

Determinants of Saving of Institutional Sectors of the National Economy in the Czech Republic

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Abstract:

The paper analyses the saving of individual sectors in the national economy. The analysis at this level is crucial to consider the specificities of each institutional sector. First, saving are described from the perspective of Keynesian economic theory, followed by a literature review. Next, the sectors of the national economy are briefly defined, particularly the concept of saving in each sector is presented. The analysis concludes with an empirical verification of the determinants of sectoral saving by using ARDL models reparameterized into EC. The results of the models show that the sectoral determinants are different and confirm the necessity of using sectoral analysis.

Keywords: ARDL, EC, institutional sectors, national accounts, saving.

JEL Classification: D14, D22, G51, E01, E21, H60.

1. Introduction

The formation and dynamics of saving have a major impact on the development of economies, their economic growth, external (im)balance, etc. The evolution of saving with regard to investments can serve as one of the indicators of imbalance and an impending financial (economic) crisis. These reasons lead to the fact that the issue of saving has long been one of the most important topics in practical economic policy as well as in theoretically oriented (academic) publications.

* The views expressed are the author's own and do not reflect the views of the Czech Statistical Office.

The determinants of saving and the impact of saving on the aforementioned economic growth or external imbalances of the economy are widely discussed in the academic literature. Until recently, less attention had been paid to saving from the perspective of individual sectors of the national economy. To the extent that earlier studies had looked at saving generation from a national perspective (IMF, 2005) or sectoral perspective, they had very often focused only on ‚private‘ and ‚public‘ saving (see, for example, Grigoli, Herman, and Schmidt-Hebbel, 2014), and not on saving from the perspective of national accounts. Also neglected was a precise definition of the concept of saving and its creation in the context of the specificities of each sector.

A sectoral perspective of saving creation and development is essential. For example, if imbalances at the level of one sector (e.g. manifested by low saving and saving creation with regard to investment activity) are not compensated by other sectors, then, all other things being equal, the external balance of the economy may be disturbed due to a lower current account balance¹ (see, inter alia, the issue of the twin-deficit).

These aspects are crucial for any economy, but for a small open economy like the Czech one, the issue is even more pressing. The aim of this paper is to find the determinants that affect saving in individual sectors of the national economy according to the ESA 2010 methodology in the Czech Republic for the period 1995–2022 and to find out whether the determinants of gross saving differ between sectors of the national economy in the Czech Republic and to confirm the need for a sectoral perspective for this small open economy. The main added value of the paper lies in the systematic sector-specific approach and the explicit alignment of explanatory variables with ESA 2010 sectoral functions.

The author sets out two research hypotheses:

- 1) There are differences in the methodological approach to saving between individual sectors of the national economy in terms of the national accounts.
- 2) The determinants of saving in individual sectors of the national economy are not the same for all sectors, or at least they affect the development of saving to varying degrees.

1 The author acknowledges the methodological differences between the current account as defined in the balance of payments and in the national accounts. However, in economically oriented texts, it is quite common to disregard these methodological differences, given the efforts to harmonize the two sets of statistics.

The content of the paper is as follows. The first chapter describes saving from the perspective of Keynesian economic theory, followed by a review of the literature and empirical knowledge to date. The second chapter focuses on a sectoral view of saving using the ESA 2010 methodological framework. The third chapter empirically tests the determinants of saving for different sectors of the national economy using ARDL reparameterized into EC models. The last section of the paper summarises the whole text.

2. Theoretical background of saving

This chapter focuses first on saving formation from the perspective of selected economic theories (mainly from Keynes's perspective). The following part of the chapter will be devoted to the literature review.

2.1 Fundamentals of saving theory

Classical economists (such as J. S. Mill) viewed saving primarily as a "resource" from which funds could be drawn to maintain or expand the capital stock. Thus, saving represents that part of factor income (labor, land, and capital) that was not used for consumption but can be allocated to expand the economy's productive capacity (Kates, 2018). Important neoclassical publications come from L. Walras (1954) and I. Fisher (1930), who viewed saving primarily as an increasing² function of the interest rate. The seminal publication, however, was J. M. Keynes's (1936) *General Theory of Employment, Interest, and Money*, on which the Keynesian saving function is based. According to this theory, income can be used for consumption, tax payments, and saving. The income net of taxes and the balance of transfers represents disposable income. Disposable income can be expressed as:

$$Y_D = S + C, \tag{1}$$

where Y_D is disposable income, S is saving, and C is consumption.

In this model, saving depends mainly on the disposable income of the subjects. It assumes a general form of the saving function³ as:

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- 2 The function is increasing and concave, i.e. the first derivative of the function is positive and the second derivative is negative. An increase in the interest rate can increase saving, i.e. the substitution effect is greater than the income effect. However, at a certain level of the interest rate, the income effect may outweigh the substitution effect (an increase in the interest rate may no longer lead to a proportional increase in saving).
- 3 Keynes also discusses the consumption function, but the text focuses on the saving part.

$$S = f(Y_D) \quad (2)$$

A general linear saving function in line with Keynes' interpretation can be formulated as follows:

$$S = S_0 + S'Y_D, \quad (3)$$

where S represents saving, S_0 refers to the level of saving when disposable income is zero, Y_D is disposable income, and S' represents marginal propensity to save.

This basic approach has stimulated discussions on the factors determining the slope and position of the consumption and saving functions in relation to disposable income. Keynes assumed stability in the short run for the factors determining the function. Since Keynes's *General Theory*, disposable income has been regarded as the main determinant of saving (and consumption). Also necessary are subjects' preferences, which are reflected in the propensity to save (consume). Keynes (1936) defines the main motives for saving for individuals (households) and other sectors. From the perspective of the individual, there are eight subjective motives for saving: 1) precaution, 2) foresight, 3) calculation, 4) improvement, 5) independence, 6) enterprise, 7) pride, 8) avarice. Regarding the other sectors⁴, there are mainly four motives: 1) enterprise, 2) liquidity, 3) improvement, 4) financial prudence, and anxiety.

Following Keynes and in discussion with him, other theories were developed to explain the process of saving, e.g. the permanent income hypothesis (Friedman, 1957), life cycle theory (Modigliani and Brumberg, 1954), the current income hypothesis of saving (Modigliani, 1949; Duesenberry, 1949), the bequest motive for saving (Fischer, 1973; Abel, 1986), and others. However, this text focuses primarily on Keynes's approach to saving, on which the concept of national accounts is based when defining functional relationships.

2.2 Literature review

The literature review in this article first focuses on the various sectoral classifications of the national economy across relevant articles and then provides an overview of the usual determinants of saving.

Earlier studies focused on the analysis of total national saving (see, for example, IMF, 2005), or saving was divided only into private and public saving (Masson, Bayoumi, and

4 By other sectors Keynes meant: central and local government, commercial companies and institutions.

Samiei, 1998). Subsequently, publications focusing on the development and determinants of gross saving in a selected sector of the national economy can be found. For example, Pitoňáková (2015) analysed the determinants of household saving in Slovakia. Her study shows the importance of the economic nature of the sector under analysis and the related relevant variables explaining the evolution of saving in this sector. Grigoli, Herman, and Schmidt-Hebbel (2014) distinguish between national, private, household, and corporate saving, looking for commonalities and differences in the behaviour of the sectors. However, fewer studies focus more comprehensively on examining all sectors of the national economy separately as defined by ESA 2010.

Across the economic literature, more or less similar determinants of saving can be found for econometric purposes. In general, factors affecting the evolution of saving include changes in the level and distribution of household income, productivity and output growth, fiscal policy⁵, inflation, interest rates, changes in some relative prices, financial liberalization, the age structure of the population or other demographic variables (such as urbanization), uncertainty, pension and saving systems, and wealth⁶ (for example, Grigoli, Herman and Schmidt-Hebbel, 2014 and IMF, 1990). However, if the issue of saving is viewed not from a general aggregate perspective but from the perspective of individual sectors, then certain specificities can be found for each sector of the national economy. The development of saving in sectors may be influenced by different factors or by the same factors but with different intensity of impact. For household saving, the main motivation is assumed to be to smooth consumption over time based on expected lifetime income.⁷ Saving can be used to acquire housing or other assets⁸. Furthermore, increased uncertainty about an individual's future income also reinforces the precautionary motive to save - see Deaton (1989).

The usual determinants of saving according to the economic literature will be described more below. Regarding exchange rates and saving, the strength and direction of the relationship generally depend on the type of change source. Changes in exchange

5 For example, in the form of government expenditure in various forms (transfers, etc.). On the revenue side, fiscal policy can influence saving patterns, for example through various tax incentives.

6 It should be noted that different sectors and their saving trends may interact, but this analysis is beyond the scope of this article.

7 This idea is consistent with life cycle theory.

8 Such as net acquisition of valuables, accumulation of saving in financial assets (in the case of the Czech Republic, this may involve the purchase of savings bonds of the Republic).

rates can be caused, for example, by fiscal policy, monetary policy, or changes in the preferences of international investors. According to Boughton et al. (1986), an eventual depreciation increases national saving regardless of its source. The relationship between private saving and public debt has been explored by Checherita-Westphal and Rother (2010). Another determinant of saving identified in the literature is the interest rate. Saving and real interest rates are generally assumed to be positively related, and the strength of this relationship is likely to depend on the size of household net assets (see Deaton, 1993). According to Grigoli, Herman, and Schmidt-Hebbel (2014), other relevant demographic variables include urbanization, which can have both inverse and positive effects on saving through various transmission channels.

The level of financial liberalisation is also an essential determinant of saving. Suppose households' (or corporations') access to credit is freed up. In that case, these units can spread their consumption more widely over their working lives (e.g., saving for gross fixed capital formation), which reduces saving (Hubbard et al., 1986). According to Faulkner-MacDonagh and Mühleisen (2004), wealth effects associated with asset price spikes (for households, especially real estate) are reflected in the evolution of private credit, which typically acts in the direction of a decline in household sector saving.

3. Saving from the perspective of institutional sectors of national accounts

It is clear from the overview of Keynes's Theory of Saving above that this theory works significantly with indicators compiled within the national accounts system (e.g., saving, disposable income, consumption, etc.). The economic foundations of national accounts are based on the ideas of the English economist J. M. Keynes, specifically his seminal publication, *General Theory* (1936). Thus, knowledge of the national accounts methodology plays an essential role in the analysis. In this publication, the national accounts act as a kind of bridge between the theoretical and practical parts of the research.

The current version of the standard of national accounts is the SNA 2008 (UN, 2009). The European Union has also developed its standards inspired by the SNA. Currently, the European standard ESA 2010 (EUROSTAT, 2013) is in use. The concept of national accounts will be used in this paper to analyse the saving of sectors of the national economy. The European System of National Accounts ESA 2010 divides the national economy into individual sectors and also defines sectors' economic functions:

- Non-financial corporations (S.11) - the main activities are producing goods and providing non-financial services.
- Financial corporations (S.12) - the main activity of institutions is the provision of financial services or financial auxiliary activities (EUROSTAT, 2013; CZSO, 2021).
- General government (S.13) - primarily represents non-market producer functions and distributes income and national wealth. They are also the administrators of social security.
- Households (S.14) - the main economic function is consumption and, for entrepreneurs, the production of market goods (including for own final use) and financial and non-financial services.
- Non-profit institutions serving households (S.15) - their function is to provide non-market services to households.

Defining the economic functions of the sectors is absolutely crucial in the text of the paper, because the variables tested in the analytical part of the paper are derived from these functions. Before analysing saving from the perspective of the sectors of the national economy, it is helpful to define in more detail how saving is formed in the system of national accounts (according to ESA 2010). It is important to know the nature of the indicators that are analysed in order to interpret the subsequent results correctly.

Saving – a sectoral view

Regarding the fundamental macroeconomic identity, gross national saving is obtained as the difference between gross national disposable income and final consumption. It is, therefore, the sum of residents' saving in all institutional sectors of the national economy. From this perspective, saving is the balance of the use of the disposable income account or the balance of the use of an adjusted disposable income account. Disposable income is the balance of the secondary distribution of income account, and adjusted disposable income is the balance of the redistribution of income in kind account, which concerns only selected sectors (general government, households and non-profit institutions serving households).

From a sectoral perspective, saving can be defined as follows (EUROSTAT, 2013):

- Saving for the non-financial corporations sector (S.11) equals disposable income (sector has no final consumption).
- For the financial corporations sector (S.12), saving equals disposable income adjusted for the change in pension entitlements (item D.8).

- For general government sector (S.13), saving corresponds to the difference between disposable income and final consumption expenditure.
- For the household sector (S.14)⁹, saving corresponds to disposable income that is not used for final consumption expenditure. In the case of the household sector, an adjustment is made for the change in pension entitlements (item D.8).
- For the non-profit institutions serving households sector (S.15), as in the general government and household sector, saving is the difference between disposable income and final consumption expenditure.

The System of National Accounts also distinguishes between gross and net variables¹⁰. Gross saving values are used by many prominent institutions (for example, the IMF and ECB) and think tanks (i.e., the NBER and CEPR). The difference between gross and net figures corresponds to the consumption of fixed capital.¹¹

4. Empirical verification of the determinants of gross saving in individual sectors of the national economy

This part of the text presents the data used, the econometric method used for verification of the second hypothesis, the results of the empirical verification, and where appropriate, the economic rationale for the results and, in justified cases, a comparison with other relevant research. At the beginning of the empirical analysis, however, the differences in the development of gross saving¹² across sectors of the national economy are first highlighted.

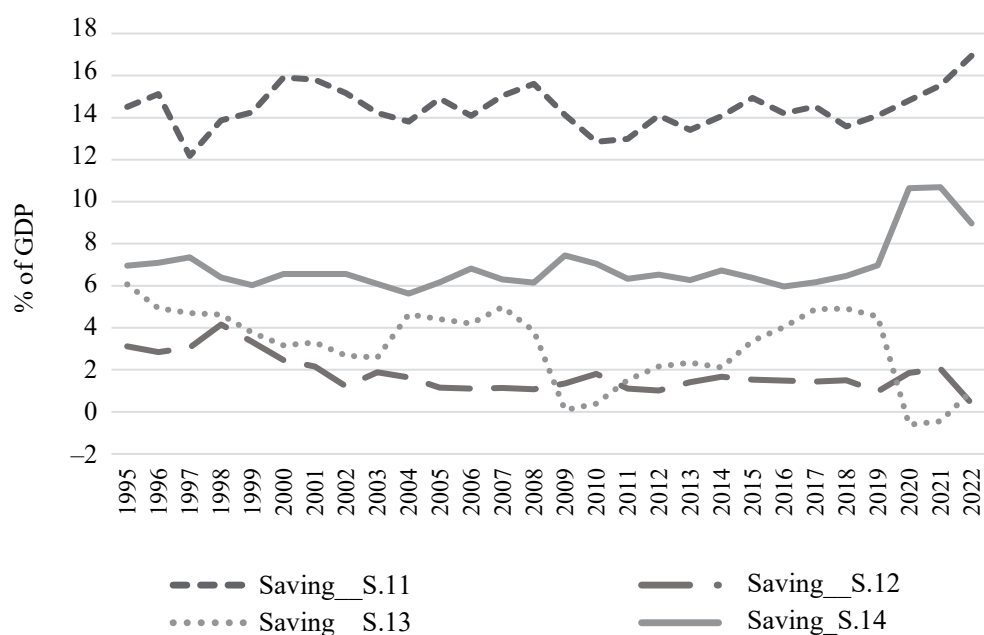
Figure 1 shows that the saving of each sector are different in terms of their ratios to GDP. The dynamics of their development probably respond to various factors and at different intensities.

9 This sector also includes self-employed persons.

10 However, as Spěváček (2007) points out, due to the use of different methods and wear and tear norms, estimates of fixed capital consumption are not fully comparable between countries. According to Spěváček (2007) this is probably the main reason why indicators in net terms (not only GDP and GNI, but also net saving, net disposable income) are virtually absent from analyses, even though they are commonly available in national accounts.

11 A comparison of classical models for estimating fixed capital consumption and alternative models are discussed in Krejčí and Sixta (2012).

12 Hereinafter referred also as “saving”.

Figure 1: Gross saving by sector of the national economy (% of GDP)

Source: Eurostat, own processing

Figure 1 shows that gross saving of the non-financial corporations sector (S.11) accounts for the largest share of gross saving in relation to GDP. The household sector (S.14) accounts for the second largest gross saving. The figure suggests that households in the Czech Republic form precautionary saving during economic downturns (e.g., the effects of the currency crises in 1997, the global financial crisis in 2009, and the COVID-19 pandemic in 2020¹³). In contrast, the financial corporations sector (S.12), interpreted in many economic articles as an intermediary sector, accounts for the smallest part of gross saving. The general government sector (S.13) accounts for the second smallest part of gross saving.

13 However, during the COVID-19 pandemic, this was more like forced saving, because many stores were closed due to restrictions.

4.1 Description of variables and econometric approach to analysis

The analysis is carried out for the period 1995–2022¹⁴ for the Czech Republic. To apply the Auto Regressive Distributed Lag (ARDL) model, gross saving for the relevant sector of the national economy (in % of GDP) was used as the explained variable¹⁵. Descriptive statistics and information on the explained variables for gross saving of each sector (i.e., non-financial corporations, financial corporations, general government, households¹⁶) are provided in Table 1 below. All explanatory variables used are also listed and described in Table 1, including the expected direction of influence of explanatory variables on explained variables.

14 The time series analysis ends in 2022, as not all variables in the models are available for more recent years due to the frequency of data collection and publication by international statistical organizations.

15 For all explanatory variables, the author assumes exogeneity in the case of the Czech Republic, even for variables such as exchange rate, general government debt, and domestic credit. These assumptions are based on academic articles; for example, Montiel and Servén (2008) recognize exchange rates as an exogenous determinant of national saving. ARDL models are suitable for testing the determinants of saving in sectors of the national economy because, by including lagged values of both explained and explanatory variables (lagged regressors) and correctly selecting the lag length (using AIC/BIC criteria), it is possible to mitigate endogeneity problems.

16 Due to the lower analytical and scope importance of non-profit institutions serving households (S.15), this sector is abstracted from in the text in analytical part of the paper. In academic articles and monographs, it is common to add this sector to the household sector or to abstract from it entirely (e.g., Vejrnělek, et al., 2025 and Spěváček, 2006).

Table 1. Descriptive statistics of variables

Variable		Mean	Std. Dev.	Min	Max	Units of measure	Source	ADF test - order of integration	Expected direction of impact
S_S11	gross saving by non-financial corporations	14.455	1.015	12.175	16.943	% GDP	Eurostat	I(0)	x
S_S12	gross saving by financial corporations	1.784	0.854	0.398	4.157	% GDP	Eurostat	I(1)	x
S_S13	general government gross saving	3.150	1.815	-0.611	6.069	% GDP	Eurostat	I(1)	x
S_S14	household gross saving	6.902	1.233	5.627	10.691	% GDP	Eurostat	I(1)	x
prod	productivity per worker	83.015	14.398	58.861	104.870	index, 2020 = 100	AMECO	I(1)	+
TT	impact of terms of trade goods and services on real income	-0.036	0.922	-2.600	1.200	% GDP	AMECO	I(0)	+
GermGDP	GDP in Germany	85.400	9.345	74.544	108.444	index, 2020 = 100	IMF	I(1)	+
realwage	real compensation per employee (deflator GDP)	2010,240	427,700	1260,200	3019,223	bil. CZK	AMECO	I(1)	-
Irlend	lending interest rate	6.389	2.980	3.202	13.204	%	World Bank	I(1)	-
IRspr	interest rate spread	4.247	0.799	2.827	5.838	pp	World Bank	I(1)	+
GD	general government debt	29.802	10.345	11.577	44.420	% GDP	Eurostat	I(1)	+/-
Pcrd	domestic credit to the private sector	46.480	11.206	23.665	65.032	% GDP	World Bank	I(1)	+
Fmac	financial markets access index	5.313	3.350	0.973	15.850	index	IMF	I(1)	-
REER	real effective exchange rate	94.354	16.468	61.475	124.192	index, %	Eurostat	I(1)	+
GAP	output gap	0.084	1.999	-2.964	4.056	% of Y_{POT}	MoF CR	I(0)	+
unem	unemployment rate	5.623	2.191	2.000	8.800	%	CZSO	I(1)	-
GDP_ph	GDP per head	453.257	84.772	324.300	583.400	1000 CZK	AMECO	I(1)	-
ch_wealth	revaluation of household wealth	4.810	4.583	-3.187	20.470	% GDP	CZSO	I(1)	+
health_exp	government expenditures on health	7.457	0.793	6.400	9.800	% GDP	AMECO	I(1)	+
urb	urbanisation	98.349	1.049	96.595	100.000	index, 2020 = 100	World Bank	I(1)	-
RIR	real interest rate	0.529	2.341	-3.300	7.100	%	AMECO	I(0)	+

Note: Y_{POT} = potential product, MoF CR = Ministry of Finance of the Czech Republic, CZSO = Czech Statistical Office

Source: own processing, in STATA

In the first phase of the research, the same determinants were applied to all sectors of the national economy (such as GDP growth, real interest rates, demographic variables, real exchange rates). However, these models were not robust¹⁷, and that's why the explanatory variables finally used in the models are in some cases different for each sector, based on the economic function of the sectors. The reasons for selecting specific explanatory variables will be described below in the text.

The determinant of saving in the non-financial corporations sector (S.11) is *productivity per worker*, which reflects the volume of output that can affect the development of corporate profits. The *impact of terms of trade for goods and services on real income* is also very important for the non-financial corporate sector's saving, especially in the context of a small open economy such as the Czech Republic. *Germany's GDP* is a key variable specific to the market production sector in the Czech Republic. Germany is an important trading partner of the Czech Republic (Dražozalová, Galuščák, and Kábrt, 2023). As is evident from the Czech Statistical Office's data on sector accounts, *real compensation per employee* is the dominant component of resource use in the context of this sector, and is therefore an essential variable in the development of non-financial corporations' saving. In the case of the interest rate variable, it can be assumed that the non-financial corporations sector (S.11) is more of a borrower in the national economy and therefore the *lending interest rate* is more relevant for this sector.

The financial corporations sector (S.12)¹⁸, in turn, is more influenced by the *interest rate spread* (in terms of its saving generation), given the economic nature of their operation (often acting as an intermediary in financial transactions). *General government sector debt* is most relevant for the financial corporations sector (S.12), because this sector is the country's most crucial holder of government bonds (CNB, 2024a). The variable *domestic credit to the private sector* is also important for saving in the financial corporations sector. This is because this sector largely acts as an intermediary between surplus and deficit entities and provides credits to deficit entities as an integral part of its economic function. The *financial markets access index* variable is important for deficit units, which this intermediary sector provides in the form of credits. A more developed financial market and a higher level of financial market accessibility for deficit units may result in a certain crowding-out effect of credits from this sector with regard to these units. The *real effective*

17 The models are unsuitable for several reasons. For example: low R2 value, statistical (non) significance, autocorrelation, model instability according to CUSUM, etc. The author can provide these unsuitable models upon request from readers.

18 Especially deposit-taking corporations except the central bank (S.122).

exchange rate is important for saving in this sector for several key reasons that affect both their profitability and risk management. Banks, in particular, need the exchange rate to convert foreign currencies, hedge investments, and comply with central bank instructions, thereby fulfilling their economic functions.

For the general government sector (S.13), the *output gap* is important because this variable affects the government's corporate and personal income tax revenues, and it is also crucial for the derivation of the expenditure fiscal rule. This, among other things, influences the level of saving in the general government sector. *General government sector debt* is a relevant variable for the general government sector's saving because of debt service payments. In the case of the relationship between the *unemployment rate* and general government saving, a significant relationship is expected. This phenomenon may occur through higher expenditures on employment policy, which puts more pressure on the government budget. The *real effective exchange rate* is a key factor for saving and the overall fiscal balance of the general government sector. Exchange rate developments affect the value of general government debt, the cost of servicing debt denominated in a foreign currency.

It is clear that there are differences between sectors for the variable expressing economic development. For the household sector (S.14), the *GDP per capita* is an important variable explaining the development of entities in this sector. This is a kind of proxy variable for the development of household economic welfare. It can be assumed that the *reevaluation of household wealth* is an important variable for household sector saving, more specifically, according to behavioral economic theory, the so-called "Wealth Effect". For the household sector (S.14), healthcare expenditures are an important variable. According to Kerdrain, Koske, and Wanner (2010), healthcare expenditures can be considered a good indicator of government participation in the economy, i.e., these types of government expenditures "lighten" households' expenditure burden. Hence, households have to pay less for their health out of their disposable income as an expenditure. Socio-demographic variables such as *urbanization* are relevant for household sector saving. Economic research reveals several directions and channels through which this variable operates. However, it can generally be assumed that urbanization affects saving in this sector due to its impact on the disposable income of these entities and the amount of subsequent consumption costs. For the household sector (S.14), as an interest rate type variable, it is more appropriate to consider the *real interest rate*, where we assume that it is more likely to be a surplus unit in the national economy and can allocate its saving through financial corporations, both in the lending market and invested in selected financial instruments.

4.2 Econometric approach to analysis

In this section, the models used in the empirical part of the paper are presented at the theoretical level. Specifically, the Autoregressive distributed lag model (ARDL model) and the relevant tests that apply to this type of model. Furthermore, an expression of the ARDL model in EC form will be presented, including relevant tests related to this method.

Autoregressive distributed lag model (ARDL model)

In general, the ARDL model according to Pesaran, Shin, and Smith (2001) and Kripfganz and Schneider (2022), can be defined as follows:

$$y_t = c_0 + c_1 t + \sum_{i=1}^p \phi_i y_{t-i} + \sum_{i=0}^q \beta'_i x_{t-i} + u_t, \quad (4)$$

where $t = \max(p, q), \dots, T$. The optimal lag orders p and q (it's possible to have different number of lags across regressors) were obtained by minimizing a model selection criterion, specifically the Akaike information criterion (AIC)¹⁹. The variables in $(y_t, x_t)'$ are allowed to be purely $I(0)$, $I(1)$, or cointegrated. None of the time series should be $I(2)$. In order to determine the order of the time series, the time series of each variable were unit root tested using the Augmented Dickey-Fuller test. All models were tested for the presence of autocorrelation, specifically the Breusch-Godfrey LM test for autocorrelation and also the Durbin-Watson test. In addition, the Breusch-Pagan/Cook-Weisberg test for Heteroskedasticity was also applied. The STATA function package "cusum6" i.e. Cumulative sum test for parameter stability was also applied to each of the models. In addition, the "sbcusum" Cumulative sum test for parameter stability was also applied.

Error correction (EC) representation of ARDL model

Before we can move on to the interpretation of the EC expression of the ARDL model (Kripfganz, Schneider, 2022), it is necessary to test the model with a cointegration test for the existence of a long-run relationship. Since, according to the ADF test, there are time series of $I(0)$ and $I(1)$ variables in the model, the Bounds test according to Pesaran, Shin, and Smith (2001) is the most appropriate. If the Bounds test confirms the existence of a long-run relationship, then the EC model can be interpreted.

Reparameterization in conditional EC form:

$$\Delta y_t = c_0 + c_1 t - \alpha(y_{t-1} - \theta x_{t-1}) + \sum_{i=1}^{p-1} \psi_{yi} \Delta y_{t-i} + \omega' \Delta x_t + \sum_{i=1}^{q-1} \psi'_{xi} \Delta x_{t-i} + u_t, \quad (5)$$

where the adjustment rate coefficient $\alpha = 1 - \sum_{j=1}^p \phi_j$ and the long-term coefficients $\theta = \frac{\sum_{j=0}^q \beta_j}{\alpha}$.

19 However, it would also be possible to use Bayesian information criterion (BIC).

4.3 Results of the empirical verification of the sectoral analysis of the determinants of gross saving and the discussion of the results

In this section, the results of the estimated models are presented, specifically, the results of ARDL models in the EC specification.

Before estimating the ARDL models, unit roots were tested for each variable using the Augmented Dickey-Fuller test.²⁰ These results show that the time series are $I(0)$ and $I(1)$, see Table 1. The optimal number of lags for each variable in the models below was determined using the Akaike Information Criterion (AIC).

In estimating the model, autocorrelation was tested using the Durbin-Watson test and the Breusch-Godfrey LM test for all lags used in the model. According to the results of both tests, autocorrelation is not present in the models. Heteroskedasticity was also tested according to Breusch-Pagan/Cook-Weisberg test. The test results showed that the models are not heteroskedastic. To test the stability of the ARDL models, tests from the CUSUM6, CUSUM, and CUSUMSQ function packages (Royston, 1992, and Baum, 2000) in STATA were used. All estimated models are stable according to the test results²¹.

Results of the empirical verification

ARDL models were estimated for all sectors (non-financial corporations, financial corporations, general government, and households). All the ARDL models were then tested with the Bounds test to see if there is a long-run relationship in the models (Pesaran, Shin, and Smith, 2001). According to the test results, the long-run relationship was confirmed for all the ARDL models. The models with a confirmed long-run relationship were re-estimated in the EC model expression and are presented in Table 2 below. The estimated EC models in Table 2 consist of three parts, i.e., ADJ - error correction term²², LR - long run, and SR - short run.

20 ARDL models can contain variables that are $I(0)$ or $I(1)$.

21 CUSUM tests assess model stability in the context of structural breaks (H_0 : No structural break). Although it is evident from general economic data that structural breaks occurred in the economy during the analyzed period (specifically in 1997, 2000, and 2020), testing with three different types of CUSUM tests shows that these events do not lead to instability in the selected models even at these critical moments; thus, in the specific models, they do not occur in the sense that they would disrupt the model's predictive properties.

22 It is generally assumed across the econometric literature that if the coefficient of the error correction terms is between -1 and 0 , then there is a monotonic return to equilibrium. Suppose the coefficient of the error correction terms lies in the interval from -1 to -2 . In that case, there is an oscillatory return to equilibrium, i.e., it fluctuates damped around its long-run value. However, once this process is complete, the convergence to the equilibrium value is rapid (Narayan, Smyth, 2006 and Loayza, Ranciere, 2005). In the case of household sector (S.14), the high value of the adjustment coefficient was identified in EC model. This result could be interpreted as a consequence inappropriate expectations of households regarding future economic developments. For this reason, the household sector may respond to economic events by adjusting its saving more intensely than would be appropriate. This subsequently leads to an oscillatory return to equilibrium. The issue of inappropriate expectations of households is addressed, for example, in Šnobl (2023).

Table 2. EC Models Institutional Sectors of the National Economy**a) Gross saving of the non-financial corporations sector (S.11); Explained variable - S_S11**

Explanatory variable			Coefficient	p-value
	Name	Lag/D1, LD		
ADJ	<i>S_S11</i>	L1	-1.724	0.000
LR	<i>prod</i>	x	-0.130	0.013
	<i>TT</i>	x	-0.421	0.064
	<i>GermGDP</i>	x	-0.246	0.000
	<i>realwage</i>	x	0.010	0.000
	<i>Irlend</i>	x	-0.283	0.009
SR	<i>S_S11</i>	LD	0.350	0.067
	<i>prod</i>	D1	0.013	0.884
		LD	0.150	0.064
	<i>TT</i>	D1	-0.750	0.044
	<i>GermGDP</i>	D1	0.552	0.076
		LD	-0.832	0.114
	<i>Irlend</i>	D1	0.427	0.137
		LD	-0.338	0.090
	<i>cons</i>	-	52.702	0.000
Sample: 1997 thru 2022			Number of obs = 26	
			R-squared = 0.908	
			Adj R-squared = 0.792	
Log likelihood = -7.851			Root MSE = 0.503	
Breusch–Godfrey LM test for autocorrelation			Prob > chi ² = 0.894	
Durbin–Watson d-statistic (15, 26) = 1.983				
Breusch–Pagan/Cook–Weisberg test for heteroskedasticity			Prob > chi ² = 0.461	
CUSUM	Test statistic		Critical value (5%)	
	0.716		0.948	
CUSUMSQ	Test statistic		Critical value (5%)	
	0.332		1.358	

b) Gross saving of the financial corporations sector (S.12); Explained variable - S_S12

Explanatory variable			Coefficient	p-value
	Name	Lag/D1, LD		
ADJ	<i>S_S12</i>	L1	-1.652	0.000
LR	<i>IRspr</i>	x	-0.064	0.310
	<i>GD</i>	x	-0.008	0.228
	<i>Pcrd</i>	x	0.033	0.001
	<i>Fmac</i>	x	-0.051	0.176
	<i>REER</i>	x	-0.041	0.000
SR	<i>S_S12</i>	LD	0.798	0.000
	<i>IRspr</i>	D1	-0.691	0.005
	<i>GD</i>	D1	0.087	0.000
	<i>Pcrd</i>	D1	-0.029	0.078
		LD	-0.045	0.010
	<i>Fmac</i>	D1	0.011	0.849
		LD	0.053	0.101
	<i>REER</i>	D1	0.025	0.207
	<i>cons</i>	-	7.975	0.000
Sample: 1997 thru 2022			Number of obs = 26	
			R-squared = 0.962	
			Adj R-squared = 0.915	
Log likelihood = 19.476			Root MSE = 0.176	
Breusch–Godfrey LM test for autocorrelation			Prob > chi ² = 0.454	
Durbin–Watson d-statistic (15, 26) = 2.196				
Breusch–Pagan/Cook–Weisberg test for heteroskedasticity			Prob > chi ² = 0.232	
CUSUM	Test statistic		Critical value (5%)	
	0.461		0.948	
CUSUMSQ	Test statistic		Critical value (5%)	
	0.275		1.358	

**c) Gross saving of general government (S.13); Ex-
plained variable - S_S13**

Explanatory variable			Coefficient	p-value
	Name	Lag/D1, LD		
ADJ	<i>S_S13</i>	L1	-1.229	0.000
LR	<i>GAP</i>	x	0.680	0.000
	<i>GD</i>	x	0.080	0.073
	<i>unem</i>	x	-0.185	0.028
	<i>REER</i>	x	-0.123	0.000
SR	<i>S_S13</i>	LD	0.680	0.002
	<i>GAP</i>	D1	0.685	0.268
		LD	-0.191	0.088
	<i>GD</i>	D1	-0.101	0.010
	<i>unem</i>	D1	0.258	0.057
	<i>cons</i>	-	16.963	0.000
Sample: 1997 thru 2022			Number of obs = 26	
			R-squared = 0.925	
			Adj R-squared = 0.876	
Log likelihood = -12.820			Root MSE = 0.522	
Breusch–Godfrey LM test for autocorrelation			Prob > chi2 = 0.112	
Durbin–Watson d-statistic (15, 26) = 2.196				
Breusch–Pagan/Cook–Weisberg test for heteroskedasticity			Prob > chi2 = 0.163	
CUSUM	Test statistic	Critical value (5%)		
	0.804	0.948		
CUSUMSQ	Test statistic	Critical value (5%)		
	0.316	1.358		

**d) Gross saving of the household sector (S.14);
Explained variable - S_S14**

Explanatory variable			Coefficient	p-value
	Name	Lag/D1, LD		
ADJ	<i>S_S14</i>	L1	-1.998	0.000
LR	<i>GDP_ph</i>	x	-0.414	0.001
	<i>ch_wealth</i>	x	0.112	0.000
	<i>health_exp</i>	x	1.157	0.000
	<i>urb</i>	x	0.135	0.015
	<i>RIR</i>	x	0.062	0.018
SR	<i>S_S14</i>	LD	0.828	0.000
	<i>GDP_ph</i>	D1	-0.010	0.271
	<i>ch_wealth</i>	D1	-0.079	0.023
	<i>health_exp</i>	D1	-0.370	0.198
	<i>cons</i>	-	-28.253	0.016
Sample: 1997 thru 2022			Number of obs = 26	
			R-squared = 0.955	
			Adj R-squared = 0.925	
Log likelihood = 5.381			Root MSE = 0.259	
Breusch–Godfrey LM test for autocorrelation			Prob > chi2 = 0.589	
Durbin–Watson d-statistic (11, 26) = 2.171				
Breusch–Pagan/Cook–Weisberg test for heteroskedasticity			Prob > chi2 = 0.928	
CUSUM	Test statistic	Critical value (5%)		
	0.508	0.948		
CUSUMSQ	Test statistic	Critical value (5%)		
	0.372	1.358		

Source: own processing in STATA

Discussion of the results

Some interesting results from Table 2 are discussed below in the text.

(a) Gross saving of the non-financial corporations' sector (S.11)

The results of model a) show that growth in corporate productivity leads to growth in non-financial corporations' saving. However, in the long term, the relationship is inverse. This may be due to pressure to increase employee wages (i.e., corporate expenditures). If corporations did not increase wages in line with productivity growth, employees could

move to competitors who would reward their higher performance (see Bester, Milliou, and Petrakis, 2012). *Germany's GDP* explanatory variable is a variable specific to this market production sector in the Czech Republic. Germany is an important trading partner of the Czech Republic. It is obvious a strong economic dependence of the Czech Republic as a small open economy which is export dependent on the German economy (see, for example, Drahozalová, Galuščák, and Kábrt, 2023). In the short term, the relationship between the variables is positive. In the long term, however, the relationship is inverse. This may be due, for example, to German companies' efforts to achieve strategic saving (Klug, Mayer and Schuler, 2021), whereby these companies may seek cheaper import alternatives on the Czech market rather than purchasing orders on the domestic market. The interaction of saving of non-financial corporations and the *lending rate* over short and long term may cause corporations' borrowing costs to rise as the interest rate increases, which may reduce non-financial corporations' saving.

(b) Gross saving of the financial corporations' sector (S.12)²³

The results of EC model (b) Gross saving of the financial corporations' sector (S.12) show an inverse relationship between the *interest rate spread*²⁴ and saving in the short term. According to the CNB (2025), credit institutions hold long-term assets (i.e., primarily loans), some of which have fixed interest rates for as long as several years—particularly mortgages—and short-term liabilities (primarily various types of deposits) with “more flexible” rates. This mismatch in varying degrees of sensitivity to changes in market interest rates may be the cause of temporary rigidities. The impact of a change in the debt of the general

23 Before interpreting the results for the financial corporations sector (S.12), it should be borne in mind that this is the most heterogeneous sector in terms of the units it comprises in the entire national economy (it consists of nine subsectors, such as deposit-taking corporations except the central bank, the central bank, pension funds, etc.). This heterogeneity may then lead to differences in the response of the explained variable to changes in the explanatory variables within the time horizons considered, given the different functions and modes of operation of the units included in this sector.

Given the inappropriateness of a disproportionate approach when analyzing individual sectors (a different level of detail for the financial corporations sector than for other sectors) and also the acceptable scope of the analysis by subsectors of all selected sectors of the national economy, the author does not undertake this more detailed analysis. The author is aware that extending the analysis in texts focused on only one sector would require a more detailed breakdown by subsector or, above all, a separate analysis of the central bank.

24 The relationship between saving and the interest rate spread could have been disrupted by exchange rate commitments, low interest rates after the financial crisis of 2008, past crises, or even more intensive application of macroprudential policy.

government sector on the saving of financial corporations is positive. The financial corporations sector is the country's most crucial holder of general government bonds (CNB, 2024a). In the short run, with higher bond holdings, financial corporations can earn more interest, increasing disposable income. Different interaction of variables over time occurs for the variables *domestic credit to the private sector* and saving. These mixed results may be because credit gradually stimulates additional economic activity, leading to higher demand for the products of financial corporations with a possible positive impact on their saving generation (but initially there may be higher costs for this strategy).

(c) Gross saving of the general government sector (S.13)

EC model (c) Gross saving of the general government sector (S.13) results show that the relationship between *general government debt* and general government saving is positive in the long run, but also inverse in the short run in the EC model. Generally, rising general government debt may lead to deeper government deficits in the short run and lower saving generation. In the long run, however, debt growth may psychologically lead to greater fiscal responsibility in the future for reasons of compliance with fiscal rules (and the government's intertemporal budget constraint). The tendency towards greater fiscal responsibility in the long run is addressed, for example, by Krejdl (2006) and also by studies of the Czech Fiscal Council (CFC, 2024). In the case of the relationship between the *unemployment rate* and general government saving, the inverse relationship is statistically significant. This phenomenon may occur through higher expenditures on employment policy, which puts more pressure on the government budget. Lang and Mareš (2015) point to the dependence of unemployment benefit expenditures on the business cycle. The relationship between unemployment and government spending has been addressed, for example, by Albertini et al. (2021), who, among others, confirm the interaction between these variables. The *real effective exchange rate* and general government saving are inversely related. *Real exchange rate* appreciation acts to reduce general government saving. This phenomenon may be due to the reduced competitiveness of domestic exporters (this is important in a small open economy like the Czech Republic) and, hence, lower collection of CIT²⁵ and PIT²⁶. However, Grigoli, Herman, and Schmidt-Hebbel (2014) find the relationship between *real exchange rate* change and saving ambiguous.

25 Corporate income tax.

26 Personal income tax.

(d) Gross saving of the household sector (S.14)

The results of the EC model d) Household sector gross saving (S.14) show an inverse relationship between *GDP per capita* and household sector saving. Here, there may be a precautionary motive for household saving during an economic downturn or forced saving during the pandemic. Mastrogiacomo and Alessie (2014) also focus on the issue of precautionary saving. In the context of the Czech Republic, Michálek and Šarboch (2023) also see the precautionary motive to save as one of the possible determinants of household saving. In contrast, in the case of economic growth, households save less and “splurge” (consume) more. In the short term, *revaluation of household wealth* has an inverse effect on household saving. In the short term, the so-called wealth effect may occur. However, in the long term, the relationship is positive according to the results of the EC model, which makes it clear that the wealth effect has already subsided and that wealth growth leads to an increase in household saving rather than consumption (see Carroll, Slacalek, and Otsuka, 2010). The results obtained for the relationship between *urbanization* and household saving include a positive statistically significant coefficient. Grigoli, Herman, and Schmidt-Hebbel (2014) identify multiple transmission channels. An increase in urbanization may imply higher housing costs for households and overall higher consumption out of available disposable income than in smaller municipalities. On the other hand, an increase in urbanization may spur an increase in saving because of concerns about the higher costs of urban living. However, in the labour market in larger municipalities, these households may earn more income and thus increase their disposable income (CZSO, 2024c). It depends on which of these effects prevails.

Specific features of the Czech economy and their manifestations in the results

Overall, the Czech Republic has several specific features characteristic of the period under study, including a small open transitional converging economy and gradually liberalising financial market, etc. For example, it is evident from the results of the analytical section that for the non-financial corporations sector, a significant variable is the lending interest rate, and this link to the lending market may be related to the level of financial market development in a transitional small open economy such as the Czech Republic. Access to financial markets and the development of indicators on these markets can play a key role in shaping sector saving (see, for example, MoF CR, 2025). In the context of the Czech Republic, the credit market and especially the mortgage market and its development, including the macroprudential policy pursued by the Czech National Bank, are also important. This is particularly important for the household sector (excluding the self-em-

ployed), where home ownership is like a retirement provision for old age (Frait, 2025). The development of corporate profits and subsequently saving (for non-financial corporations sector) may also be influenced by the life cycle of foreign direct investment (see CNB, 2014), which is crucial in the context of a small open economy such as the Czech Republic. In addition, an important variable for a small open economy is the exchange rate (applies to the general government sector and the financial corporations sector). However, for the non-financial corporations sector, the exchange rate is not a major factor influencing gross saving in this sector. This may be due to the fact that non-financial corporations in the Czech Republic tend to close their open foreign exchange positions (whether by applying external or internal forms of hedging against the exchange rate) (CNB, 2024b). Furthermore, the application of an exchange rate commitment by the Czech National Bank between November 2013 and April 2017 may have contributed. Although this was a ‘unilateral’ exchange rate commitment (the impossibility of appreciating the exchange rate below CZK 27/EUR), market players apparently considered the CNB to be a credible institution and the development of the Czech economy did not signal pressures for a more significant depreciation of the CZK/EUR exchange rate. During the period under study, there were also economic downturns (e.g., the effects of the currency crises in 1997, the global financial crisis in 2009, and the COVID-19 pandemic in 2020), which also had an impact on saving formation in the sectors. However, this impact and the channels of action differ between sectors, which is to be expected given the different economic functions and content of the sectors defined at the beginning of this text.

5. Conclusion

The aim of the paper was to find the appropriate determinants of saving for each sector in the national economy and to find out whether the determinants of gross saving differ between sectors of the national economy in the Czech Republic, and confirm the need for a sectoral perspective for this small open economy. Research hypothesis 1 states that there are differences in the methodological approach to saving between individual sectors of the national economy in terms of national accounts. This hypothesis was confirmed based on the theoretical part of the text focused on national accounts methodology in the context of saving. Research hypothesis 2 says that the determinants of saving in individual sectors of the national economy are not the same for all sectors, or at least they affect the development of saving to varying degrees. This hypothesis was confirmed based on the results from the empirical part of the article. The goal of the article was achieved.

The article provides new insights into the key determinants of saving within the Czech economy, broken down by sector. Empirical verification of saving determinants by sectors of the national economy using EC models confirms the descriptive heterogeneity of these sectors. Understanding the determinants of sectoral saving is crucial for assessing the impact of negative economic shocks on these sectors, as this impact may not be symmetrical across sectors of the national economy, and understanding the determinants of key economic indicators for these sectors is absolutely essential for the implementation of appropriate economic policies in addressing potential shocks and resulting imbalances.

The results show that some variables explaining the development of saving, such as exchange rate, interest rate, and income, are relevant to sectors of the national economy, but in a different modification that better reflects the economic function of these sectors. Some variables are entirely specific to the selected sector. For example, socio-demographic variables such as urbanization are relevant for the household sector. Furthermore, the models also include variables that are specific to small open economies such as the Czech Republic. These include, for example, GDP in Germany (the main trading partner).

Given the use of a national sectoral accounts framework, it is relatively easy to replicate the insights gained in this paper to other countries, especially EU members, that publish their data in the context of ESA, 2010 rules. Thus, further research could focus on a panel analysis of EU countries to highlight (or refute) specificities in the production of sectoral saving for the countries analysed.

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