 2022 is used for this purpose. Our findings suggest that the real effective exchange rate, inflation, and non-interest income variables have common effects on profitability regardless of bank ownership. However, the bank capital ratio, bank size, loan to deposit ratio, and economic activity affect profitability differently across bank ownership types.

Keywords: ownership structure, Turkiye, bank profitability, seemingly unrelated regression

1 INTRODUCTION

Historically, public banks have often been established in crisis times to support economic developments or respond to the effects of financial, social, and now, for example, climate crises. Operating in the public sphere can lead public banks to operate differently from private banks. Public banks are not subject to the same competitive pressures as private banks due to the policy framework in the public sector and political will (Barrowclough and Marois, 2022). Public and private banks can thus operate in different institutional environments (Karas, Schoors and Weill, 2010). Public banks may perform functions that are not necessarily fulfilled by private banks, such as providing finance for projects with high social but relatively low private returns (Coelho, de Mello and Rezende, 2013), or continuing to provide finance during cyclical downturns. Public banks usually respond to the needs of governments due to the presence of state officials in their management. Extensive state participation in the banking system could thus undermine fiscal discipline by providing access to quasi-fiscal in addition to any regular public sector budget financing (Garcia and Grigoli, 2014).

Foreign banks generally differ from local banks through better access to superior technology and international capital markets, more sophisticated risk management techniques, and often a more experienced workforce (Wanke et al., 2021). There has been a remarkable increase in foreign bank participation worldwide in the past thirty years. The literature generally evaluates this trend as beneficial, as foreign banks make the banking sector more competitive, provide easier access to cross-border funds, increase the efficiency of local banking markets, and stabilise lending conditions during local crisis periods (Jeon and Miller, 2005; Albertazzi and Bottero, 2014). Moreover, there is strong evidence that foreign banks are more efficient (Berger, Hasan and Zhou, 2009; Berger et al., 2005; Liu et al., 2020; Chen and Hsu, 2022). Therefore, governments in developing countries have adopted policies to privatise public banks and reduce entry barriers for foreign banks.

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The assets of public and private banks increased in tandem until the 2008 Global Financial Crisis (GFC). During the GFC, foreign banks typically reduced their lending to a greater extent than domestic banks (Caparusso and Hardy, 2022; Cull, Peria and Verrier, 2017), even though domestic banks' access to cross-border financing was often more restricted than that of foreign banks. Although the GFC did not lead to a significant change in the ownership structure of banks in developing countries, foreign banks adjusted their balance sheets more rapidly in developing countries with a high share of foreign banks (Mihaljek, 2014).

On the other hand, the importance of publicly owned banks has increased since the GFC. One reason noted in the literature is that they finance their assets largely with deposits, which tend to be sticky – including in crisis periods. Another is that in many countries public banks receive allocations from government budgets to finance targeted programmes in the real economy. By rapidly expanding their assets and branches after the GFC, public banks thus became stronger competitors in many countries' local markets (EBRD, 2020).

The resilience of public banks during the GFC revived the debate on the economic costs and benefits of state-owned banks (Borsuk, Kowalewski and Pisany, 2022). One aspect of this debate has been the influence of ownership and management structures on bank profitability. Numerous studies found that public banks tend to be less profitable than either private domestic or foreign banks (Flamini, McDonald and Schumacher, 2009; Micco, Panizza and Yanez, 2007; Bonin, Hasan and Wachtel, 2005; Gupta and Mahakud, 2020). As banks become more profitable and develop a more robust financial structure, they contribute to both financial development and financial stability (Ozili and Ndah, 2021). Therefore, it is crucial to analyse the variables that determine profitability, specifically in relation to bank ownership.

Developments in the Turkish banking sector have followed the global trend. In order to encourage economic growth, especially in the post-2010 period, state-owned banks have been used as an important policy tool for credit expansion. As a result, the weight of public banks in the Turkish banking sector has increased. Economic policies implemented during the GFC and the covid pandemic have made differences in bank management based on ownership even more evident. This study aims to highlight these management factors in explain differences in the profitability of public, domestic and foreign banks operating in Turkiye between 2010 and 2022.

Our study differs from the existing literature in two respects. First, unlike most earlier studies, which focused on the link between the ownership structure and efficiency of banks, we focus on the link between differences in managerial structure and profitability of banks. Second, we analyse factors affecting bank profitability on a bank-by-bank basis by using a seemingly unrelated regression (SUR) framework. We argue that the SUR framework is appropriate due to the oligopolistic structure of the Turkish banking sector. To support and complement the

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findings of the SUR estimation, we also include in the model dummy variables to represent different bank types, and use panel data analysis to capture relative differences in profitability. In this way we can more robustly examine the heterogeneity of the determinants of bank profitability.

The remainder of this paper is organised as follows. Section 2 describes some stylised facts on the Turkish banking sector and its ownership structure. Section 3 reviews the relevant empirical literature. Section 4 describes the data and the empirical framework. Section 5 presents and discusses the estimation results. Section 6 concludes.

2 STYLISED FACTS ON THE BANKING SECTOR IN TURKIYE

The financial sector in Turkiye is bank-based (BAT, 2021) and the most important source of external finance for the private sector is bank loans. Restrictions on foreign entry in the pre-1980 period allowed domestic commercial banks to operate in an oligopolistic structure with almost no competition. In the post-1980 period, liberalisation and deregulation aimed at integrating domestic banks with the global financial system, and providing greater diversity in money and capital market instruments, resulted in greater competition, as new domestic and foreign banks entered the market (BAT, 2019: 21).

The financial fragility of the banking sector increased during the 1990s. Public banks were exposed to high interest rate risk due to the large holdings of public debt instruments in their portfolios. Private banks were more exposed to exchange rate risk due to their open foreign exchange position (Akçay, 2011). The sudden increase in interest rates and a sharp depreciation of the exchange rate in 2001 weakened the financial structure of both public and private banks, resulting in a banking crisis (Akyüz and Boratav, 2003). A significant part of the stand-by agreement signed with the IMF consisted of banking sector restructuring (Özatay and Sak, 2002). Regulation of foreign currency positions, connected lending practices, and capital adequacy criteria were considerably strengthened. Basel II was taken as an international benchmark to determine the regulatory framework. Foreign bank participation increased as a result, including in domestic majority-owned banks. Although the number of public banks remained constant, their relative share in the sector decreased until the GFC.

In the aftermath of the GFC, quantitative easing policies of major central banks and falling global interest rates led to a decrease in interest rates and rapid credit expansion in Turkiye. Government policies contributed to the expansion in 2018, for example, a state-backed Credit Guarantee Fund was established to support credit to small and medium-sized enterprises (Orhangazi and Yeldan, 2021). In 2020, public banks played a leading role in credit expansion aimed at alleviating the damage caused by the covid pandemic. These developments increased the weight of public banks in the banking sector. Separately, the central bank and the Banking Regulation and Supervision Agency (BRSA) implemented a set of

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regulations that compelled domestic private banks to lend more (BAT, 2020). These generally increased the operational costs and the complexity of risk management for domestic private banks, making it easier for public banks to attract deposits. As a result, the share of assets, loans and deposits of publicly owned banks increased further, to over 40% of the banking sector total in 2021.

Table 1 presents the main indicators of performance for deposit banks operating in Turkiye. Public banks differ from domestic private and foreign banks in several respects. Although they expanded strongly in terms of asset, loan and deposit shares in the sector after the GFC, they had the lowest equity, asset and branch profitability in the sector. In terms of foreign currency net general position, public banks and domestic and foreign banks were similar in the 2000s, but after 2010 private domestic and foreign banks showed much higher foreign net currency surplus.

Although the banking sector as a whole strengthened considerably after the 2001 restructuring programme, public banks were unable to increase their profitability and efficiency sufficiently. In addition, their capital adequacy ratio, which reached 50% after recapitalisation in 2002, decreased in the following years and was below the sector average as of 2021.

Public banks use deposits as a source of funding to a greater extent than private domestic and foreign banks. Similarly, the share of domestic currency deposits in total deposits, and the share of domestic currency loans given in total loans were higher for public than private banks.

The ratio of non-performing loans (NPL) to total loans in public banks increased well above that in private banks after the 2001 crisis, decreasing gradually in the following years. During the downturn in 2018, many public bank loans were restructured, so by 2021 the NPL ratio was lower in public than in private banks.

The liquidity ratio of public banks was below the sector average in 2021, and their interest expenses were higher as a share of total expenses than those of domestic and foreign private banks. Interest income as a share of total revenue was higher for public banks as private banks generated much more non-interest income. Private domestic and foreign banks thus had much higher interest margins than public banks.

Finally, the number of employees and branches per bank was much higher for public than private banks. Foreign banks operated with the smallest number of branches and employees per bank.

Table 1

Selected indicators of commercial banks in Turkiye

	Public banks			Domestic private banks			Foreign banks			All deposit banks		
	2002	**2010**	**2021**	**2002**	**2010**	**2021**	**2002**	**2010**	**2021**	**2002**	**2010**	**2021**
Average return on equity (%)	50	17	15	20	18	20	33	17	19	23	18	18
Foreign currency net general position / Equity (%)	2*	1	1	1*	0	10	4*	-1	9	0*	0	7
Average return on equity (%)	16	23	6	16	18	18	6	11	17	8	18	14
Average return on assets	2	2	0	2	2	2	1	1	2	1	2	1
Turkish lira deposits / Total deposits (%)	63	78	41	31	64	34	18	67	32	42	70	37
Turkish lira loans / Total loans (%)	75	79	69	34	65	62	44	82	58	43	72	64
Loans/Deposits (L/D) (%)	22	70	88	43	90	89	73	106	89	35	80	89
Non-performing loans (NPL) / Total loans (%)	13	0	3	4	0	4	1	1	4	7	1	4
Interest income / Interest expenses (%)	131	184	147	144	200	186	234	252	209	137	202	170
Interest expenses / Total assets (%)	23	4	5	11	4	4	8	4	3	15	4	4
Interest income / Total revenue (%)	91	86	98	82	75	86	75	87	80	87	80	89
Interest expenses / Total expenses (%)	85	71	90	72	59	80	51	47	78	77	61	84
Liquid assets / Short-term liabilities (%)	56	45	24	80	57	34	80	62	42	74	54	32
Total loans / Total assets (%)	14*	48	58	32*	52	54	39*	58	56	54*	48	56
Total deposits / Total assets	72	77	66	70	62	61	52	58	58	70	66	64
Net profit per branch (million TL)	1	3	3	1	3	11	0	1	11	0	2	8
Employment ('000)	40	47	62	67	84	66	5	42	52	118	173	180
Number of branches per bank	673	915	1,238	183	417	446	464	123	115	152	294	306

**The data are for 2003.*

Sources: The Banks Association of Turkiye 2002, 2010, 2021; Banking Regulation and Supervision Agency (BRSA); Banking Sector Data; Banking System in Turkiye (from 1958 to 2021).

3 LITERATURE REVIEW

3.1 BANK-RELATED DETERMINANTS OF PROFITABILITY

The bank-related factors that determine the profitability of banks consist of the active and passive items of the bank's balance sheet. Banks' efforts to achieve high returns with the least risk by utilizing their various resources in alternative investment areas constitute asset management, and their efforts to raise funds with the least cost constitute liabilities management. Equity is an endogenous variable that determines the profitability of banks. It is considered a tool that guarantees the bank's ability to protect itself against risk (Demirgüç-Kunt, Detragiache and Merrouche, 2013). The relationship between equity and profitability is controversial, as previous empirical findings have shown. For instance, Iannotta, Nocera and Sironi (2007) analysed 180 banks from 15 European countries and found that equity increases profitability in both public and private banks. In their study of Pakistani banks from 2011-2014, Waleed, Shah and Mughal (2015) found that the variable of equity/total assets has a greater impact on the profitability of private banks than that of public banks. Chortareas, Girardone and Ventouri (2012) found that equity has a positive effect on profitability. In contrast, Bitar, Pukthuanthong and Walker (2018) discovered a negative effect of high levels of equity on the profitability of public and private banks with high liquidity in their study of European banks from 1999-2013. In a study with comparable results, Goddard et al. (2013) concluded that the capital ratio negatively affects profitability. This indicates that banks with higher capital have lower risk levels and therefore earn lower returns.

Results regarding the relationship between non interest income (NNI) and profitability vary in the literature. NNI activities can have a positive impact on bank profitability by being less sensitive to changes in interest rates and the economic conjuncture and by allowing banks to benefit from scope economies through diversification (Hsieh, Chen and Lee, 2013; Berger, Hasan and Zhou, 2010). Expanding NNI activities, on the other hand, may entail an increase in fixed expenses (for example, new employees), which increases banks' operating leverage (Stiroh, 2004). Diversification may cause managers to work beyond their areas of competence and banks to abandon sectors where they have a comparative advantage (Adesina, 2021; Vidyarthi, 2020; Abedifar, Molyneux and Tara, 2018). There are studies in the literature showing that the relationship between non-interest income and bank performance differs according to the ownership structure of the bank. It is seen that public banks benefit less from non-interest income than domestic and foreign banks (Ahamed, 2017; Tan, 2020). Additionally, Abugri, Osah and Andoh (2016) found that non-interest income does not differ on bank performance in terms of domestic and foreign banks.

The credit-deposit ratio is the ratio of bank loans created from deposits, in other words, the lending capacity of banks. A high ratio indicates that banks generate more loans from their deposits. This ratio reflects a bank's ability to use its existing resources optimally (Ramchandani and Jethwani, 2017). Since loans are the

primary source of income for banks, a high credit-deposit ratio means that deposits are used better and generate higher earnings (Biswal and Gopalakrishna, 2014; Gurung and Gurung, 2022). However, it can lead to significant credit misallocation when politicians use state bank loans to secure political patronage (Carvalho, 2014; Laidroo, 2016). Therefore, for public banks, there may be an inverse relationship between the loan-to-deposit ratio and bank performance. Domestic banks have more precise information about the market in which they operate than foreign banks. Foreign banks may be reluctant to lend to small and medium-sized firms due to an information disadvantage. However, the global advantages hypothesis suggests that foreign banks may have better risk management and operational techniques (Garcia and Trindade, 2019; Rosalina and Nugraha, 2019). For this reason, the ownership structure can affect banks' lending decisions and thus their risk management. Athanasoglou, Brissimis and Delis (2008) reported that loan/deposit ratio increases the profitability of private banks. Aydemir, Övenç and Koyuncu (2018) reported an inverted U-shaped relationship between loan/deposit ratio and profitability.

A negative or positive relationship between bank size and profitability can be expected. Large banks can benefit from scale economies by keeping their costs low and also earn very high profits by using their market power in pricing their products if they have well-differentiated products. However, small banks can increase their profitability by serving more risky customers and applying higher rates to loans, thus earning higher interest income (Liu and Wilson, 2010; Afanasieff, Lhacer and Nakane, 2002; Ejoh and Sackey, 2014).

In their study of six Eastern European countries, Košak and Čok (2008) discovered that market share had a positive impact on profitability for the entire sample of banks. However, a negative relationship was statistically significant for a subsample of foreign banks. This outcome has been attributed to the above-average growth of foreign-owned banks, usually immediately after entering the market. Pasiouras and Kosmidou (2007) found that the profitability of European banks is positively affected by their size. This is because larger banks tend to have a higher level of product and loan classification than smaller banks, which enables them to benefit from economies of scale. Micco, Panizza and Yanez (2007) state that the size of the bank does not affect the return on assets, as the estimated coefficient is not statistically significant. Empirical evidence suggests that whether a bank is privately or state-owned impacts its financial outcomes. Similarly, some studies report an insignificant relationship between bank profitability and bank size (Goddard, Molyneux and Wilson, 2004; Athanasoglou, Brissimis and Delis, 2008).

3.2 MACROECONOMIC DETERMINANTS OF PROFITABILITY

The relationship between economic growth and bank profitability is inconclusive. A rise in the rate of growth will result in an increase in the sector's activities, which will benefit profitability (Hasan, Manurung and Usman, 2020). When the economy is doing well, both the rise in client deposits and loans and the increase

in interest margins benefit bank profitability (Petria, Capraru and Ihnatov, 2015). Another key reason that bank profits rise in tandem with economic expansion is that fewer loans default during periods of rapid growth (Vejzagic and Zarafat, 2014). Bertay, Demirgüç-Kunt and Huizinga (2012) examined state-owned banks in 111 countries in the period 1999-2010 and found that the loans given by public banks were less cyclical than those of private banks. Moreover, loans issued by state-owned banks in high-income countries are counter-cyclical. Numerous studies have found a negative correlation between economic growth and the performance of public banks (Laidroo, 2016; Ferri, Kalmi and Kerola, 2014).

The exchange rate and bank profitability are related in both direct and indirect ways. A direct negative effect on the bank balance sheet occurs when the bank has more foreign currency liabilities than foreign currency assets and the local currency depreciates unexpectedly. On the other hand, even if the bank is not in a foreign exchange open position, banks are indirectly exposed to exchange rate risk in the case of default of bank loans because real sector firms carry large amounts of net foreign currency debt, especially in developing countries (Hahm, 2004). Košak and Čok (2008) found that the depreciation of the national currency positively affects the profitability of the entire banking sector, while the exchange rate variable is insignificant for domestic banks. Acaravcı and Calım (2013) found that the effect of real exchange rate on bank profitability in Turkiye for the period 1998-2011 was positive for public and foreign banks and insignificant for domestic private banks.

There are different views on the effect of inflation on bank profitability. The dominant view is that the relationship is positive. This argument relies on the assumption that bank income grows faster than bank costs in an inflationary environment. High inflation rates are often linked to high interest rates on loans and consequently high income. However, when inflation is unforeseen and banks are slow to adjust interest rates, there is a risk that bank costs will rise faster than income and thus negatively affect profitability. Unexpected inflation may also cause debtors to have difficulty in paying, resulting in credit losses. At the same time, bank costs tend to increase with inflation. More transactions can lead to higher labour costs (Demirgüç-Kunt and Huizinga, 1999; Vong and Chan, 2009). High inflation can weaken the domestic currency, so that profits of banks with open foreign exchange positions may decrease due to exchange rate losses. Inflation may also lead to slower output growth, weaker growth of deposits and loan demand, and a decrease in profitability. Empirical studies have found both negative (Rahman, Hamid and Khan, 2015; Aftab, Samad and Husain, 2015; Supriyono and Herdhayinta, 2019) and positive effects of inflation on bank profitability (Sufian, 2009; Rose and Wieladek, 2012; Al-Jafari and Alchami, 2014).

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4 DATA AND EMPIRICAL FRAMEWORK

4.1 DATA

This study aims to examine the internal and macroeconomic determinants of profitability in the banking sector in Turkiye according to ownership structure by using seemingly unrelated regression analysis. Monthly data covering the period from 2010M1 to 2022M12 are used for this purpose. The variables and their abbreviations are shown in table 2.

Table 2
Variable definitions

Notation	Definition	Source
ROE	Return on equity (Net income / Total equity)*100	TBA
EQUITY	The ratio of equity to total assets (Equity / Total assets)	TBA
NNI	Non-interest income (Fees and commission income / Total assets)*100	TBA
CUR	Rate of capacity utilisation (%) (proxy for economic growth on a monthly basis)	CBRT
RER	Real effective exchange rate (2003=100)	CBRT
INF	Inflation rate (%)	CBRT
SIZE	Logarithm of the ratio of assets by ownership to total assets (%)	TBA
CREDIT/ DEPOSIT	Loan-to-deposit ratio (Total loans / Total deposits)	TBA

Return on equity is used as the dependent variable and the bank-related variables are the ratio of equity to total assets, the ratio of fee and commission income to total assets and the ratio of total loans to total deposits. In addition, the logarithm of the share of assets of public, domestic private and foreign banks in sector assets is used as an indicator of bank size. These variables are obtained from the Turkish Banks Association database in an aggregated form. Macroeconomic variables are the industrial sector capacity utilization rate as a proxy for economic growth, real effective exchange rate (RER), and inflation rate. These variables are taken from the CBRT database. Table 3 presents the descriptive statistics of the variables used in this study.

Table 3
Descriptive statistics

Variable	N	Mean	Std. dev.	Min.	Max.
ROE	468	8.4	5.7	0.003	36.5
EQUITY	468	0.1	0.02	0.1	0.15
NNI	468	12.2	3.1	6.1	18.8
CUR	468	75.3	3.7	67.8	81.9
RER	468	95.1	18.4	53.5	126.5
INF	468	15.2	16.9	3.9	85.5
SIZE	468	13.3	0.8	11.5	14.9
CREDIT/DEPOSIT	468	1.1	0.2	0.5	1.2

4.2 EMPIRICAL FRAMEWORK

Regression analysis is used to determine the cause-effect relationship between two or more variables and to make predictions based on this relationship. Some problems encountered in daily life can be solved by using linear regression models and obtaining statistical results. Sometimes, multiple models can be encountered and there can be individual relationships between these models. These models, although they may seem unrelated to each other, can contain different dependent variables in the system of linear regression models and have error terms that are correlated with each other. Especially, situations related to models that use the same data set or models that have some independent variables in common with other models can be encountered. Such situations are called seemingly unrelated regression (SUR) models. SUR models are models that allow for correlated errors between equations. In other words, as much as possible, SUR models take into account the interactions between statistical data that are difficult to perceive. These models were first proposed by Zellner (1962). A general approach to SUR models is to combine these models as a system instead of treating them separately. According to this approach, the models are combined using block matrices. Therefore, it is important to present the results related to the SUR model and the parameter estimates under this model clearly (Zellner, 1962). The SUR model is a system of equations that contains multiple multivariate equations. Each equation is a linear and multivariate regression equation and there is usually no connection between the equations. If there is a neglected variable in any equation, the effect of this variable appears in the error term. If this variable is highly correlated with one of the explanatory variables of the other equations, a connection between the error terms or an existing connection is strengthened (Elhorst, 2003).

Such regression equations with associated error terms are frequently encountered in economic models. Equations related to error terms can be seen in the demand functions of various goods or the production functions of various industries. For example, the error term of the demand function for good A can be associated with the error terms of the demand functions for goods B and C. In addition, the SUR model can be encountered when the dependent and independent variable data are time series or survey data (Youssef, Abonazel and Kamel, 2022).

The SUR model can be defined as follows using n regression models:

$$\left.\begin{aligned} y_{1t} &= \beta_{10} + \beta_{11}X_{1t,1} + \beta_{12}X_{1t,2} + \ \dots\ + \beta_{1kt}X_{1t,k1} + u_{1t} \\ y_{2t} &= \beta_{20} + \beta_{21}X_{2t,1} + \beta_{22}X_{2t,2} + \ \dots\ + \beta_{2kt}X_{2t,k2} + u_{2t} \\ y_{nt} &= \beta_{n0} + \beta_{n1}X_{nt,1} + \beta_{n2}X_{nt,2} + \ \dots\ + \beta_{nk}X_{nt,kn} + u_{nt} \end{aligned}\right\} t = 1, 2, \dots, n \quad (1)$$

The regression equations given above can be expressed in matrix form as follows:

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$$\begin{bmatrix} Y_1 \\ . \\ . \\ . \\ . \\ . \\ Y_N \end{bmatrix} = \begin{bmatrix} x_1 & 0 & . & . & . & 0 \\ 0 & x_2 & . & . & . & 0 \\ . & . & . & . & . & . \\ . & . & . & . & . & . \\ . & . & . & . & . & . \\ . & . & . & . & . & . \\ 0 & 0 & . & . & . & x_N \end{bmatrix} \begin{bmatrix} \beta_1 \\ \beta_2 \\ . \\ . \\ . \\ \beta_N \end{bmatrix} + \begin{bmatrix} u_1 \\ u_2 \\ \\ \\ \\ u_N \end{bmatrix}$$

In the matrix, the dimension of the *yn* matrix is *(TNx1)*, the dimension of the *xn* matrix is *(TNxK)*, the dimension of the *βn* matrix is *(Kx1)* and the dimension of the *un* matrix is *(TNx1)* (Wang and Kockelman, 2007). There are five basic assumptions of the SUR model. These assumptions can be expressed as follows.

$$Cov(u_{it}, u_{jt}) = E(u_{it} u_{jt}) = \sigma_{ij}, \ i \neq j, \quad t = 1, 2, \ldots, n, \quad i, j = 1, 2, \ldots, N \tag{2}$$

According to this assumption, there is a relationship between the error terms of the equations in the same period.

$$Cov(u_{it}, u_{jt}) = Var(u_{it}) = \sigma_{ij} \tag{3}$$

According to this assumption, the constant variance condition is valid for the equations in the model.

$$Cov(u_{it}, u_{js}) = E(u_{it} u_{js}) = 0, \ t \neq s \tag{4}$$

There is no relationship between the error terms of the equations in different periods.

The error terms follow a normal distribution.

$$E = (u_i) = 0, \quad i = 1, 2, \ldots, n \tag{5}$$

According to this assumption, the expected value of the error term for each equation is zero.

In addition to the five basic assumptions of the SUR model expressed above, it is also necessary to ensure that the time dimension is larger than the unit dimension (T>N) in the SUR model (Kmenta and Gilbert, 1968).

Following the theoretical information presented in the methodology section, we will first estimate the model using SUR estimation. This approach is essential because the interdependence between the error terms can lead to biases in the regression results when using common arguments in the models. Additionally, we will predict the model using the panel data approach. By using both panel data models and the SUR model, we aim to facilitate meaningful comparisons and reduce potential biases.

5 ESTIMATION RESULTS

The correlation matrix between the error terms obtained from the models for the public, foreign private, and domestic private deposit banks operating in Turkiye and the Breusch-Pagan test results indicating cross-sectional dependence are given in table 4.

Table 4

Correlation matrix of error terms obtained from models related to banks

	ROE_1	**ROE_2**	**ROE_3**
ROE_1	**1.000**		
ROE_2	0.668	**1.000**	
ROE_3	0.826	0.908	**1.000**
Breusch-Pagan test of independence: chi2(45) = 337.742			Pr = 0.000

According to the correlation matrix, there is a very high degree of relationship between the error terms of the three types of banks. There is a 66.83% relationship between the error terms obtained from the model for public banks and the error terms obtained from the model for foreign banks. There is an 82.67% relationship between the error terms obtained from the model for public banks and the error terms obtained from the model for domestic private deposit banks. There is also a very high correlation relationship of about 90.81% between the error terms obtained from the models for foreign private and domestic private deposit banks. The high correlation relationship between the error terms obtained from the models for the banks indicates that the results obtained from the normal regression model are not appropriate. In addition, according to the Breusch-Pagan Cross-Sectional Dependence test results, the null hypothesis that there is no cross-sectional dependence has been rejected. That is, there is a relationship between the error terms obtained from the models for different types of banks. In this context, since the error terms in the equations related to the sample banks in this study are related to each other, that is, there is cross-sectional dependence, the "Seemingly Unrelated Regression (SUR)" estimation method can be used (Tatoğlu, 2012).

Table 5

Pesaran and Yamagata (2008) test results

	Delta	**P-value**
Δ	4.527	0.000
Adj-Δ	4.665	0.000

The results of the Pesaran and Yamagata test to test the homogeneity of the slope coefficients are summarized in table 5. According to the results obtained, the probability values of the test statistics are less than 0.05. That is, the null hypothesis H0 which states that the slope coefficients are homogeneous is rejected. As a result, it is appropriate to use the SUR model in this study. This finding supports the correlation matrix and the Breusch-Pagan cross-sectional dependence tests.

Table 6
Overall statistical significance of equations

Equation	RMSE	R^2	Chi^2	Probability
ROE_1	0.989	0.717	59.07	0.000
ROE_2	0.735	0.723	62.82	0.000
ROE_3	0.739	0.716	51.78	0.000

The general model results obtained for each type of bank are shown in the table 6. According to the results, the model results obtained for each type of bank are statistically significant. In addition, the explanatory power of the model results for public banks (71.7%) is higher than the explanatory power of the models for foreign private (72.3%) and domestic private banks (71.6%).

Table 7
Panel SUR estimations for Turkish banks

Dependent variable	Independent variables	Coefficient		
		Public	Foreign	Domestic private
ROE	EQUITY	8.232 (5.542)	22.443*** (3.715)	9.377** (4.101)
	NNI	0.154** (0.067)	0.029** (0.015)	0.105*** (0.028)
	CUR	0.049 (0.045)	0.077*** (0.018)	0.065*** (0.017)
	RER	-2.159** (1.036)	-3.135*** (1.353)	-3.047*** (1.026)
	INF	-0.027*** (0.007)	-0.004* (0.019)	-0.047** (0.013)
	SIZE	0.536** (0.218)	-0.038 (0.112)	0.017 (0.272)
	CREDIT/DEPOSIT	-2.053*** (0.725)	0.267* (0.128)	-2.349*** (0.539)
	Constant	3.428 (3.572)	14.761*** (4.551)	11.672* (5.852)

*Note: *10% level, **5% level, ***1% level.*

According to our findings, RER, INF and NNI variables have common effects regardless of bank ownership. The NNI variable positively affects profitability in public, domestic, and foreign private banks, while the RER and INF have a negative effect. The high inflationary environment experienced in the Turkish economy in recent years negatively affects the profitability of commercial banks regardless of ownership. These results are consistent with the studies of Rahman, Hamid and Khan (2015); Aftab, Samad and Husain (2015); Supriyono and Herdhayinta (2019). A decrease in the real exchange rate (i.e. an appreciation of the foreign currency) leads to an increase in bank profitability. This relationship is confirmed by the existence of a surplus in the foreign currency position in the

banking sector in Turkiye, which is a result of regulations on foreign currency position and good management of exchange rate risk in the sector. In the model results, the RER variable is significant at 1% for domestic private and foreign banks, and significant at 10% for public banks. Regarding ownership structure, it is noteworthy that private banks tend to have a higher excess foreign currency position compared to public banks, which has a greater impact on their profitability. In Turkiye, public banks have been conducting foreign exchange sales in recent years to prevent the depreciation of the national currency. This practice has a negative impact on the foreign currency position of state banks.

The positive relationship between NNI, which is an internal variable, and bank profitability shows that commercial banks in Turkiye increase their profitability through diversification. These results are consistent with the studies of Hsieh, Lee and Shen (2023) and Berger, Hasan and Zhou (2010). Our finding that NNI increases profitability raises a very important implication for bank managers. In recent years in particular, regulations on the Turkish banking sector by policymakers have been aimed at affecting bank balance sheets. Therefore, commercial banks can take measures against regulations that reduce their profitability and increase their risks by increasing their activities related to NNI.

The effect of capital ratio, bank size, loan-to-deposit ratio, and CUR utilization rate variables on bank profitability varies according to bank ownership. Capital ratio is a significant variable that increases profitability for domestic private and foreign banks, while no significant relationship has been found for public banks. The low asset profitability and high financial leverage ratios of public banks compared to domestic private and foreign banks indicate that public banks in Turkiye cannot benefit from the financial leverage effect. At the same time, it can be said that the prudent attitude of the managements of domestic private and foreign banks on capital adequacy is positively reflected in bank profitability. Moreover, the insignificance of the relationship between equity and profitability for public banks points to an implicit guarantee that the losses of state-owned banks in Turkiye are covered by the state and that public banks do not face a liquidity problem.

The relationship between the Credit/Deposit variable and profitability is negative for public banks and domestic private banks, and positive for foreign banks. In Turkiye, the ratio of foreign sources to total assets of foreign banks is higher than public and domestic private banks (BAT, 2022). Therefore, foreign banks' cost of funds is lower. According to the BRSA data for our analysis period, both the amount of non-performing loans (NPL) and the amount of provisions allocated for NPL is lower in foreign banks than in public and domestic private banks. Our finding shows that foreign banks manage their funding costs and credit risks better than public and domestic private banks. Therefore, public and domestic private banks need to do better risk analysis when they increase the amount of loans they give. Otherwise, their profitability will be negatively affected. Our findings are in line with Garcia and Trindade (2019); Rosalina and Nugraha (2019) and confirm the global advantages hypothesis.

It is seen that as the size of public banks increases, their profitability also increases. No significant relationship has been detected between the bank size and profitability of domestic private and foreign banks. Considering that the three public banks operating in Turkiye are the first three banks in terms of asset size in the market, the existence of a positive relationship between size and profitability for public banks indicates that public banks benefit positively from scale economies. However, public banks have lower asset and equity profitability than domestic, private and foreign banks. In this case, it can be said that public banks cannot reflect the advantage they gain from economies of scale in profitability. Our findings are consistent with Pasiouras and Kosmidou (2007); Goddard, Molyneux and Wilson (2004) and Athanasoglou, Brissimis and Delis (2008).

One of the macroeconomic variables added to the model to represent economic growth, the industrial sector capacity utilization rate (CUR) variable, has been found to have a positive and significant relationship with the profitability of domestic private and foreign banks. No relationship has been detected between CUR and public bank profitability. This finding, which indicates the independence of public bank profits from the business cycle, points to the fact that the government uses public banks as a counter-cyclical policy tool.

Table 8
Panel SUR-MG results

Variable	Coefficient	Standard error	t-statistic
EQUITY	13.351	1.915	6.972***
NNI	0.096	0.025	3.884**
CUR	0.064	0.017	3.719**
RER	-2.780	0.663	-4.193***
INF	-0.026	0.008	-3.242**
SIZE	0.172	0.122	1.407
CREDIT/DEPOSIT	-1.378	0.304	-4.532***
Constant	9.954	2.743	3.629**

*Note: *10% level, **5% level, ***1% level.*

Table 8 shows the results of Panel SUR-MG estimation, which indicate a positive and significant relationship between profitability and the variables EQUITY, NNI, and CUR. Conversely, a negative and significant relationship was found with the variables INF, RER, and CREDIT/DEPOSIT. No relationship was detected between profitability and the SIZE variable.

This study examines the profitability of banks in Turkiye using the SUR model. The SUR model should theoretically produce similar results to the panel data model. The data in the estimated panel model is divided into clusters, equal to the number of units, for appropriate analysis. In the other hand, the panel model provides common results for general data. In other words, the working mechanism of both the SUR model and the panel data model are similar. Therefore, the

coefficient and significance levels obtained will be close and compatible with each other. Thus, the SUR model results have been supported by the panel data analysis. The econometric model examined in the study is discussed below within the scope of panel data analysis.

$$ROE = \alpha 0 + \alpha 1EQUITY + \alpha 2NNI + \alpha 3CUR - \alpha 4RER - \alpha 5INF + \alpha 6SIZE - \alpha 7CREDIT/DEPOSIT + \beta 0FOREIGN + \beta 1EQUITY*FOREIGN - \beta 2NNI*FOREIGN - \beta 3CUR*FOREIGN - \beta 4RER*FOREIGN - \beta 5INF*FOREIGN - \beta 6SIZE*FOREIGN + \beta 7CREDIT/DEPOSIT*FOREIGN + \gamma 0DOMESTIC + \gamma 1EQUITY*DOMESTIC - \gamma 2NNI*DOMESTIC + \gamma 3CUR*DOMESTIC - \gamma 4RER*DOMESTIC - \gamma 5INF*DOMESTIC - \gamma 6SIZE*DOMESTIC - \gamma 7CREDIT/DEPOSIT*DOMESTIC$$

The model includes the variable "FOREIGN", which is a dummy variable that takes the value "1" if the bank is foreign. Similarly, the variable "DOMESTIC" is a dummy variable that takes the value "1" if the bank is a domestic private bank. The α coefficients in the model represent the results for public banks when the dummy variables "FOREIGN" and "DOMESTIC" are "0". The model results for foreign and domestic private banks vary depending on the value of the dummy variables. Table 9 presents the results of the panel model for all banks.

Table 9

Results of panel model estimation

	Fixed effects model	
Dependent variable: ROE	**Coefficient**	**Standard error**
EQUITY	8.404	(7.357)
NNI	0.163*	(0.063)
CUR	0.052	(0.047)
RER	-1.003**	(0.312)
INF	-0.021***	(0.002)
SIZE	0.423*	(0.218)
CREDIT/DEPOSIT	-0.631**	(0.211)
Foreign	9.193*	(4.582)
EQUITY*FOREIGN	22.630***	(3.722)
NNI*FOREIGN	0.021*	(0.063)
CUR*FOREIGN	0.051**	(0.147)
RER*FOREIGN	-3.045*	(1.027)
INF*FOREIGN	0.044**	(0.003)
SIZE*FOREIGN	0.219	(0.372)
CREDIT/DEPOSIT*FOREIGN	0.234*	(0.382)
Domestic	8.705*	(4.168)
EQUITY*DOMESTIC	9.412*	(0.482)
NNI*DOMESTIC	0.150	(0.081)
CUR*DOMESTIC	0.087*	(0.013)
RER*DOMESTIC	-3.025**	(0.947)

	Fixed effects model	
Dependent variable: ROE	**Coefficient**	**Standard error**
INF*DOMESTIC	-0.039*	(0.005)
SIZE*DOMESTIC	0.940	(0.958)
CREDIT/DEPOSIT*DOMESTIC	-2.969**	(1.358)
Constant	4.791*	(2.268)
Model specification		
R^2	71%	
Overall F-stat/Wald	6.48***	

*Note: *10% level, **5% level, ***1% level.*

Table 9 presents the relevant equations for public, foreign, and domestic private banks respectively. This allows for a comparison with the SUR estimation results in table 7. The equations for all three bank types are provided, taking into account the values of the dummy variables.

6 CONCLUSION

This paper examined the determinants of Turkiye's banking sector profitability in 2010-20 depending on ownership structure of banks. The seemingly uncorrelated regression method was used with aggregate monthly data. Our results showed that bank-related and macroeconomic variables generally affected bank profitability differently depending on ownership structure and management practices. Only the real effective exchange rate, inflation, and non-interest income had similar effects on profitability irrespective of bank ownership. This suggests that exchange rate risk was well managed in the banking sector, and that all banks benefited from asset diversification.

Other macroeconomic and bank-specific factors – the capital ratio, the loan-to-deposit ratio, and macroeconomic conditions (proxied by the capacity utilisation rate) – affected profitability differently across public, domestic private, and foreign banks.

The capital ratio was a significant determinant of profitability of domestic private and foreign banks, but had no statistically significant effect on the profitability of public banks. One reason could be that public banks in Turkiye collected deposits at rates above and extended loans at rates below the sector average in order to support government policies. This gradually weakened their capital, requiring intermittent capital injections from the Ministry of Treasury and Finance, financed by domestic borrowing. Using public banks in pursuit of government policy goals not only led to additional interest burden on government budget, but also narrowed the room for manoeuvre of fiscal policy in the fight against inflation.

Another notable finding related to government policies is that the loan-to-deposit ratio was negatively correlated with profitability of public and domestic private banks, but positively correlated with profitability of foreign banks. This suggests

that government regulations forcing public and domestic private banks to lend placed them at a competitive disadvantage relative to foreign banks. This had not only weakened the domestic banking sector but may have also affected macroeconomic stability through second-round effects of credit expansion on inflation. It would therefore be important to adjust government policies and banking regulation in a way that provided incentives for banks to strengthen their management of funding costs and credit risk, rather than forced them to lend more to the private sector.

Macroeconomic conditions, proxied by the capacity utilisation rate in the economy, had a positive and statistically significant effect on the profitability of domestic private and foreign banks, but no discernible effect on that of public banks. This finding clearly points to the use of public banks as a counter-cyclical policy tool.

Disclosure statement

The authors have no potential conflict of interest to report.

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Fiscal dominance and inflation: evidence from Sub-Saharan Africa

JOHN HOOLEY, MSc[*]
LAM NGUYEN, Ph.D.[*]
MIKA SAITO, Ph.D.[*]
SHIRIN NIKAEIN TOWFIGHIAN, MA[*]

Article[**]
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John HOOLEY
Senior Economist, International Monetary Fund, Fiscal Affairs Department, 700 19th St NW, Washington, D.C., United States
e-mail: jhooley@imf.org
ORCiD: 0009-0001-4742-8771

Lam NGUYEN
Senior Vice President, Citigroup, Enterprise Scenario Group, 6400 Las Colinas Blvd, Irving, Texas, United States
e-mail: hoanglam296@gmail.com
ORCiD: 0000-0002-6984-9710

Mika SAITO
Advisor, International Monetary Fund, African Department, 700 19th St NW, Washington, D.C., United States
e-mail: msaito@imf.org
ORCiD: 0000-0001-6494-0809

Shirin Nikaein TOWFIGHIAN
Senior Economist, Equity Economics, 31 Alfred St, Sydney, Australia
e-mail: nikaein.shirin@gmail.com
ORCiD: 0009-0009-9088-2812

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Abstract

During the Covid-19 pandemic, the debate on monetary financing was reignited and several economists called for governments to borrow from their central banks to finance larger deficits. Sub-Saharan Africa provides useful insights into this debate since it is a region where "fiscal dominance" has long been widespread. We find that fiscal dominance is stronger during periods of pressure on public finances, particularly when alternative financing options are limited. We also find that central bank financing of government does have an inflationary impact through the exchange rate channel. Numerical legal limits on central bank financing can be an effective way to mitigate the risks, even if they are not always binding.

Keywords: inflation, monetary policy, central bank, fiscal policy, fiscal dominance, quasi-fiscal, policy coordination, exchange rate

1 INTRODUCTION

Central bank financing of government returned to the fore of the policy debate during the Covid-19 crisis as many countries faced additional budgetary pressures at a time when debt levels were already high. "Fiscal dominance", or the coordination scheme in which fiscal policy dominates monetary policy (Sargent and Wallace, 1981) has long been a feature of policy discussions in Sub-Saharan Africa (SSA). But questions of whether (or by how much) central banks should finance fiscal deficits have recently returned to the forefront of the policy debate in the wake of increased borrowing needs from the steady rise in government deficits since the mid-2000s and additional budgetary pressures from the 2020 Covid-19 pandemic (IMF, 2018; 2020).[1] Several economists called for an expansion in Quantitative Easing programs and injections of "Helicopter Money" for explicitly fiscal purposes (Blanchard and Pisany-Ferri, 2020; Gali, 2020), lifting the "taboo" on central bank financing of governments, at least temporarily (Yashiv, 2020). This paper therefore examines evidence for central bank financing of government deficits and its macroeconomic impact in SSA in the two decades before the onset of the Covid-19 crisis.

Central bank lending to governments has a long history and has been associated with hyperinflationary episodes. The first central banks were created explicitly to meet fiscal needs (Riksbank created in 1668 and the Bank of England created in 1694). Many central banks founded in the nineteenth century were also fiscally motivated, often for the financing of wars (Bordo and Siklos, 2018). At the same time, many hyperinflation episodes have been associated with central bank financing of government debt: Weimar Germany (1922-23), Hungary (1945-46), Greece (1941-45), Latin America during the debt crisis in the 1980s, to name a few (Hanke and Krus, 2012).[2] Governments that borrow from their central banks to

[1] For example, in the context of the Covid-19 pandemic, the South African Reserve Bank faced political pressure to directly fund government, while the Bank of Ghana was quick to extend additional financing to the government (See Cotterill, 2020 and Ministry of Finance of Ghana, 2020).

[2] Cagan (1956) defined hyperinflation as beginning when monthly inflation rates exceed 50 percent and ending in the month before the rate declines below 50 percent (where it must remain for at least a year).

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finance fiscal deficits or debt have long been a pressing problem in many countries in the SSA region too. The episodes in Zaire (1991-92 and 1993-94), Angola (1994-97), Democratic Republic of Congo (1998), and Zimbabwe (2007-08, 2019-20) are the starkest examples where unsustainable deficit financing by the central bank led to hyperinflation.

As a result of the macroeconomic risks from fiscal dominance, legal limits on central bank financing of fiscal debt became a feature of Central Bank acts in all regions over the past three decades. In most countries, advances and loans cannot exceed 10 percent of government revenues of the previous fiscal year or the average of the last three fiscal years (Jácome et al., 2012). The aim of allowing some limited budgetary financing from the central bank is to provide a lender-of-last-resort facility to cover intra-year fluctuations in revenue in economies in which alternative market financing options may be sparse and shocks relatively frequent (Cottarelli, 1993). In SSA countries, these limits are set somewhat higher than in other regions but still permit only modest and temporary levels of central bank lending to the government.

In practice, however, lending by central banks to the government in SSA has not been modest and temporary as intended in the laws. Central bank lending to governments during 2001-17 amounted to 2 percent of GDP on average for SSA countries, compared to less than a half a percent in other regions. In four SSA countries, this ratio exceeded 10 percent of GDP.[3] Furthermore, after declining in the first part of the past decade, it started to pick up again in 2014, coinciding with a rise in deficits and debt. Unsurprisingly, large increases in central bank lending to the government meant that legal limits were often exceeded: our study suggests 16 percent of revenue on average.

Yet despite the importance of central bank lending in practice, academic literature has given limited attention to fiscal dominance, either in SSA or elsewhere. The gap in the literature likely reflects the declining importance of central bank financing of government deficits in advanced economies over the past few decades.[4] However, there is a closely related strand of literature that looks at the much broader concept of central bank independence and inflation. For example, based on a sample of 16 advanced economies between 1955 and 1988, Alesina and Summers (1993) found a negative relationship between central bank independence and both the level and the variance of inflation. Fischer (1995) presented theoretical and empirical evidence to support the case for enhancing central bank independence. Most recently, Garriga and Rodriguez (2020) found that higher central bank independence is associated with lower inflation rates, using a sample of 118

[3] The median for SSA countries is 2 percent of GDP, while the arithmetic mean is 4 percent during the same time period. Given the presence of extreme outliers in the sample, the median is reported in this paper.
[4] The Covid-19 crisis notwithstanding, during which some advanced economies provided loans directly to government. For example, the Bank of England temporarily increased the limit on its overdraft facility with the Treasury: https://www.bankofengland.co.uk/news/2020/april/hmt-and-boe-announce-temporary-extension-to-ways-and-means-facility.

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developing countries between 1980 and 2013. These studies tended to focus on monetary policy aspects only and used broad composite indices of *de jure* independence, in which central bank lending was only one element. A few studies that touch on fiscal aspects have not found a strong relationship between central bank independence and fiscal policy, including Sikken and de Haan (1998) and Alagidede (2016), who investigated its relationship with budget deficits, and Alpanda and Honig (2009), who examined its role during political monetary cycles. There are a few individual country case studies of central bank lending on inflation in emerging and low-income economies (Brazil, Ghana, DRC), but there has been no systematic empirical study.

This paper therefore looks at what lessons can be drawn from sub-Saharan Africa, a region where government financing by central banks was common even before the Covid-19 crisis. It attempts to answer three main questions: First, what is the evidence for central bank lending to government in practice and how does it relate to legal limits? We construct a new database of quantitative legal limits and compare these with the actual level of lending. Second, why do governments choose to finance deficits through central bank borrowing? We empirically estimate the impact of factors such as the availability of outside financing options and whether legal limits are binding in practice. Third, should we care? We attempt to identify the macroeconomic impacts of fiscal dominance on monetary aggregates, the exchange rate, and inflation.

Our main finding is that although legal limits have not always been binding, they have posed a constraint. Our evidence shows that recourse to the central bank when deficits rise is lower when legal limits are in place. The effect of legal limits is analogous to that of a speed limit for car drivers; the limit is often exceeded, but rarely by an excessive amount. Our results also show that when more financing options are available, less central bank financing is used. We also find conditionality that seeks to limit central bank lending under Fund-supported programs does pose a constraint.

Second, central bank deficit financing matters for inflation. We find a statistically significant contemporaneous impact on the exchange rate and a lagged impact on inflation. An increase in central bank credit to the government by one percentage point of GDP – or about five percentage points of revenue – is associated with the depreciation of the – exchange rate by one percentage point contemporaneously and an increase in inflation by half a percentage point a year later. These results are also robust to many tests, including using alternative variations of the dependent variable, estimation techniques, and different sets of control variables.

The rest of the paper proceeds as follows. Section 2 describes the data in this study and introduces the database on legal limits. Section 3 presents stylized facts on fiscal dominance in SSA. Section 4 discusses the empirical approach and results for estimating the determinants of fiscal dominance. Section 5 then describes the

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approach for estimating the macroeconomic impact of shocks to central bank claims. Section 6 concludes. Additional statistics and robustness checks are in the appendix.

2 DATA AND DEFINITIONS

In this paper, **fiscal dominance** is referred to as in Sargent and Wallace (1981) where fiscal policy dominates monetary policy. That is, the fiscal authority independently sets its budgets (deficits) and determines the amount of revenue that must be raised through bond sales and seignorage, and the monetary authority faces the constraints imposed by the government as it must try to finance with seignorage any discrepancy between the revenue demanded by the fiscal authority and the amount of bonds that can be sold to the public. Separating any central bank's claims on government (on its balance sheet) into monetary and fiscal policy purposes is not straightforward in practice. Some claims are typically extended for monetary policy purposes. For example, central banks may hold treasury bills for liquidity management purposes (or for conducting open market operations). In advanced and some emerging market economies, unconventional monetary policies (UMP) have also involved substantial increases in central bank holdings of government bonds, typically when the policy rate has reached the zero-lower bound (though these programs can sometimes, in theory at least, have a fiscal purpose (Cukierman, 2020)). On the other hand, central bank claims on government extended for fiscal needs are typically provided as loans through overdraft facilities, although governments may also issue bonds to the central bank (or convert outstanding overdraft facilities into long-term bonds).

For our sample of SSA central banks[5], direct government bond issuance to central banks for fiscal purposes or securitization of overdrafts has, to our knowledge, only occurred in a few countries and on an exceptional basis; we, therefore, assume that central bank holdings of government securities are mostly for monetary policy purposes, while loans and advances to governments are for fiscal policy purposes. We also take comfort from the fact that on average, SSA central banks' securities holdings are smaller than their stock of loans, although in our empirical work, we include securities holdings in our measure of central bank financing in our robustness checks.[6]

Central bank financing (CBF) is therefore measured using the outstanding end-year stock of the central bank's loans and advances to the central government from the IMF's International Financial Statistics database, available from 2001-2017.[7] Loans, as opposed to total claims, are used for the reasons described above.

[5] The list of SSA countries in this analysis is in table A8.
[6] Limited central bank holdings of government securities likely reflects, in turn, an absence of UMP needs (the policy rate has not yet reached the lower bound in any SSA country) and the lack of benefit from holding T-bills for liquidity management (since in practice most SSA countries have had a structural surplus of liquidity, which means the central bank needs to sell them to absorb liquidity).
[7] Within-year data on central bank loans are not available. Although there is likely to be some intra-year volatility in central bank lending to government, it is not clear that there would be a particular bias since government financing needs are likely to depend on country-specific seasonality in revenues and expenditures.

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We also use gross loans and do not net out government deposits, since legal limits are typically applied on a gross basis and deposits are not under the control of the central bank. However, to check the robustness of our results, we also take any difference in the outstanding stock of loans from one year to the next to measure new loans extended each year.

We construct a database of numerical *legal limits* on central bank financing from central bank acts (typically found in the section on relations with the government) in SSA. We source the current and historical acts from the IMF's central bank legislation database (CBLD), including relevant amendments where available, to construct a time series of effective legal limits for each country.[8] Table A1 in the appendix presents a summary of the legal limits found in the most recent central bank Act. Out of 45 SSA countries, 41 had legal limits in 2017.[9]

Countries specify legal limits differently (figure 1). A typical example of how a legal limit is specified in central bank acts is: *(i) The bank may make temporary advances to the Government in respect of temporary deficiencies in revenue; or (ii) The total amount of advances shall not at any time exceed X percent of the revenue of the Government of the previous fiscal year.*

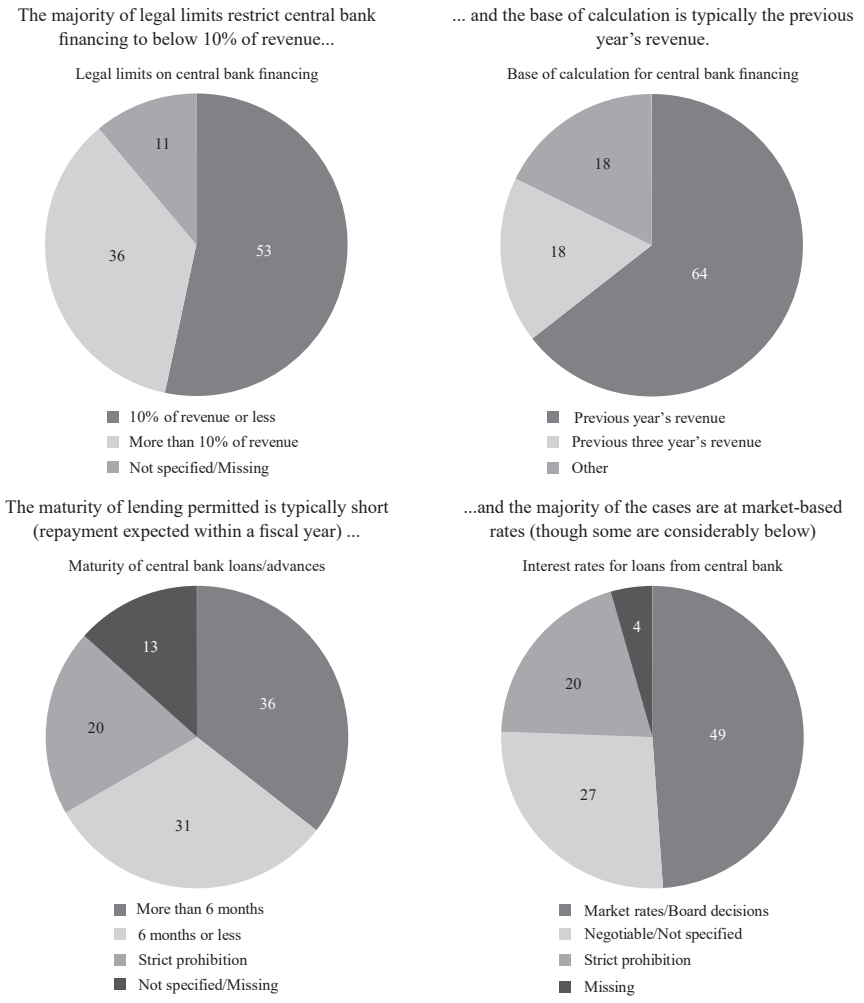
As observed in table A1, the legal limits are typically set in terms of percent of revenue, with varying reference years. The type of lending the limit applies to (e.g., loans, securities, or total claims) varies across countries, and in some cases, the limits apply to stock (e.g., of loans outstanding), while in other cases, they apply to flow rather than stock outstanding (e.g., new loans extended each year). Some acts allow lending in normal times, others only in emergencies. Some allow for securitization of advances, others do not.

[8] The database is publicly accessible on request, at https://cbld.imf.org. Since the latest update of the database was in 2016, we complemented the information by checking the Central Bank and Ministry of Finance websites of individual countries for recent legislative updates, up to 2017.

[9] Liberia, South Sudan and Somalia are excluded from our sample of Sub-Saharan African countries due to the incomplete time series of central bank loans to government.

FIGURE 1

Sub-Saharan Africa: quantitative limits on central bank lending, 2017 (percent of sample)



Sources: Central Bank Legislation Database (CBLD); national authorities; and IMF staff calculations.

3 STYLIZED FACTS

Fact 1. Central bank lending to the government is highest in the SSA region. On average, the stock of loans to government was 2 percent of GDP in SSA during 2001-17, compared to 0.2 percent of GDP for the Latin America and Caribbean and the South Asia regions, 0.6 percent of GDP for the Middle East and North Africa region and close to 0 percent of GDP for the other regions.[10] In 2017, the median for SSA countries was 2.2 percent of GDP, and in ten SSA countries, this ratio exceeded 5 percent of GDP (figure 2).

[10] The difference with respect to other regions is even more pronounced in revenue terms: central bank lending to government during 2001-17 amounted to 12 percent of revenue on average for SSA countries, compared to less than 1 percent in other regions.

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Fact 2. The two notable increases in central bank loans to the government in SSA countries over the past two decades occurred during periods of pressure on public finances. The first increase was during the temporary terms-of-trade shock in 2008-09, although the recourse to central bank financing was contained by drawing on fiscal buffers built up during the preceding commodity price boom (IMF, 2014). The second increase in central bank financing occurred in the wake of the decline in commodity prices in mid-2014, which hit SSA countries (particularly commodity-dependent countries) hard because they entered the crisis with few buffers and commodity prices remained low for a prolonged period. During the subsequent years, central bank loans to the government increased more in SSA than in other regions. The timing of the increase also coincided with a rise in gross debt (figure 2).

FIGURE 2

Sub-Saharan Africa: central bank lending to government, 2001-17

Sources: CBLD; International Financial Statistics (IFS); World Economic Outlook (WEO); national authorities; and IMF staff calculations.

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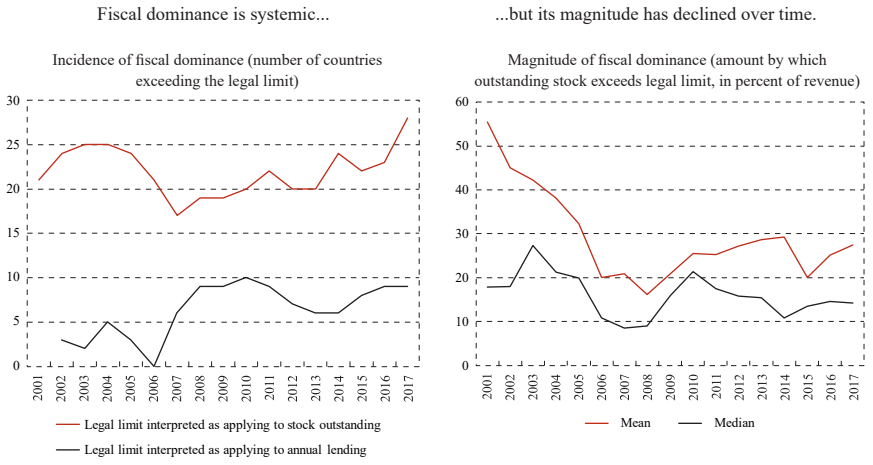
Fact 3. Legal limits in SSA countries have become stricter over time. Almost all SSA countries have legal limits on central bank lending (table A1). These limits, expressed in terms of percent of revenue, vary substantially between 0 and 20 percent of revenue. The median of legal limits was 18 percent in the early 2000s but declined in 2003/4 to 10 percent of revenue, and again in 2017 to 8.5 percent (figure 2). The average legal limits declined more gradually over this period from 15 percent in 2001 to 9.8 percent in 2017.

Fact 4. Fiscal dominance has declined over time, despite the tightening of legal limits. Central bank lending above the legal limit (what we call "fiscal dominance") appears to be a systemic phenomenon in SSA.[11] In 2017, lending exceeded the limit in between 9 and 29 countries (out of 41 countries) depending on whether the legal limit is interpreted as applying to the outstanding stock or the flow of lending (figure 3).[12] Noncompliance (or the *incidence* of fiscal dominance) is more common for those with stricter limits (i.e., legal limits are interpreted as applied to the stock of loans outstanding), most likely because some central banks are carrying legacy loans from the past. Nevertheless, the amount by which central bank lending exceeds legal limits (or the *magnitude* of fiscal dominance) has fallen, despite the tightening in limits.

FIGURE 3

Sub-Saharan Africa: fiscal dominance, 2001-17



Sources: CBLD; national authorities; MFS; WEO; and IMF staff calculations.

[11] However, we cannot assess whether a legal violation occurred in practice. There may be many reasons why it doesn't, including differences in legal interpretations, accounting practices, and independence of the judiciary.
[12] There is sometimes ambiguity in the central bank Act whether the limit applies to the outstanding stock of loans, or new lending only. When it is specified, the laws always refer to the outstanding stock but when it is not specified there is a possibility the law may be interpreted as applying to new lending, particularly in countries with large legacy central bank claims on government.

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4 WHY DO GOVERNMENTS BORROW FROM CENTRAL BANKS?

In this section, we examine the effects of legal restrictions and alternative financing options on central bank lending. Why do governments borrow from central banks? The most obvious reason is that the government has a financing need (otherwise there is no need to borrow from anyone, let alone the central bank).[13] A more interesting question therefore is what determines the extent to which a government meets its financing need through recourse to the central bank, relative to other sources of funds?

We also examine the effect of other restrictions on central bank lending, such as conditionality in IMF-supported programs. In addition to limits on central bank lending in legislation, quantitative ceilings on central bank lending to the government are often observed in IMF-supported macroeconomic adjustment programs in the region. The conditionality to amend (revise downwards) the limits in the laws themselves also features in IMF-supported programs.

4.1 EMPIRICAL APPROACH

Governments typically have several financing options other than borrowing from the central bank. A government typically finances its fiscal deficits by a combination of borrowing abroad, borrowing from domestic banks (either from commercial banks or the central bank), and borrowing from domestic nonbank institutions (e.g., pension funds).[14] The amount of borrowing from the central bank therefore depends on the size of financing needs and the government's ability to borrow from the market (e.g., by selling sovereign bonds to commercial banks, pension funds, or nonresidents).[15] The availability of external assistance (concessional loans from official bilateral or multilateral creditors), the size of the government's deposits, and the extent of legal or any other limits on central bank financing also affect the government's borrowing from the central bank.

In this context, we estimate the following empirical model. The model is estimated on annual data with central bank lending to the government in country i at time t as the dependent variable.

$$Y_{it} = \beta_1 F_{it} + \beta_2 F_{it} \times L_{it} + \beta_3 F_{it} \times MKT_{it} + \beta_4 F_{it} \times QPC_{it} + [a]'X_{i,t} + [b]'Z_{i,t-1} + \varsigma_i + \theta_t + \varepsilon_{it} \quad (1)$$

where Y_{it} is the central bank lending as a percent of GDP; F_{it} is the fiscal deficit as a percent of GDP; L_{it} is the legal limit on central bank lending as a percent of

[13] This is of course a bit of a simplification: several governments continue to issue marketable debt, but for market development purposes even when they have a fiscal surplus, which they might use to retire existing debt or build cash buffers.

[14] Running arrears to suppliers or staff has also sometimes been an informal way of borrowing in many SSA countries but is not considered in this paper, due to data constraints.

[15] "Ability" of the government to borrow from the market here can refer to both the existence of an investor base for additional debt issuance but also willingness to pay the market rate, since where notional borrowing rates are high, the central bank may not be the only option, just the apparently (much) cheaper option.

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revenue; MKT_{it} is the dummy for market access (=1 if country issues government securities over 1-year maturity, 0 otherwise); QPC_{it} is the dummy for the IMF conditionality on central bank lending (=1 if the country has conditions in IMF-supported program, 0 otherwise); $X_{i,t}$ is a vector of [L_{it}, MKT_{it}, QPC_{it}]; $Z_{i,t-1}$ is a vector of control variables; ς_i is the country fixed effect; θ_t is the time fixed effect; and ε_{it} is the residual.

This specification has one particularly noteworthy feature. The interaction terms allow us to assess how legal limits, domestic market development, and IMF conditionality may be associated with the size of central bank financing (for a unit increase in fiscal deficit) by looking at the partial derivative of equation (1) for F_{it}. We expect a positive sign for β_2 and negative signs for β_3 and β_4, as lower legal limits, more domestic market development, and IMF conditionality are likely to be associated with lower central bank lending, respectively.

We use the Arellano-Bond estimator with several lagged control variables and country- and time-fixed effects (FEs) to address various endogeneity concerns. First, we use the dynamic panel model using the Arellano-Bond generalized method of moments (GMM) estimator since our panel is large in the cross-sectional dimension relative to the time dimension.[16] Second, the lag of the dependent variable is included as a regressor to account for inertia.[17] Third, we include country- and time-FEs to address a possible selection bias.[18] More specifically, to control for *time-varying local factors* that are heterogeneous across countries, we have included observable macroeconomic factors that reflect each economy's strength and its government's fiscal position, including the real GDP growth, government deposits at the central bank, and the levels of government debt. To control for *time-varying global factors* that can affect both the extent of fiscal dominance and the broader economic conditions (e.g., the terms-of-trade shock in 2008-09 or the decline in commodity prices in mid-2014), we include the time fixed effect. To control for all *time-invariant country-specific characteristics* (e.g., a country with strong institutions may have both lower legal limits and less fiscal dominance, or a country with a history of high inflation due to fiscal dominance may tend to enforce stricter legal limits and have less central bank lending to the government), we include country-specific fixed effects. Finally, a few other lagged variables (lags of real GDP growth, lag of government deposit to GDP ratio, and lag of government debt to GDP ratio) are included to control for country-specific variation in the macroeconomic environment, not captured by the country and time fixed effects.[19]

[16] See Arellano and Bover (1995) and Blundell and Bond (1998).

[17] The central bank lending series are persistent as confirmed by statistical significance of the coefficients of the lags of central bank loans/GDP in table 2.

[18] Other sources of endogeneity such as simultaneity and measurement errors are less likely to be present in our sample. For example, amendments to the central bank laws, even if prompted by macroeconomic outcomes, are rarely completed within a year. And to reduce the possibility of measurement error, all the legal limits in the CBLD database were checked against the original legislation.

[19] Other estimators such as the IV estimator or the matching estimator may be superior in establishing causal relationships to the GMM estimator with FEs. In our sample, however, it is challenging to find good instruments or counterfactuals without losing too many degrees of freedom.

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4.2 RESULTS

Our database covers 41 countries and a period of 18 years, from 2001 to 2017.[20] Descriptive statistics of key variables are presented in table 1. For all our variables of interest, a full time series of data is available for most of the countries in our sample.

TABLE 1

Sub-Saharan Africa: descriptive statistics, 2001-17 (percent; otherwise indicated)

Variable	No. of obs.	Mean	St. dev.	Min.	Max.
Central bank claims/GDP	719	6.1	8.9	0.0	63.2
Percentage change of central bank claims/GDP	675	5.2	22.8	-217.5	150.7
Central bank loans/GDP	719	3.7	5.6	0.0	61.5
Percentage change of central bank loans/GDP	677	2.1	21.6	-260.5	162.1
Fiscal deficit/GDP	756	2.6	5.6	-27.2	30.4
Real GDP growth	770	4.6	5.2	-36.7	60.1
Legal limit/revenue	703	11.2	7.8	0.0	25.0
Government deposits/GDP	731	4.4	5.1	0.0	33.0
Government gross debt/GDP	754	62.1	49.6	0.5	406.7
Dummy for domestic market development (1 or 0)	781	0.5	0.5	0.0	1.0
Dummy for IMF conditionality on central bank lending (1 or 0)	781	0.2	0.4	0.0	1.0
Interaction between fiscal deficit and legal limits (% × %)	678	15.7	88.6	-610.1	545

Sources: WEO; IFS; and IMF staff calculations.

Our baseline results confirm both the existence of fiscal dominance in SSA and its mitigation by *de jure* limits and outside financing options. Our main findings are based on estimating variants of equation (1) and are presented in table 2. First, *the size of central bank lending is positively correlated with financing needs*. The size of fiscal deficits and the size of central bank lending are highly correlated. Second, *the presence of limits on central bank lending matters*. The government's propensity to borrow from the central bank is higher if limits are looser (the coefficients on interaction terms are all statistically significant in Models 2-5). Third, *the government's ability to borrow from the market is associated with lower central bank financing*. The ability to raise resources from the market, by issuing sovereign bonds to banks, nonbanks, and nonresidents, tends to be associated with lower central bank lending (coefficients on the dummy for market development in Models 3 and 5 are statistically significant). Being able to raise resources from the market

[20] Countries were excluded in cases where: (i) no Central Bank Act was found (Burundi and Eritrea), and (ii) where the Central Bank Act did not specify a numerical legal limit on central bank lending (South Africa and Seychelles).

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also matters (coefficients on interaction terms are all statistically significant in Models 3 and 5).

The size of the coefficients is economically meaningful. Using the results of Model 5 and taking the partial derivative of equation (1) for the fiscal deficit, we can estimate the government's propensity to resort to central bank financing. On average, about 9 percent of a fiscal deficit is financed by the central bank. But if the government can borrow from financial markets and issue bonds, then only about 3 percent of the fiscal deficit is covered by central bank financing. And if the government has an IMF-supported program with a condition on domestic borrowing or borrowing from the central bank (akin to a quasi-legal limit), then almost none of the deficit is covered by central bank financing.

TABLE 2

Sub-Saharan Africa: determinants of central bank lending, 2001-17

	(1)	(2)	(3)	(4)	(5)
Dependent variable: central bank loans/GDP	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**
Fiscal deficit	**0.1041*** **	0.0362	**0.0409***	0.0216	0.0267
	(0.0359)	(0.0254)	**(0.0209)**	(0.0262)	(0.0220)
Fiscal deficit × Legal limit		**0.0046*** **	**0.0053*** **	**0.0055*** **	**0.0062*** **
		(0.0015)	**(0.0014)**	**(0.0019)**	**(0.0018)**
Fiscal deficit × Domestic market development			**-0.0639****		**-0.0622****
			(0.0284)		**(0.0260)**
Fiscal deficit × IMF conditionality				**-0.0269***	**-0.0255****
				(0.0149)	**(0.0123)**
Legal limit		-0.0014	0.0007	-0.0036	-0.0018
		(0.0317)	(0.0344)	(0.0318)	(0.0343)
Domestic market development			**-0.9234****		**-0.8080****
			(0.4267)		**(0.3835)**
IMF conditionality				-0.7964	-0.6888
				(0.5420)	(0.5166)
Lags of central bank loans/GDP	**0.8049*** **	**0.7952*** **	**0.7992*** **	**0.7904*** **	**0.7952*** **
	(0.0461)	**(0.0381)**	**(0.0402)**	**(0.0354)**	**(0.0368)**
Lag of real GDP growth	-0.0163	**-0.0223****	**-0.0210****	**-0.0221****	**-0.0209****
	(0.0115)	**(0.0108)**	**(0.0098)**	**(0.0112)**	**(0.0100)**
Lag of government deposits/GDP	-0.0737	-0.0811	-0.0952	-0.0735	-0.0873
	(0.0739)	(0.0606)	(0.0640)	(0.0598)	(0.0630)
Lag of government debt/GDP	**-0.0100***	-0.0035	-0.0026	-0.0073	-0.0062
	(0.0057)	(0.0067)	(0.0070)	(0.0068)	(0.0068)
Observations	667	596	596	596	596
Number of countries	45	41	41	41	41

*Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.*

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4.3 ROBUSTNESS

To check the robustness of our results, we estimated several alternative specifications of equation (1), with results shown in appendix tables A2 to A6. First, to ensure that our results are not influenced by the possible endogeneity of the fiscal deficit, we used lagged values of all independent variables as instruments (table A2). Second, to account for the possibility that governments circumvent the legal limit by asking the central bank to lend through channels that are not defined in the legal framework, we used total claims on government as the dependent variable rather than total loans (table A3).[21] Third, because some countries may interpret the legal limit differently, we used the flow of lending as the dependent variable. The stock of outstanding loans is used in our baseline model as it corresponds to the definition of the legal limit in central bank Acts. However, some countries may interpret the law differently, particularly if there is a large outstanding legacy stock of debt to the central bank. The flow of lending also corresponds more closely to annual financing needs (table A4). Fourth, we tested whether alternative aspects of outside financing conditions play a role, such as sovereign risk and international capital market access. In all cases, the results remained robust, while the alternative measures of outside financing options did not seem to matter as much as the availability of domestic market financing (table A5). Fifth, we re-estimated our main results in table 2 with the dynamic bias-corrected least squares dummy variables estimator as proposed by Bruno (2005). This estimator was shown to have a smaller bias in finite samples; however, it is only consistent when we assume that all variables, excluding the lag effects, are exogenous. The results are qualitatively similar when it comes to statistical significance and expected signs of the coefficients (table A6). In summary, we conclude that our main results for the determinants of fiscal dominance are robust to different specifications.

5 WHAT ARE THE MACROECONOMIC IMPACTS?

In this section, we examine the macroeconomic impact of central bank financing. In particular, we explore its impact on monetary aggregates, inflations, and exchange rates.

We estimate the dynamic response of key macroeconomic variables to a shock by combining the local projections (LP) method of Jordà (2005) with country and time-fixed effects. In this paper, we use the LP method to estimate the impulse response functions (IRFs), rather than the vector autoregression (VAR) following Sims (1980) since in our panel data setting, the high-dimensionality of a fully-specified VAR would make its estimation prohibitive, whereas with LP it is possible to achieve a reasonable degree-of-freedom in our estimation and even include additional control variables.

[21] One practice sometimes used is securitization of the government's overdraft with the central bank. For example, if the legal limit applies to the overdraft, once the size of the overdraft exceeds the legal limit, the balance may be converted into a bond. In such cases, total claims would be a better measure of fiscal dominance.

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Our baseline model is

$$W_{i,t+h} = \gamma^{(h)} Y_{it} + [d^{(h)}]' Controls + \zeta_i^{(h)} + \theta_t^{(h)} + u_{i,t+h} \quad (2)$$

where $W_{i,t+h}$ is the macroeconomic variable of interest (base money, inflation, exchange rate, and broad money) measured at time horizon $t+h$, Y_{it} is the ratio of total central bank loans to GDP, and Controls are all the control variables from our baseline regression equation (1). We estimate a separate regression for each horizon h. Standard errors are clustered by country and time. The number of observations for each horizon is presented in table A7.

Table 3

Sub-Saharan Africa: descriptive statistics, 2001-17 (in percent)

Variable	No. of obs.	Mean	St. dev.	Min.	Max.
Base money	729	11.0	7.4	0.1	52.8
Exchange rate	780	4.6	16.6	-28.1	295.5
Inflation	764	8.2	18.0	-72.7	357.3
Broad money	764	32.4	24.2	3.1	150.8

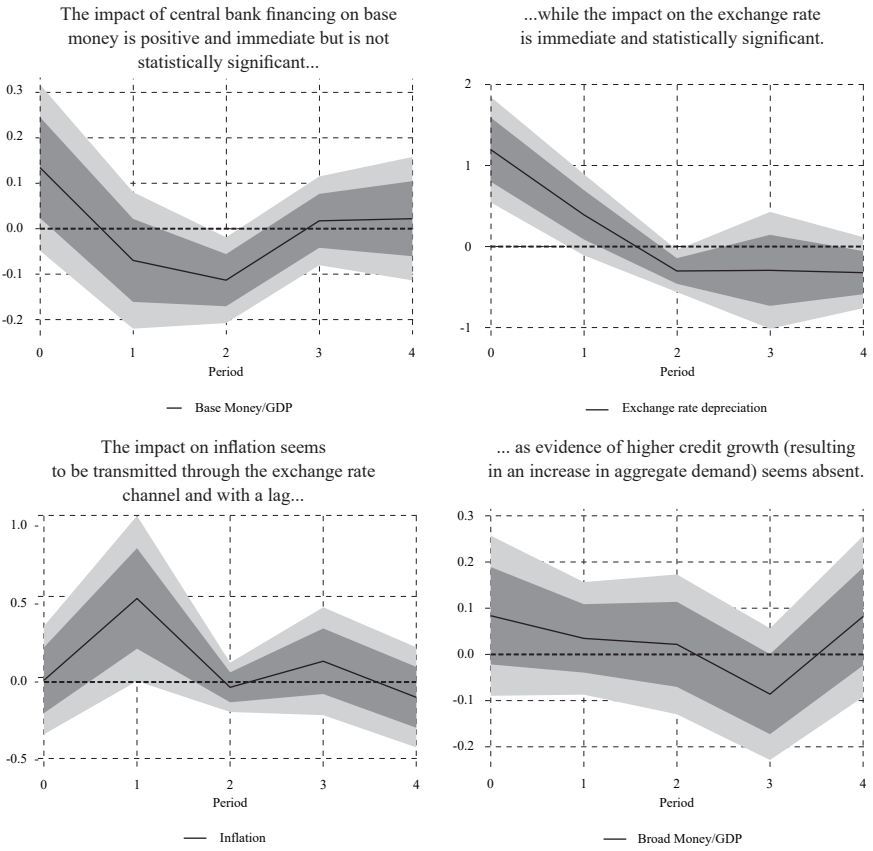
Notes: Base money is defined as a ratio to nominal GDP, exchange rates are defined as the annual percent change in terms of national currency per USD, inflation is the annual growth rate of CPI, and broad money is defined as a ratio to nominal GDP.

Sources: WEO; IFS; and IMF staff calculations.

The results of the IRFs are economically intuitive and some are statistically significant. The precision of the estimations is affected by the large variation in our variables of interest (table 3). So, while the impact of central bank financing on base money is positive and contemporaneous, no statistical significance is observed. On the other hand, the impact on the exchange rate is contemporaneous and statistically significant. An increase in central bank credit to the government by one percentage point of GDP – or about five percentage points of revenue on average – is associated with a depreciation of the exchange rate by one percentage point contemporaneously. The impact on inflation seems to show with a lag. The same increase in central bank credit to the government is associated with an increase in inflation by half a percentage point a year later. Moreover, the impact on inflation seems to be transmitted mostly through the exchange rate channel as the evidence of credit growth (resulting in an increase in aggregate demand) seems absent (figure 4).

FIGURE 4

Sub-Saharan Africa: impact of central bank financing on money, the exchange rate, and inflation



Notes: The figure shows the impulse response functions for a one unit innovation in the ratio of central bank loans to GDP and presents both the point estimates and the 68 and 90 percent confidence intervals around them.

6 CONCLUDING REMARKS

Economists and policymakers often warn of the dangers of direct central bank financing of governments, and history provides no shortage of cautionary tales. However, there has been surprisingly little empirical research on the incidence, magnitude, or impact of central bank financing of government deficits beyond the most extreme episodes of hyperinflation; instead, the focus of studies on a central bank's relations with government has been on the much broader question of central bank independence. This gap in the literature is problematic since the question of whether (or by how much) to restrict central bank lending to the government has been a prominent feature of debates on central bank reform in SSA. And while most central banks in the region do now have legislative limits in place, support has been far from unanimous, while the Covid-19 crisis generated some renewed calls to permit direct financing of government.

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Our study therefore represents a first attempt at systematically studying the issue of central bank deficit financing in the SSA region. We show that central bank financing of government deficits has been (1) common, (2) increasing in the past few years, (3) large at around 2 percent of GDP on average, and (4) quantitatively important relative to other parts of the world. We also construct a new database to document the evolution of *de jure* limits on central bank financing in SSA. We find that the majority of SSA countries now have formal limits on central bank lending to the governments and that these have become both more numerous and stricter over time. Our new database allows us to define and explore the concept of *fiscal dominance*: central bank lending to government for fiscal purposes beyond legal limits, which is empirically more relevant given non-zero limits in many countries in the region.

Our empirical findings show that fiscal dominance is widespread in SSA but efforts to contain it can be effective. Although the *incidence* of fiscal dominance is high (we observed central bank lending above the legal limit in between 9 and 29 countries in 2017), its *magnitude* (the amount by which central bank lending exceeds legal limits) has declined over time. In our empirical analysis, we find an important role for policy: countries borrow less from central banks when they have stricter legal limits (or IMF programs that restrict lending) and more developed financial markets. We also find that even low amounts of fiscal dominance can have important macroeconomic effects: central bank lending is associated with exchange rate depreciation and subsequent higher inflation. These findings suggest that fiscal dominance is a relevant macroeconomic issue that policymakers should take seriously in normal times and not just from the perspective of hyperinflation risk.

Disclosure statement

The authors have no conflict of interest to declare.

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APPENDIX

Table A1

Sub-Saharan Africa: central bank acts, 2017

Country name	Legal limit	Name of most recent legislation	Year current legislation took effect (last amendment)
Angola	10% of previous year's revenue	Banco Nacional de Angola Act. Law No. 16/10	2010
Benin	0%	Treaty of the West African Monetary Union (UEMOA)	N/S
Botswana	5% of previous three years' average revenue	The Bank of Botswana Act	1997
Burkina Faso	0%	Treaty of the West African Monetary Union (UEMOA)	N/S
Burundi	N/A		
Cabo Verde	5% of previous year's revenue	Organic Law of the Bank of Cape Verde	2002
Cameroon	20% of previous year's revenue	Charter of the Bank of Central African States (CEMAC)	2010
Central African Rep.	20% of previous year's revenue	Charter of the Bank of Central African States (CEMAC)	2010
Chad	20% of previous year's revenue	Charter of the Bank of Central African States (CEMAC)	2010
Comoros	20% of previous three years' average revenue	Statuts de la Banque Centrale des Comoros	2008
Congo, Democratic Rep. of	0%	Law 005/2002 on the Establishment, Organization, and Operations of the Central Bank of Congo	2002
Congo, Rep. of	20% of previous year's revenue	Charter of the Bank of Central African States (CEMAC)	2010
Côte d'Ivoire	0%	Treaty of the West African Monetary Union (UEMOA)	N/S
Equatorial Guinea	20% of previous year's revenue	Charter of the Bank of Central African States (CEMAC)	2010
Eritrea	N/A		
Ethiopia	N/S	Monetary and Banking Proclamation No. 183/1994 and No. 591/2008	1994 (2008)
Gabon	20% of previous year's revenue	Charter of the Bank of Central African States (CEMAC)	2010
Gambia	10% of previous year's revenue	Central Bank of Gambia Act	2005
Ghana	5% of current year's revenue	Bank of Ghana Act	2002 (2016)
Guinea	5% of previous year's revenue	Charter of the Central Bank of the Republic of Guinea	1994 (2017)
Guinea-Bissau	0%	Treaty of the West African Monetary Union (UEMOA)	N/S
Kenya	5% of previous year's revenue	The Central Bank of Kenya Act	1966 (2014)
Lesotho	Net claim is 5% of previous year's budget	Central Bank of Lesotho Act	2000

Country name	Legal limit	Name of most recent legislation	Year current legislation took effect (last amendment)
Madagascar	7% of previous year's revenue	Charter of the Central Bank of Madagascar	1994 (2016)
Malawi	20% of current year's revenue	Reserve Bank of Malawi Act – Laws of Malawi (Chapter 44:02)	1989
Mali	0%	Treaty of the West African Monetary Union (UEMOA)	N/S
Mauritania	5% of previous year's revenue	Charter of the Central Bank of Mauritania	2007
Mauritius	10% of current year's revenue	The Bank of Mauritius Act	2004 (2015)
Mozambique	10% of previous year's revenue	Law 1/92	1992
Namibia	25% of previous three years' average revenue	Bank of Namibia Act	1997
Niger	0%	Treaty of the West African Monetary Union (UEMOA)	N/S
Nigeria	5% of previous year's revenue	Central Bank of Nigeria Act	2007
Rwanda	11% of previous year's government revenue	Law No. 55/2007, Governing the Central Bank of Rwanda	2007
São Tomé and Príncipe	5% of previous year's revenue	Law 8/92, Organic Law of the Central Bank of STP	1992
Senegal	0%	Treaty of the West African Monetary Union (UEMOA)	N/S
Seychelles	N/S	Central Bank of Seychelles Act	2004 (2011)
Sierra Leone	5% of previous year's revenue	Bank of Sierra Leone Act	2000
South Africa	N/S	South African Reserve Bank Act 90	1989
Sudan	15% of current year's revenue	The Bank of Sudan Act	2002
Swaziland (Eswatini)	20% of previous three years' average revenue	The Central Bank of Swaziland Order	1974 (1979)
Tanzania	12.5 % of previous year's revenue	The Bank of Tanzania Act	2006 (2010)
Togo	0%	Treaty of the West African Monetary Union (UEMOA)	N/S
Uganda	18% of previous year's revenue	The Bank of Uganda Statute	1993 (2010)
Zambia	15% of previous year's revenue	Bank of Zambia (Amendment) Act	1998
Zimbabwe	20% of previous year's revenue	Reserve Bank of Zimbabwe Act (Chapter 22:15)	2010

Notes: N/S indicates not specified in the Central Bank Act, while N/A indicates no Central Bank Act was found in the CBLD database or on the websites of the relevant Central Bank or Ministry of Finance.

Sources: National Authorities; and Central Bank Legislation Database (CBLD).

TABLE A2

Determinants of central bank lending: treating the fiscal deficit as endogenous

Dependent variable: central bank loans/GDP	Model 1	Model 2	Model 3	Model 4	Model 5
Fiscal deficit	0.0156	-0.0329	-0.0172	-0.0077	-0.0010
	(0.0416)	(0.0415)	(0.0312)	(0.0243)	(0.0207)
Fiscal deficit × Legal limit		**0.0066****	**0.0053****	**0.0056*****	**0.0053****
		(0.0028)	**(0.0025)**	**(0.0021)**	**(0.0021)**
Fiscal deficit × Domestic market development			0.0202		-0.0148
			(0.0555)		(0.0427)
Fiscal deficit × IMF conditionality				**-0.0252****	**-0.0239****
				(0.0119)	**(0.0107)**
Legal limit		0.0098	0.0122	0.0139	0.0043
		(0.0185)	(0.0152)	(0.0226)	(0.0210)
Domestic market development			**-0.8749*****		**-0.7560*****
			(0.2580)		**(0.2244)**
IMF conditionality				-0.5713	-0.5919
				(0.4638)	(0.4116)
Lags of central bank loans/GDP	**0.7584*****	**0.7355*****	**0.7319*****	**0.7243*****	**0.7237*****
	(0.0264)	**(0.0315)**	**(0.0311)**	**(0.0269)**	**(0.0275)**
Lag of real GDP growth	-0.0143	-0.0130	**-0.0146***	-0.0163	**-0.0166***
	(0.0106)	(0.0100)	**(0.0087)**	(0.0102)	**(0.0093)**
Lag of government deposits/GDP	-0.0248	-0.0328	-0.0356	-0.0265	-0.0264
	(0.0443)	(0.0341)	(0.0314)	(0.0270)	(0.0270)
Lag of government debt/GDP	-0.0022	**0.0057****	**0.0059****	**0.0051****	**0.0042****
	0.0156	**-0.0329**	**-0.0172**	**-0.0077**	**-0.0010**
Observations	667	596	596	596	596
Number of countries	45	41	41	41	41

*Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.*

TABLE A3

Determinants of central bank lending: total claims

Dependent variable: central bank claims/GDP	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**
Fiscal deficit	**0.1449*****	**0.0375***	**0.0398***	0.0274	0.0298
	(0.0460)	**(0.0228)**	**(0.0210)**	(0.0245)	(0.0230)
Fiscal deficit × Legal limit		**0.0037****	**0.0038****	**0.0044****	**0.0046****
		(0.0015)	**(0.0016)**	**(0.0020)**	**(0.0020)**
Fiscal deficit × Domestic market development			-0.0184		-0.0187
			(0.0373)		(0.0355)
Fiscal deficit × IMF conditionality				-0.0183	-0.0181
				(0.0153)	(0.0135)
Legal limit (measured in percent of revenue)		0.0339	0.0384	0.0320	0.0359
		(0.0382)	(0.0390)	(0.0404)	(0.0410)
Domestic market development			-0.6718		-0.5889
			(0.4664)		(0.4591)
IMF conditionality				-0.6187	-0.5315
				(0.6402)	(0.6146)
Lags of central bank claims/GDP	**0.8974*****	**0.8269*****	**0.8272*****	**0.8240*****	**0.8251*****
	(0.0752)	**(0.0360)**	**(0.0374)**	**(0.0335)**	**(0.0348)**
Lag of real GDP growth	-0.0270	-0.0254	-0.0235	-0.0270	-0.0252
	(0.0174)	(0.0206)	(0.0192)	(0.0211)	(0.0195)
Lag of government deposits/GDP	-0.0839	-0.0733	-0.0786	-0.0704	-0.0756
	(0.0768)	(0.0626)	(0.0634)	(0.0643)	(0.0652)
Lag of government debt/GDP	**-0.0148****	-0.0105	-0.0103	**-0.0129***	-0.0125
	(0.0068)	(0.0078)	(0.0080)	**(0.0077)**	(0.0078)
Observations	667	596	596	596	596
Number of countries	45	41	41	41	41

Robust standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

TABLE A4

Determinants of central bank lending: change in central bank loans

Dependent variable: Change in central bank loans/GDP	Model 1	Model 2	Model 3	Model 4	Model 5
Fiscal deficit	**0.6263****	0.0935	0.1016	-0.0331	-0.0253
	(0.3038)	(0.2369)	(0.2366)	(0.2522)	(0.2538)
Fiscal deficit × Legal limit		**0.0415*****	**0.0441*****	**0.0540*****	**0.0565*****
		(0.0159)	**(0.0157)**	**(0.0205)**	**(0.0200)**
Fiscal deficit × Domestic market development			-0.1821		-0.1929
			(0.3505)		(0.3321)
Fiscal deficit × IMF conditionality				**-0.2427***	**-0.2372****
				(0.1256)	**(0.1150)**
Legal limit		0.6758	0.6126	0.5591	0.4772
		(0.5628)	(0.5009)	(0.4962)	(0.4424)
Domestic market development			3.9462		4.9117
			(5.6728)		(4.9638)
IMF conditionality				-8.8235	-9.2823
				(6.8652)	(6.9630)
Lags of change in central bank loans/GDP	**-0.1952****	0.0203	0.0146	0.0052	-0.0022
	(0.0942)	(0.0628)	(0.0677)	(0.0632)	(0.0689)
Lag of real GDP growth	-0.1873	-0.2062	-0.1960	-0.2132	-0.2001
	(0.1644)	(0.2083)	(0.2150)	(0.2213)	(0.2274)
Lag of government deposits/GDP	**-1.1335***	**-0.8138***	**-0.7709***	-0.7390	-0.6889
	(0.6185)	**(0.4752)**	**(0.4557)**	(0.4700)	(0.4486)
Lag of government debt/GDP	**-0.0873***	-0.0132	-0.0059	-0.0373	-0.0280
	(0.0468)	(0.0818)	(0.0852)	(0.0753)	(0.0771)
Observations	629	561	561	561	561
Number of countries	45	41	41	41	41

*Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.*

Table A5

Determinants of central bank lending: additional explanatory variables

Dependent variable: central bank loans/GDP	**Model 1**	**Model 2**	**Model 3**
Fiscal deficit	0.0370	**0.0734***	**0.0752***
	(0.0253)	**(0.0394)**	**(0.0400)**
Fiscal deficit × Legal limit	**0.0046*****	**0.0056****	**0.0056****
	(0.0015)	**(0.0022)**	**(0.0022)**
Fiscal deficit × Domestic market dvpt + Eurobond access	-0.0358		-0.0887
	(0.0778)		(0.1133)
Fiscal deficit × Sovereign risk		-0.0054	-0.0054
		(0.0042)	(0.0042)
Legal limit	-0.0013	-0.0181	-0.0172
	(0.0321)	(0.0470)	(0.0474)
Domestic market dvpt + Eurobond access	0.1744		0.6700
	(0.6399)		(0.8910)
Sovereign risk		-0.0541	-0.0576
		(0.1557)	(0.1515)
Lags of central bank loans/GDP	**0.7947*****	**0.7908*****	**0.7887*****
	(0.0382)	**(0.0533)**	**(0.0533)**
Lag of real GDP growth	**-0.0221****	-0.0207	-0.0204
	(0.0108)	(0.0145)	(0.0147)
Lag of government deposits/GDP	-0.0805	-0.1272	-0.1242
	(0.0605)	(0.0888)	(0.0885)
Lag of government debt/GDP	-0.0034	-0.0023	-0.0023
	(0.0066)	(0.0068)	(0.0066)
Observations	596	443	443
Number of countries	41	35	35

*Robust standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.*

Notes: Sovereign risk measures the risk of debt distress using the ratings from the IMF's Debt Sustainability Analysis (=0 if the rating is "Low"; =1 if the rating is "Moderate"=2 if the rating is "High"=3 if the rating is "In debt distress"). Eurobond access is a dummy (=1 if the country has previously issued a Eurobond, 0 otherwise).

TABLE A6

Determinants of central bank lending: dynamic bias least squares dummy estimators

Dependent variable: central bank loans/GDP	Model 1	Model 2	Model 3	Model 4	Model 5
Fiscal deficit	**0.0833*****	0.0050	0.0085	-0.0007	0.0031
	(0.0173)	(0.0210)	(0.0211)	(0.0208)	(0.0208)
Fiscal deficit × Legal limit		**0.0037*****	**0.0040*****	**0.0047*****	**0.0050*****
		(0.0012)	**(0.0013)**	**(0.0013)**	**(0.0013)**
Fiscal deficit × Domestic market development			**-0.0464***		**-0.0469***
			(0.0243)		**(0.0242)**
Fiscal deficit × IMF conditionality				**-0.0336*****	**-0.0314****
				(0.0126)	**(0.0127)**
Legal limit		-0.0149	-0.0166	-0.0179	-0.0192
		(0.0264)	(0.0265)	(0.0262)	(0.0263)
Domestic market development			0.0921		0.1098
			(0.2347)		(0.2330)
IMF conditionality				-0.1878	-0.2600
				(0.1926)	(0.1933)
Lags of central bank loans/GDP	**0.7609*****	**0.7748*****	**0.7716*****	**0.7741*****	**0.7707*****
	(0.0233)	**(0.0173)**	**(0.0176)**	**(0.0172)**	**(0.0175)**
Lag of real GDP growth	-0.0250	**-0.0217***	-0.0195	**-0.0209***	-0.0187
	(0.0157)	**(0.0123)**	(0.0123)	**(0.0122)**	(0.0122)
Lag of government deposits/GDP	-0.0218	**-0.0397***	**-0.0381***	**-0.0389***	**-0.0370***
	(0.0231)	**(0.0206)**	(0.0209)	**(0.0205)**	(0.0207)
Lag of government debt/GDP	-0.0010	-0.0018	-0.0014	**-0.0036***	-0.0032
	(0.0027)	(0.0021)	(0.0021)	**(0.0021)**	(0.0022)
Observations	667	596	596	596	596
Number of countries	45	41	41	41	41

*Robust standard errors in parentheses. *** p<0.01, ** p<0.05, *p<0.1.*

TABLE A7

Number of observations (countries) in each local projection

Dependent variable	Horizon						
	0	**1**	**2**	**3**	**4**	**5**	**6**
Base money	580	545	507	469	430	391	354
	(40)	(40)	(40)	(40)	(40)	(38)	(37)
Exchange rate	596	560	521	482	442	402	364
	(41)	(41)	(41)	(41)	(41)	(39)	(38)
Inflation	596	560	521	482	442	402	364
	(41)	(41)	(41)	(41)	(41)	(39)	(38)
Broad money	596	560	521	482	442	402	364
	(41)	(41)	(41)	(41)	(41)	(39)	(38)

Note: The table summarizes the number of observations and the number of countries in each local projection. The number of observations in each regression is less than in the summary statistics because a full set of data is not available for all the control variables.

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Table A8

List of the 45 Sub-Saharan countries used in the analysis

Angola	Madagascar
Benin	Malawi
Botswana	Mali
Burkina Faso	Mauritania
Burundi	Mauritius
Cabo Verde	Mozambique
Cameroon	Namibia
Central African Republic	Niger
Chad	Nigeria
Comoros	Rwanda
Congo, Democratic Republic of the	São Tomé and Principe
Congo, Rep.	Senegal
Côte d'Ivoire	Seychelles
Equatorial Guinea	Sierra Leone
Eritrea	South Africa
Ethiopia	Sudan
Gabon	Swaziland
Gambia	Tanzania
Ghana	Togo
Guinea	Uganda
Guinea-Bissau	Zambia
Kenya	Zimbabwe
Lesotho	

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