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STATE ECONOMIC POLICY

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MASTER'S THESIS

AUTOMATINIŲ STABILIZATORIŲ EFEKTYVUMAS EUROPOS SĄJUNGOJE	**THE EFFECTIVENESS OF AUTOMATIC STABILIZERS IN THE EUROPEAN UNION**

Supervisor _____

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INTRODUCTION

The relevance of the topic: 2007 marked the year for the most rapid economic decline since the 1930s, commonly referred to as the Great Recession. After the large economic shocks caused by this phenomenal downturn between 2007 and 2009, more and more attention has been paid to fiscal stabilization measures – automatic stabilizers (Andersen, 2016). Firstly, automatic stabilizers gained popularity due to their rule-based nature and resistance to any information or implementation lags, as well as their symmetry which means they are not affected by a pro-cyclical bias, or any other issues related with discretionary policies (Andersen, 2016). Secondly, these tools are embedded in the state's financial system and are triggered automatically in response to business cycle fluctuations, thus there is no need for additional government decisions, which take time to be implemented, or constant adjustments (Braun, 2018). Lastly, during economic downturns stabilization of disposable incomes lies primarily on tax-benefit systems where automatic stabilizers help maintain consumption and boost aggregate demand, reducing the negative effect on real GDP (Dolls, Fuest, Peichl and Wittneben, 2019).

Level of research on the topic: Even though not much research has been done in relation to this topic (Dolls, 2019), several authors should be distinguished due to their in-depth research. Their previous work on the topic covers cross-country comparative analysis in the EU area focusing on household disposable income (Paulus and Tasseva, 2020; Dolls, Fuest, Peichl, and Wittneben, 2019; Callan, Doorley and Savage, 2018) which gives a clearer picture on the effect of automatic stabilization mechanism. Mentioned authors focus their research on the Great Recession and its aftermath period between 2007 and 2014, examining how effective were the automatic stabilizers during and after the recession across the EU member states through the expression of household disposable income. Other authors (Fuss and Palacios, 2019; Braun, 2018) focus on changes in the size of automatic stabilizers, however performing only single-country analysis, expressing the changes in variables against the period in time.

Novelty of the master's thesis. Novelty of the thesis primary relies on the newest data available for EU member states and covers the period not covered in the previous research. In addition, this thesis combines several empirical methods which have not been combined in previous research. This contribution aims to bring broader perspective of how automatic stabilizers are performing in EU area and how effective their levels are in terms of fighting economic recessions, which is achieved by latest data available and newly combined methodology.

The statement of the problem. As the automatic stabilization tools are the first responders to the economic fluctuations, it is imperative to ensure they are working to the best effectiveness to ensure the damages from recession periods are reduced to minimum. The main problem raised in this thesis is *which automatic stabilizers have the highest effect in ensuring that economic shocks during recession are softened to the highest extent possible with minimal damages to the disposable income*.

The aim of the research. The research aims to evaluate the effectiveness of the automatic stabilizers in EU member states during and after the economic fluctuations caused by the Great Recession combining traditional methodology with supplemental additional variables.

Research objectives. *1 objective*: the analysis of the literature related to fiscal policy and automatic stabilization mechanisms to be performed. *2 objective*: empirical evaluation of what will be included in the research to be provided. *3 objective*: the research methodology on how the process will be carried out to be provided. *4 objective*: the research to evaluate the size of automatic stabilizers across EU countries in the period 2007-2020 giving the broader overall picture. *5 objective*: the analysis to compare the size of automatic stabilizers to average disposable household income in the EU member states, which will help evaluate the size and effectiveness of the measures on the disposable income. *6 objective*: real GDP changes across countries in the given period to be evaluated to assess the severity of the recession in the member states. Finally, what were the most effective automatic stabilizers, as well as provide recommendations for policymakers on the future fiscal policy decisions relating to automatic stabilizers.

Research methods. To examine the automatic stabilizers as such, theoretical framework analysis will cover the papers related to the topic and analyse firstly, the function of automatic stabilizers and their overall role in fiscal policy. Secondly, analysis will expand to overall role fiscal policy and importance of optimized automatic stabilization levels to understand how it cushions the effect of economic shocks. More detailed description of research methodology is provided in Section 2 of this paper.

Following the insights of previous authors' research, empirical calculations will be performed with the new model, which combines two most popular methods, and data from EU member states for the period of 2007-2020. Key variable for the research will be changes in disposable household income for each EU member state, reflecting the effectiveness of automatic stabilization measures, and taking into consideration automatic stabilizers such as social security contributions, tax contributions, unemployment insurance and government spending.

The structure of the thesis: In addition to current introductory section, the thesis proceeds with Section 1 which discusses the fiscal policy and automatic stabilization related literature. Section 2 describes the research methodology and strategy as well as arguments for selecting a particular research method. Empirical results are analysed and presented in Section 3 of the thesis, and Section 4 provides conclusions and recommendations for practical implications in EU regulatory institutions. Additional details on the data and research are provided in the appendix.

1. THE ANALYSIS OF SCIENTIFIC LITERATURE FOR FISCAL POLICY AND AUTOMATIC STABILIZATION

This section of the thesis covers three major parts: firstly, the general information about automatic stabilizers will be reviewed and systemized, covering most important concepts of this thesis – definition of terms for the variables and additional terminology. The overview will include types of automatic stabilisers, their role and functions. Secondly, overview of the fiscal policy will be presented covering the types, aims and characteristics of the latter. Additionally, analysis will cover the potential limitations and facilitations of the fiscal policy in terms of stabilizing economy. Lastly, an essential part of this thesis will deep dive into the effectiveness of automatic stabilization and will cover different approaches in measuring, assessing and evaluating what are the optimal levels of automatic stabilization which help ensure minimal fluctuations in different business cycles.

1.1. Overview of the fiscal policy

Just as automatic stabilisers, fiscal policy can be either procyclical or countercyclical and there are opinions about both. Early theories for the public finance emphasize the importance of fiscal policy as a tool for economic stabilization and argues that it should be countercyclical to be of the best effectiveness (Musgrave, 1959), that is to say, it should be contractionary in good times and expansionary in bad times to ease the business cycle fluctuations (Gootjes & de Haan, 2022). Latest empirical research provides support to the idea and shows that the highest level of effectiveness is also closely related to the effectiveness of monetary policy interest rate (Bonam, De Haan & Soederhuizen, 2022). However, with the creation of the European Economic and Monetary Union (EMU), member states abandoned domestic monetary and exchange rate policies to respond to country-specific shocks, so the fiscal policy is the only tool available for macroeconomic stabilization at the national level in these countries (Gootjes et al, 2022).

As shown by the latest studies (Bova, Medas, & Poghosyan, 2018, Eyraud, Gaspar & Poghosyan, 2017) fiscal policies in the EU are not really countercyclical. Even though there are arguments against the procyclicality, stating that it increases output volatility, negatively impacts the long-term economic growth and was considered to be mainly a problem in developing economies, fiscal policies in the EU countries are in fact procyclical (Gootjes et al, 2022). This fiscal procyclicality may be caused by intensified borrowing constraints in times of economic slump, forcing governments to introduce fiscal adjustments while they should have introduced

fiscal expansions, or another explanation is that during an economic boom it is hard to keep government spending under control due to political incentives (Gootjes et al, 2022).

Looking from another perspective, fiscal policy is generally made up of two parts: discretionary fiscal policy and non-discretionary fiscal policy, the latter being automatic stabilisers (Sen & Kaya, 2019). Automatic stabilizers have been regarded as more advantageous due to their ability to fulfil the three essential characteristics of an ideal fiscal policy: being timely, temporary and targeted, while discretionary policy was perceived as sluggish, leading to enduring modifications in expenditure and excessively reliant on the political objectives of the ruling party (Fatas, 2019).

Picture 1 below help visualise the fiscal policy framework, as described in this thesis.

Picture 1

Fiscal policy visualisation

Source: Created by the author.

Table 1 below illustrates the findings of the Fatas (2019) research on cyclicality of the fiscal policies and compares the euro area with OECD countries. The analysis splits the fiscal policy into discretionary and non-discretionary, i.e., automatic stabilisers, parts. Year 2008 was selected as benchmark for the financial crisis of 2007, in order to see if there were any changes in the aftermath of the recession. Positive coefficients indicate that the fiscal policies are countercyclical, i.e., public spending increases when GDP growth is higher and reduces in periods of economic slowdown. The overall budget balance changes within range of 0.1percentage point of GDP for a 1% change in real GDP (Fatas, 2019). As the research finds, all the countercyclicality is coming from automatic stabilisers. Discretionary fiscal policy is destabilizing, or cyclical, as the values have the negative sign (Fatas, 2019). This conclusion is in line with the previously mentioned findings by the Bova et al (2018) and Eyraud et al (2017). The results remain similar throughout the years, no dramatic changes are showing. Automatic stabilizers gained stronger role in fiscal policy in post-recession period, and the discretionary policy has become less procyclical, bringing the overall fiscal policy more towards countercyclicality and better stabilization. Looking at the results, there is no significant difference if comparing a typical OECD economy with the

Euro members. However, Euro area countries seem to display slightly more procyclicality than an average OECD country (Fatas, 2019).

Table 1

Cyclicality of the fiscal policies in euro area and OECD countries

Variable	OECD	Euro area
Overall	0.255	0.230
Discretionary	-0.152	-0.188
Automatic Stabilisers	0.383	0.363
Overall (post-2008)	0.361	0.334
Discretionary (post-2008)	-0.107	-0.103
Automatic Stabilisers (post-2008)	0.455	0.412

Source: Fatas, A., 2019. Calculations using OECD data.

Note: Numbers show variation of budget balances (in % of GDP) to a 1% change in real GDP growth (Fatas, 2019).

1.1.1. Discretionary fiscal policy

In literature, the customary approach to assessing discretionary fiscal policy involves quantifying alterations in the budget balance by excluding the influence of automatic stabilizers. This concept is commonly referred to as the cyclically adjusted balance (CAB), alternatively known as the structural balance. (Fatas, 2019). The measurement of the CAB typically relies on an indirect approach, using the output gap and is done separately for different budget components - once the CAB is calculated, then it is possible to find the part of automatic stabilisers as a residual, as it is not captured by the CAB calculations but still is the part of the overall budget balance (Fatas, 2019).

One of the tools for discretionary policy worth mentioning is fiscal stimulus. Most recent example of governments using this measure is related to the Covid-19 pandemic, where governments introduced financial aid packages for unemployment compensation. As a performed study finds, this kind of fiscal stimulus not only was successful, but it actually significantly boosted household spending, even in those periods where unemployment has risen greatly (Casado, Glennon, Lane, McQuown, Rich & Weinberg, 2020). Although it is not a very often used tool by the governments, nevertheless it can be quite effective in times of stronger economic shocks when it is imperative to boost spending.

1.1.2. Non-discretionary fiscal policy

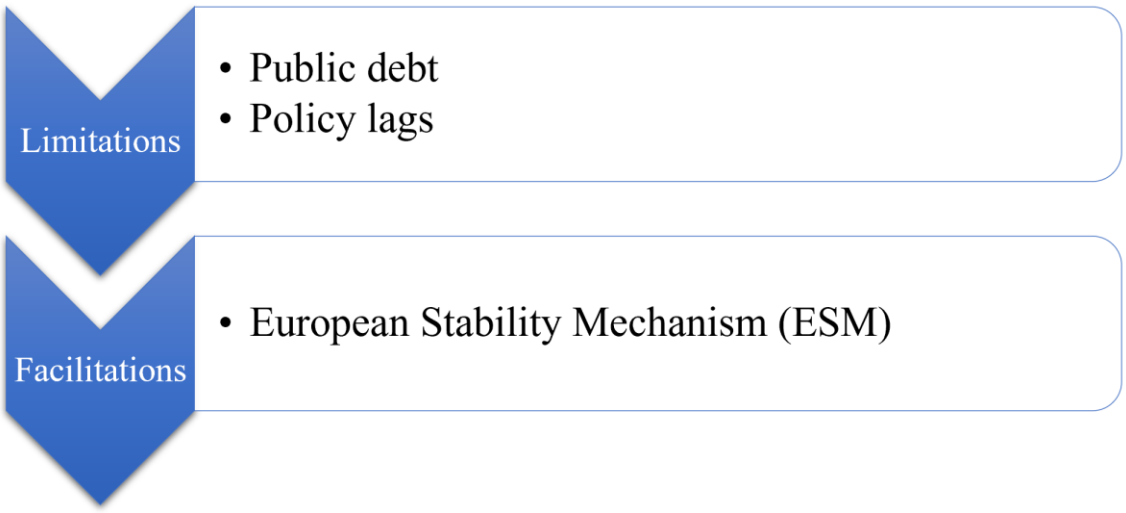
Non-discretionary, also called passive, fiscal policy is everything else that is not a discretionary fiscal policy – i.e., the automatic stabilizers. Role and types of these have already been review previously in section 1.1.

1.1.3. Fiscal policy limitations and facilitations

Despite the importance, fiscal policy has its own limitations and facilitations. On limitation side it is worth mentioning public debt and policy lags, while on facilitation side a great example is European Stability Mechanism (ESM). Picture 2 below helps visualise the content to be reviewed further.

Picture 2

Limitations and facilitations of the fiscal policy



Source: Created by the author.

On limitations side, from the public debt perspective, the fiscal response to the recent COVID-19 crisis has prevented larger declines for the employed, overall income and output, making way for a sustainable recovery. However, government debt in terms of GDP has reached the peak levels as had never been reached in the past several decades, further increasing the pre-crisis build-up in debt. From theoretical perspective, public finance sustainability is often defined in terms of ability to pay and refers to the coverage of governments' liabilities by current assets and future revenues. In other words, the present amount of public debt cannot exceed the future primary surplus discounted in present value terms. However, this approach is nearly impossible as it requires foreseeing significant future unknowns for long periods of time and the economy is likely to vary due to different circumstances which cannot be predicted precisely (Rawdanowicz, Turban, Haas, Crowe, & Millot, 2021). If current level of public debt will not be reduced before

the next economic recession hits, future economic shocks will result in ever-rising debt which consequently will limit the fiscal policy space and in turn, limit its abilities to mitigate the fluctuations (Rawdanowicz et al, 2021).

Covid-19 pandemic has also contributed significantly to public debt across the Euro area as not only the growth of GDP has declined but the whole economy has slowed down. Even though the level of public debt in euro area has been successfully decreasing since 2014, according to the information provided in the Annual Report 2020 of the European Stability Mechanism, the public debt share of GDP has skyrocketed since 2019, rising from 84% to around 98%. Just as the public debt has risen, real GDP growth across euro area plummeted as well, reaching around 7% drop on average across the euro area. These changes have made it even harder for the EU member states to implement successful fiscal policy and seek additional funding when needed (ESM, 2020). This in fact shows, how dynamic and ever-changing the economic situation is, given different scenarios.

Another fiscal policy limitation is lags. This does not apply to automatic stabilizers, as they react immediately when needed, but is entirely related to the discretionary fiscal policy. According to Loisel (2021) lags can either be internal – recognition, decision and implementation – or external – transmission lags. Recognition lag can be described as a time between the moment when a need for policy adjustments arise and the moment when government notices the need for action (Jovanovski & Muric, 2011). Decision lag refers to the time spend on deciding the right course of action (Jovanovski et al, 2011). Implementation lag is the period from the government's enactment of the policy change to the time of its enforcement (Morita, 2017). Transmission lag is the delay of the policy effects in the economy (Loisel, 2021).

As a facilitation example, it is worth to mention European Stability Mechanism (or ESM). Established in 2012 by the EU member states, the European Stability Mechanism is an intergovernmental organisation (ESM, 2022). The goal is to assist ESM Members in significant need of financing, and which have impaired access to capital markets, either because they cannot find lenders or because the financing costs are so high it would undermine the sustainability of public finances (ESM Annual Report, 2020). After the establishment, ESM replaced its temporary predecessor – European Financial Stability Facility (EFSF) created in 2010. In principle, ESM provides loans or other financial assistance to its members that are not able to refinance their public debt by other means and is usually referred to as a lender of last resort. As a recent support package, on 15 May 2020, ESM's Board of Governors agreed to make the Pandemic Crisis Support available to its member states (ESM, 2022). It is also important to note, that the funding of this organisation does not come from the taxpayers, but it raises funds for its financial assistance

through the sale of bonds and bills to investors (ESM, 2022). In terms of governance, ESM has 19 shareholders which contributed to the organisation's capital, where Germany and France together have contributed almost half of the amount (see Table 2).

Table 2

Contributions to ESM capital by country

	Contribution to ESM capital, %	Contribution to paid-in capital, EUR
Germany	26.8992	21 666 875 213
France	20.2003	16 271 018 445
Italy	17.7506	14 297 824 290
Spain	11.7953	9 500 925 425
Netherlands	5.665	4 563 066 860
Belgium	3.4454	2 775 214 574
Greece	2.791	2 248 105 844
Austria	2.7581	2 221 605 420
Portugal	2.4863	2 002 674 869
Finland	1.7811	1 434 647 552
Ireland	1.5777	1 270 812 107
Slovakia	0.9849	793 321 191.6
Slovenia	0.467	376 161 028
Lithuania	0.4063	327 268 149.2
Latvia	0.2746	221 185 906.4
Luxembourg	0.2482	199 921 128.8
Cyprus	0.1945	156 666 638
Estonia	0.1847	148 772 894.8
Malta	0.0898	72 332 463.2
Total	**100**	**80 548 400 000**

Source: Created by author, based on ESM Annual Report 2020.

In principle, fiscal policy has its limitations and it can sometimes be a reason for ineffective stabilization. However, in a severe economic slowdown, when the public debt is constraining the fiscal space and governments struggle, there is an option to overcome the limitation by additional funding which would help to stabilize the economy in a short term.

1.2. General overview of automatic stabilizers

To begin with, it is important to cover the main definitions of terms used in this thesis. First part of this section will cover what are the main descriptions of key terms used throughout

this paper and will describe dependent and independent variables which will be used in the research later. In addition, explanation of the overall role of automatic stabilizers in the fiscal policy will be reviewed, defining their main functions and reviewing what might be the optimal levels of automatic stabilisation in the economy. Finally, the types of automatic stabilisers will be briefly reviewed, focusing on their correlation with business cycles.

1.2.1. Definitions of the terms used in this thesis

As first recognized by Fisher (1933) and Keynes (1936), the standard view on the automatic stabilizers is based on the idea that a portion of tax revenue and government spending adjusts itself automatically to absorb output fluctuations without government discretionary decisions (Shi, 2018). Automatic stabilizers function as fiscal policy mechanisms that effectively counteract economic fluctuations without necessitating alterations to the policy itself or direct intervention by the government. (Fuss & Palacios, 2019). In principle, automatic stabilisers have the advantage of being timely, targeted and temporary in smoothing the economic cycle as well as they do not suffer some of the same drawbacks as discretionary fiscal measures, such as the need for measurement of the economic cycle or implementation lags (Bouabdallah, Checherita-Westphal, Freier, Nerlich and Sławińska, 2020). The mechanisms through which automatic stabilisers work are similar to those through which discretionary fiscal policy works, but there is one more reason why they were always seen as a more effective tool compared to the discretionary measures: various discussions on discretionary fiscal policy most often generate contradicting views and opinions, because they have a more political and ideological nature which results in strong debates (Fatas, 2019).

A little later after Fisher (1933) and Keynes (1936), more defined opinion was formed by Keiser (1956) who explicitly defined the criteria that automatic stabilizers must meet: a) they have to be permanently embedded into the policy; b) they have to be well-defined in their purpose and provisions; c) they have to be linked reliably with the cyclicality of the economy and start to operate countercyclically as soon as there is a need for action. In the provided examples of automatic stabilisers, the author lists the items that are usually defined as such: a) government spending; b) unemployment benefits and social security pay-outs; c) government farm price support programme; and d) taxation (personal and corporate). However, government spending is criticized by the same author as it does not meet the definition criteria for automatic stabilization. The different opinion is presented by another author who states that automatic stabilizers can be classified into two main types – cyclically-sensitive items and non-cyclical items (Bouabdallah et al, 2020). Based on the latter, cyclical items cover unemployment insurance benefits and drop in

tax and social security contributions, while non-cyclical focuses on government spending, which the previous scholar has criticized.

Next, follows the brief overview of the dependent and independent variables that will be used in the research, however detailed description is provided in research methodology part. Disposable household income is the dependent variable in the research performed further in this paper. It is closest to the concept of income as generally understood in economics and is defined as income available to households such as wages and salaries, income from self-employment and unincorporated enterprises, income from pensions and other social benefits, and income from financial investments (less any payments of tax, social insurance contributions and interest on financial liabilities) (OECD, 2022).

Independent variables include tax-benefit policies, i.e. monetary values of policy parameters in each EU member state, individual household characteristics and gross domestic product. By definition, tax-benefit policies cover the different tax rates, thresholds and other deductions related to income in each of the EU member state. Household characteristics help define statistical items, i.e. how many children family has, marital status of household members, age, gender, etc. Finally, GDP measures the monetary value of final goods and services produced in a country in a given period of time and is composed of goods and services produced for sale in the market as well as some nonmarket production, such as defence or education services provided by the government (IMF, 2020).

1.2.2. Function and optimal size of automatic stabilizers

Automatic stabilizers add up to the most important function of fiscal policy – stabilization (Braun, 2018). Level of stabilization required depends on the fluctuations in the economy, but the tools for mitigation remain the same – using revenues and expenditures of public finance to influence economic cycles and lessen the effects for household disposable income (Braun, 2018).

As the investigation on optimal size of automatic stabilizers revealed, there are no research papers that would cover EU member states. However, the one scientific paper found covers the US example and measures the optimal size of such stabilization measures. In the performed study, scholars found that the role of various social insurance programs affects the optimal design of automatic stabilizers and, in relation to unemployment insurance, it can lead to significant differences in defining how generous should those benefits be (McKay & Reis, 2021). Interestingly, this paper concluded that lowering income, sales and property taxes, as well as reducing the tax progressivity, does not significantly affect the business cycle volatility. In this US example, findings show that disposable income stabilization channel is somewhat weak, and

the leading role is put on savings and social security channel (McKay & Reis, 2021). Even though US economy is different from that of EU member states, nonetheless it would be very interesting to see the findings of the similar research performed in EU area.

1.2.3. Types of automatic stabilization tools

As mentioned above, the automatic stabilizers can either be cyclical or countercyclical. Cyclical items cover unemployment insurance benefits as well as tax and social security contributions, while countercyclical focus on government spending. Subsections below will cover each type in more detail.

1.2.3.1. Cyclical automatic stabilizers

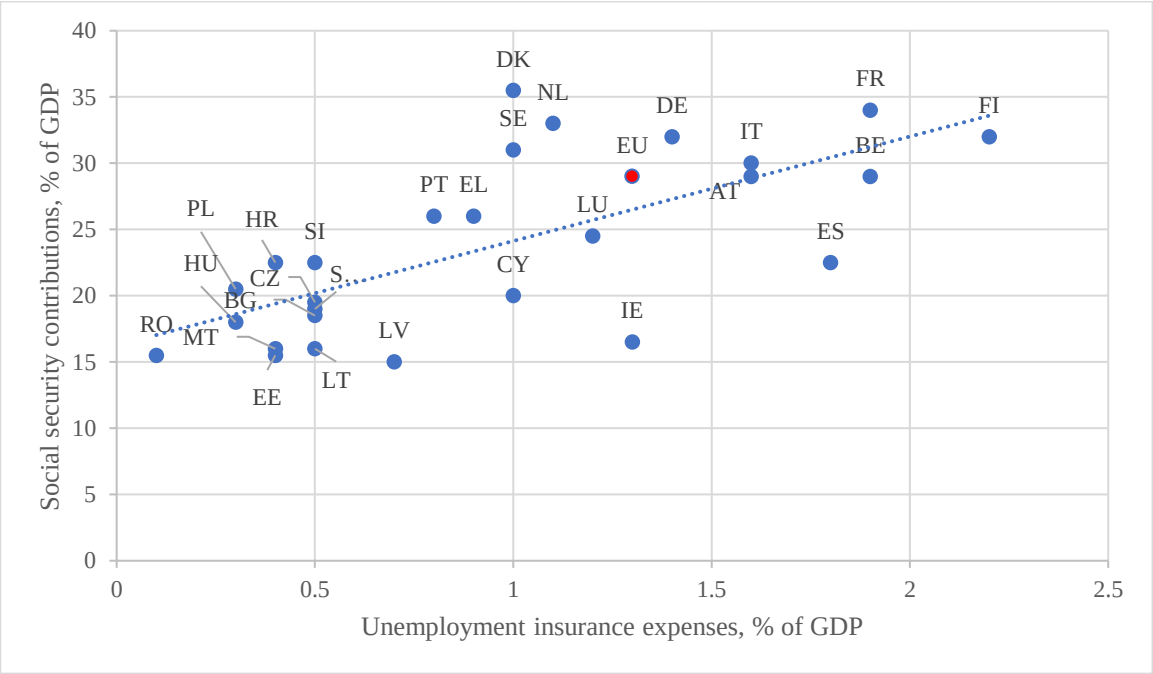
As one of the cyclical automatic stabilizers, unemployment insurance supports the income of those who have lost their jobs and are looking for another employment possibilities, thereby contributing to protecting individuals against poverty (European Commission, 2017a). Unemployment insurance benefits exist in all EU member states and are based on contributions, meaning that a person can only claim them after having had a certain minimum period of employment with paid contributions (also known as qualifying period) (European Commission, 2017a). However, the key question to be answered is how generous unemployment benefits should be? Too small benefits could not support households enough and might not contribute to avoiding poverty, on the other hand, too generous benefits could lead to less incentive to find a job and in turn generating negative fiscal externalities in the government budget (D'Ambrosio & Scrutinio, 2022). Given the EU perspective, average size of unemployment benefits in 2017 amounted to EUR 174 billion, which is around 1.3% of GDP (Eurostat, 2017).

Another cyclical automatic stabilizer type is tax and social security contributions (SSCs) that make up a significant part of taxation in EU countries. On average, social protection contributions in the EU area are around 29.2% of GDP (Eurostat, 2017a). To compare, in OECD countries on average, SSCs are around 26% of tax revenues (Bozio, Breda & Grenet, 2019).

Picture 3 below illustrates the correlation between both aforementioned variables – social security contributions and unemployment insurance expenses in the EU member states. The data shows clear trend where the countries that spend more on unemployment insurance benefits, and likewise, gather bigger share of social security contributions as part of the taxation.

Picture 3

Relation between social security contributions and unemployment insurance expenses in the EU



Source: Created by the author, based on Eurostat data (Eurostat, 2017a; Eurostat, 2017b).

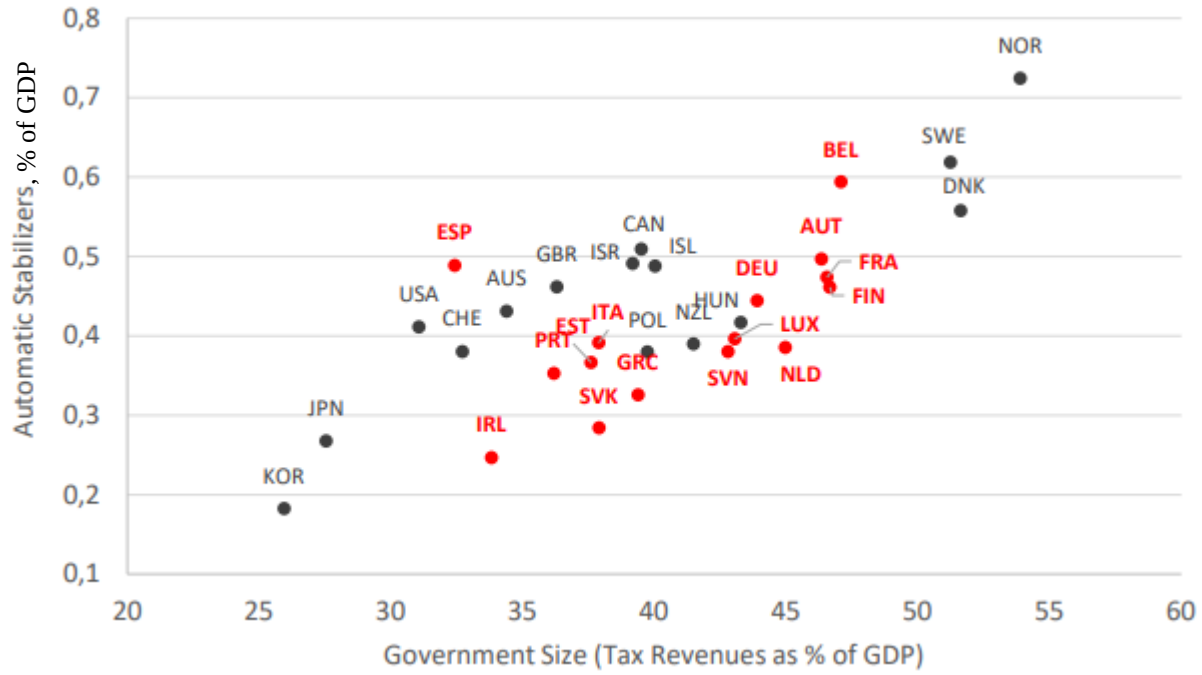
1.2.3.2. Non-cyclical automatic stabilizers

In the literature, there is well-established evidence that the effectiveness of the automatic stabilizers tends to co-move with the government size – namely, the bigger size of the government sector means the larger size of automatic stabilizers, however larger size of government may harm economic growth in the long run and thus create a conflict between output stability and economic efficiency (Sen & Kaya, 2019). There was an observation made that governments with a smaller size tend to allocate less funding, while larger governments tend to allocate more funding (Fournier & Johansson, 2016).

The effectiveness of automatic stabilizers primarily derives from the scale of government involvement, which is why the coefficients in Table 1 closely align with the average size of government in those countries (Fatas, 2019). The pattern is highly evident: there exists a robust correlation between the elasticity of automatic stabilizers and the size of government, with the two exhibiting a perfect alignment (see Picture 4). This is just another confirmation that countercyclical or less volatile government spending remains the main source of automatic stabilisers among euro area members (and OECD countries, in general) (Fatas, 2019).

Picture 4

Correlation between automatic stabilisers and government size



Source: Fatas, A. (2019), calculations using OECD data. Euro area members are marked in red.

Earlier evidence states that the fiscal stabilization greatly depends on the government size raised back in 2000 by Van den Noord who argued that the size of the government defines the cyclical sensitivity of the fiscal policy, which in turn affects the size of automatic stabilizers (Van den Noord, 2000).

1.3. Effectiveness of automatic stabilization

The degree of the effectiveness of automatic stabilizers depends on various factors which include, amongst others, the progressivity of the tax system and its progressiveness degree, the generosity of unemployment benefit systems and the sensitivity of unemployment to output volatility, the nature of the shocks the economy faced (Sen & Kaya, 2019). This section will cover the importance of having effective automatic stabilisers in place, their limitations, potential modernization and improvement options.

1.3.1. Importance of effective automatic stabilization

Fiscal policy plays a significant role in stabilizing the domestic economy, while monetary policy can only react to shocks that affect currency union as a whole (Mohl et al, 2019). Within a monetary union, such as the Euro area, fiscal policy stands as the sole economic policy instrument available at the national level to effectively stabilize fluctuations in economic activity (Fatas, 2019). Since the size of the shock from the recent economic and financial crisis was exceptionally

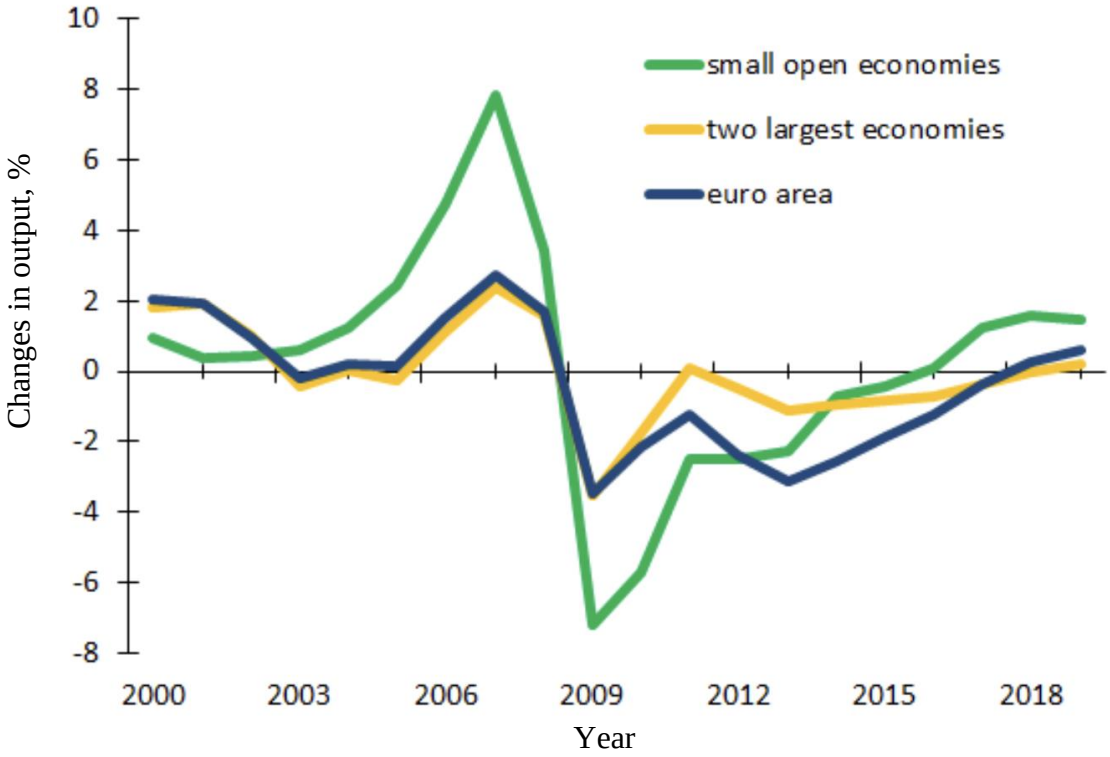
large, fiscal policy has gained even more importance and became a primary tool to smooth economic shocks at the national level (Mohl et al, 2019).

1.3.1.1. Limitations of automatic stabilisers

Despite their significant role in stabilizing the economy, automatic stabilisers require sufficient fiscal space to operate effectively but they might not be capable enough to smooth out shocks in the economy during severe recession periods. In such situations automatic stabilisers will be functioning effectively if overall fiscal policy is complementing the process with the discretionary measures. Additional policies might be required for a better result and that is especially important for the smaller economies with large cyclical swings (see Picture 5) (Mohl et al, 2019).

Picture 5

Cyclical variation across countries



Source: Mohl et al, 2019.

Note: Small economies are Estonia, Ireland, Lithuania, Luxembourg, Latvia, Slovenia and Finland. Largest economies are Germany and France.

In principle, automatic stabilisers alone can cope with cyclical fluctuations as long as those fluctuations are not significant, then the need for additional fiscal policy decisions are required.

1.3.1.3. Modernization and improvement of automatic stabilizers in fixing their flaws (on/off parameters)

According to Fatas (2019), current automatic stabilisers are mostly the result of policies that have nothing to do with stabilization, i.e., they are designed to deal with political and social demands, not stabilization. As a result from the latter, automatic stabilizers might be outdated in a sense, when they were introduced as a tool for political agenda, not targeted to be an effective stabilization tool, thus modernization and improvement of such items should be introduced. In order to improve the automatic stabilisers, it is crucial to introduce cyclical elements in the government budget which would be dynamic and become large enough in times of need. An obvious example could be having a list of investment projects waiting for the next recession, but logistically this would look more like discretionary policy, not to mention issues with timing (what is the readiness level of those projects?), with political influence (who decides which projects and why go first?) and the judgement (how severe is the actual recession?) (Fatas, 2019).

Another group of economists (Caldera, Maravalle, Rawdanowicz & Sanchez Chico, 2020) suggest two types of potential improvements to the current EU automatic stabilization set up – on the spending side, and on the tax side. On the spending side, automatic stabilisers can be improved by the following options:

- by *building automatic triggers into unemployment insurance schemes which are linked to the business cycle* (Caldera et al, 2020). In such way, the liberality of unemployment benefits would automatically depend on the length of an economic downturn period. As an example, in Canada eligibility terms are lightened and both, the duration and the degree of benefits increase automatically if the regional unemployment rate exceeds the fixed limit (OECD, 2011). Similar to Canada, US has a federal programme which empowers states to extend the duration of unemployment benefits automatically if their unemployment rate crosses a certain threshold (Chodorow-Reich & Coglianese, 2019). Unfortunately, the effectiveness of such improvement is hard to evaluate as only few states have participated in extending the duration of benefits during slowdowns.
- by *introducing automatic or semi-automatic rules which make spending on active labour market policies dependent on the economic cycle* (OECD 2019). Currently, Switzerland, Denmark and Australia have such rules in place. In practice, spending on active labour market policies reduces unemployment which in turn sustains individual's incomes while limiting unemployment spending (Caldera et al, 2020).

- by *introducing short-time working schemes* to strengthen automatic stabilisers. These allow employers to temporary shorten work hours because the loss of income is compensated to the workers and at the same time helps to retain the workplaces. During the Great Recession of 2008, several OECD countries (e.g. Belgium, Turkey, Italy, Germany, and Japan) successfully implemented such short-time working schemes and they are have proven to not only have reduced job losses but to have further provided income support for affected employees (Caldera et al, 2020).
- by *making transfers to local governmental bodies more dependent on the economic cycle*. This could prove useful, as usually local governments (i.e. municipalities, etc.) are limited by the balanced budget requirements which, in turn, encourages cyclicality due to the fact that local revenues and expenditures are bound together. Sweden is currently looking into implementing this option in order to mitigate the adverse impact of fiscal decentralisation on macroeconomic stabilisation (Caldera et al, 2020).

On the tax side, Caldera et al (2020) suggest the following actions to strengthen automatic stabilisation:

- Firstly, *to link tax collection more closely to the current economic cycle*. Governments could base their tax collections on estimations of current income in contrast to actual income from the previous year. Countries such as United States, United Kingdom and France have already incorporated such systems into their policies.
- Secondly, *to link the collection of real estate property taxes more closely to the real estate cycle to lower the tax burden in a recession*. However, this would require constant and independent evaluation of real estate property values, which ideally could and should be estimated by an independent body or a specialised governmental organisation on an annual basis to ensure transparency, as it is done in, for example, Iceland and the Netherlands (Caldera et al, 2020).
- Thirdly, *introduce automatic investment tax deductions*. Such additions will help reduce the cost of capital, ease credit constraints and stimulate investment during downturns (Caldera et al, 2020). Cyclical bonus depreciations enable companies to straightway deduct a significant percentage of the eligible assets acquisition price, instead of dividing this amount throughout the useful life of the asset. The United States example shows that such depreciation raised investments by approximately

17% during the years of 2008-2010 and the biggest effect was achieved among the small entities (Zwick & Mahon, 2017).

- Lastly, *to introduction of backwards cyclical loss-carry scheme*. This would help individuals and businesses to reduce current losses and receive a tax return on previously paid taxes. This scheme has been already introduced in some advanced economies such as Canada, France, Germany, the United Kingdom, and the United States where severely affected companies are eligible for immediate tax refunds during recessions (Caldera et al, 2020).

Overall, automatic stabilisers are functioning quite well, but as stated by the previous opinion of the authors there is still a lot of room for improvement and there are quite a few potential solutions. Aligning automatic stabilisers closely to the business cycle seems like a logical solution which would result in higher effectiveness rate, as well as introducing new measures, like the real estate or tax deduction schemes.

1.3.2. Measures of automatic stabilization

Based on available literature, there are two main ways to measure the effectiveness of automatic stabilizers. First option is to use cross-country comparative analysis focusing on household disposable income as was suggested by several authors (Paulus and Tasseva, 2020; Dolls et al, 2019; Callan et al, 2018). This research gives a clear view of the effect of automatic stabilization mechanism and focuses the research on the Great Recession period and its aftermath years, i.e., 2007-2014. This exact research method examines how effective were the automatic stabilizers during and after the recession across the EU member states through the expression of household disposable income. The latter way of measuring the extent of automatic stabilization is also used by the Organisation of Economic Co-operation and Development (OECD) which finds that automatic stabilizers are compensating on average 60% of the economic shock (Maravalle and Rawdanowicz, 2020). Similar study has been performed by the European Commission, where findings indicated that automatic stabilizers in European Union cushions around 35% of the households' loss of disposable income and around 70% of their consumption loss (Mohl, Mourre and Stovicek, 2019). This research model separates automatic stabilisers, discretionary policy changes and changes in market income and household characteristics and runs counterfactual simulations where only one variable is allowed to change while others remain fixed. The decomposition approached used in this method combines household microeconomic data with tax-benefit measures and allows to identify the effect of policy changes from other effects. In this model, ΔI is the changes in distribution of disposable household income and equals: a)

discretionary policy changes, nominal effect and other effect. Calculations are performed in EUROMOD tool, using EU-SILC data for the 2007 recession year and its aftermath period.

Second way of measuring effectiveness of automatic stabilizers is using changes in their size, performing single-country analysis and expressing the changes in variables against the period in time (Fuss and Palacios, 2019; Braun, 2018). This type of research shows the changes in variables in economic upturns and downturns and how fast the automatic stabilizers are reacting to the changes in the economy and thus proves their importance. Also, main finding in the latter research states that it is crucial that the federal government takes automatic stabilizers into account before deciding whether to use any discretionary tools to attempt to stimulate the economy (Fuss and Palacios, 2019).

Both aforementioned methodologies are different in terms of level and detail of analysis and even though the second method is simple and more suitable for systemizing the data, the first method provides more trustworthy and realistic calculations, takes into consideration key factors and therefore will be used in this thesis. Additionally, the first method is performing calculations in EUROMOD tool which provides full set of parameters for fiscal policy of each EU member state and enables user to provide even more accurate measurements. To contribute to the novelty of the thesis, additional variable will be included – changes in GDP, which will also benefit in showing how effective the automatic stabilisers are, i.e., if they are functioning effectively, during economic downturns the GDP will not decline or will decrease insignificantly and vice versa.

1.3.2.1. Disposable household income

As mentioned previously, in this paper household disposable income is understood as income available to households such as wages and salaries, income from self-employment and unincorporated enterprises, income from pensions and other social benefits, and income from investments (minus any payments of tax, social insurance contributions and interest on financial liabilities) (OECD, 2022). It reflects the purchasing power of households and their ability to invest in goods and services or save for the future (Eurostat, 2022a). For the purpose of the research performed in this paper, household disposable income is the dependent variable which is affected by the changes in three main independent variables – tax-benefit policies (monetary values of policy parameters), individual household characteristics and gross domestic product (GDP).

In defining dependencies of the disposable income, tax-benefit policies cover the different tax rates, thresholds and other deductions related to income in each of the EU member state. Household characteristics help define statistical items, i.e., how many children family has, marital status of household members, age, gender, etc. Finally, GDP measures the monetary value of final

goods and services produced in a country in a given period of time and is composed of goods and services produced in the market as well as some nonmarket production, such as defence or education services provided by the government (IMF, 2020).

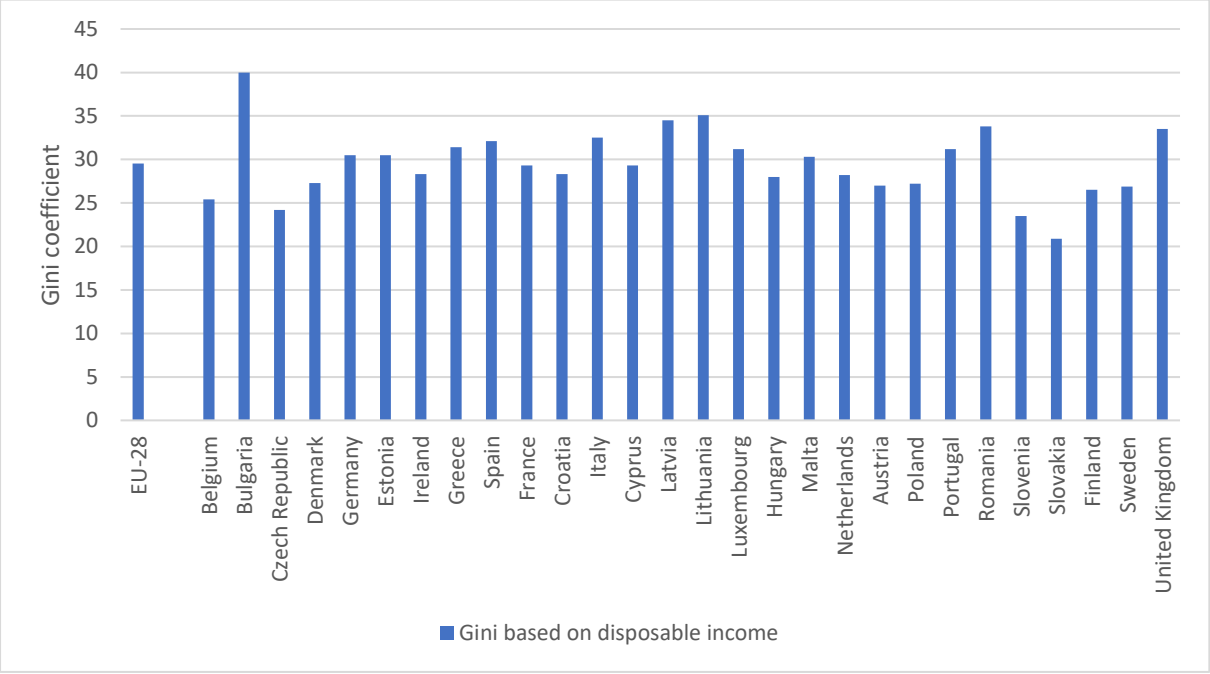
Disposable household income is the key factor in the research of this thesis and will be defined in detail in the research methodology part.

1.3.3. Automatic stabilization effect on inequality gap

Gini coefficient has been introduced in 1912 as a tool to measure inequality, in particular, to what extent does the income distribution in countries deviate from a perfectly equal distribution of income (Eurostat, 2022b). The coefficient is calculated within the scale from 0 to 100, zero being the perfect equality conditions and 100 being maximal inequality. Picture 6 below illustrates the Gini coefficient snapshot of European Union countries in 2020 where overall EU-28 average was around 29.5 points (30.6 in 2019), note that United Kingdom was included in calculations until 2020. Slovakia scored 20.9 points (22.8 in 2019) making it the country with highest income equality, while the biggest income inequality was observed in Bulgaria which scored 40 points (40.8 in 2019) (Eurostat, 2020).

Picture 6

Level of income inequality in the EU, 2020



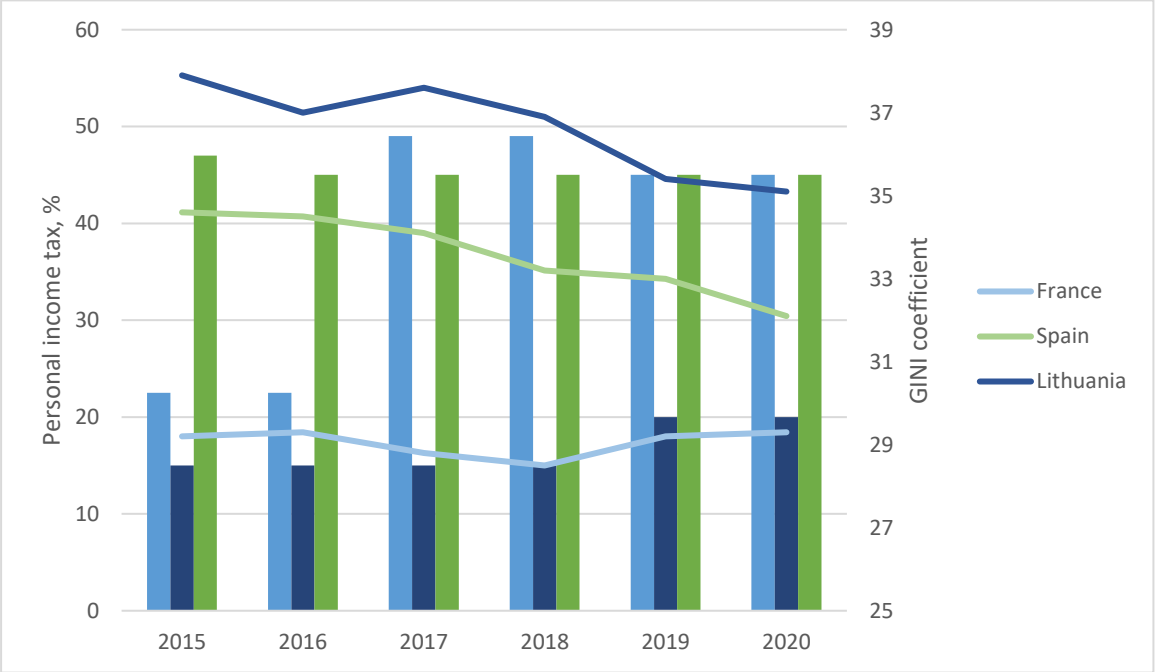
Source: Created by author. Eurostat, EU-SILC, ILC_DI12. Internet access: Eurostat.

According to the research done by European Commission (2017b), Gini coefficient was compared to the percentage of population that is at risk of poverty and results showed that Bulgaria, Estonia, Latvia, Lithuania and Romania exhibited the highest income inequality in the EU. (European Commission, 2017b).

Interesting comparison to see, is how changes in GINI coefficient were impacted by the changes in taxes. For example, let us take personal income tax in France, Spain and Lithuania.

Picture 7

Relationship between changes in personal income tax and GINI coefficient



Source: created by author. Eurostat, EU-SILC, ILC_DI12. Internet access: Eurostat.

In France personal income tax was raised in 2017, which resulted in reduced income inequality as the GINI coefficient decreased, and when the personal income tax has been reduced in 2019, it also had the same mirror effect as previously, increasing income inequality. In Spain, however, the situation is different – the reduction in personal income tax in 2016 had the opposite effect to the one in France – it actually reduced the income inequality and decreased GINI coefficient. Similarly to France, the same situation can be observed in Lithuania, where personal income tax has been increased in 2019 and was followed by the decrease in income inequality. In principle, the correlation between changes in personal income tax and GINI coefficient is rather vague, although in some instances it may have the relation. That would also depend on other rules of the fiscal policy and measures that define it.

1.4. Summary of the analysis of scientific literature

Automatic stabilizers are mechanisms that help stabilize the economy during periods of economic volatility. Examples of automatic stabilizers include unemployment benefits, progressive taxation, and social welfare programs. These programs help stabilize the economy by automatically increasing government spending during downturns and reducing it during economic upturns.

The analysed scientific literature states that there are various methods and options available to assess the effectiveness of automatic stabilizers in different countries. This statement indicates that there is no one-size-fits-all approach when it comes to evaluating the effectiveness of automatic stabilizers. Each country has its unique economic structure and political context, which makes it necessary to tailor the evaluation method accordingly. Some common evaluation methods used to assess the effectiveness of automatic stabilizers include statistical analysis, regression analysis, and simulation models.

Furthermore, the literature points out that research can have more value if additional comparisons are made. Some authors suggests that comparisons with GDP or GINI coefficients can be particularly useful in adding value to the research (Fatas, 2019, Callan, Doorley & Savage, 2018). GDP, or Gross Domestic Product, is a measure of the total economic output of a country, while the GINI coefficient is a measure of income inequality. By including these comparisons, researchers can gain a more comprehensive understanding of how automatic stabilizers affect the economy and the distribution of wealth.

To successfully achieve the aim of the research, two of the research methods analysed in literature part will be selected and combined. This approach will allow to provide a unique perspective on automatic stabilizers in the EU and contribute to the novelty of the research field. Combining different research methods can help researchers overcome the limitations of each method and provide a more comprehensive understanding of the research topic.

To achieve the aim of the research, the effect of each selected automatic stabilizer during the period of 2007-2020 will be investigated. This period includes the global financial crisis of 2008, which had a significant impact on the economy of the EU and other countries worldwide. The decision to focus on this period shows the interest in studying the impact of automatic stabilizers during times of economic crisis.

In conclusion, the reviewed scientific literature provides valuable insights into the theoretical part related to fiscal policy and automatic stabilizers. It highlights the importance of using different research methods to evaluate the effectiveness of automatic stabilizers in different

countries. It is suggested that including comparisons with GDP or GINI coefficients can add value to the research. Additionally, the author aims to select and combine two research methods to investigate the effect of each selected automatic stabilizer during the period of 2007-2020. The proposed research has significant implications for policymakers and economists, and it has the potential to contribute to the existing body of knowledge in the field of fiscal policy.

2. THE METHODOLOGY OF EMPIRICAL RESEARCH

The following section defines the logics behind the chosen research method as well as how the data was collected, which empirical method is used, what hypotheses are raised, how the calculations are performed and how the empirical research is conducted. The section is divided into two parts as follows: first, the aim, empirical model and hypotheses of the research are established and described. Second, the logical sequence of the research is presented and the variables are described in detail.

2.1. The aim, empirical model and hypotheses of the research

The aim of this empirical research is to evaluate the effectiveness of the automatic stabilizers in EU member states during and after the economic fluctuations caused by the Great Recession, using a blend of conventional methodology and supplementary variables. The further formulation of the empirical model is customized to fulfil the previously mentioned aim.

In the analysis of scientific literature part two main methods to calculate the effectiveness of automatic stabilizers were identified and described:

- Using EUROMOD: to use cross-country comparative analysis focusing on household disposable income as was suggested by several authors (Paulus and Tasseva, 2020; Dolls et al, 2019; Callan et al, 2018). Household disposable income is dependent variable (Y) while independent variables (X) are discretionary policy changes, nominal effect and other effect. The tool has fiscal parameters for each country already integrated thus making calculations more accurate. The main challenge using this tool is the data package which is not publicly available and could be shared by Eurostat upon written official request from PhD student or faculty employee.
- Using changes in automatic stabilizers size, performing single-country analysis and expressing the changes in variables against the period in time (Fuss and Palacios, 2019; Braun, 2018). In this method, authors' chosen variables are employment insurance benefits, payroll tax revenues and personal income tax revenues. This type of research shows the changes in variables in economic upturns and downturns and how fast the automatic stabilizers are reacting to the changes in the economy and thus proves their importance. However, there are several challenges with this method of research:

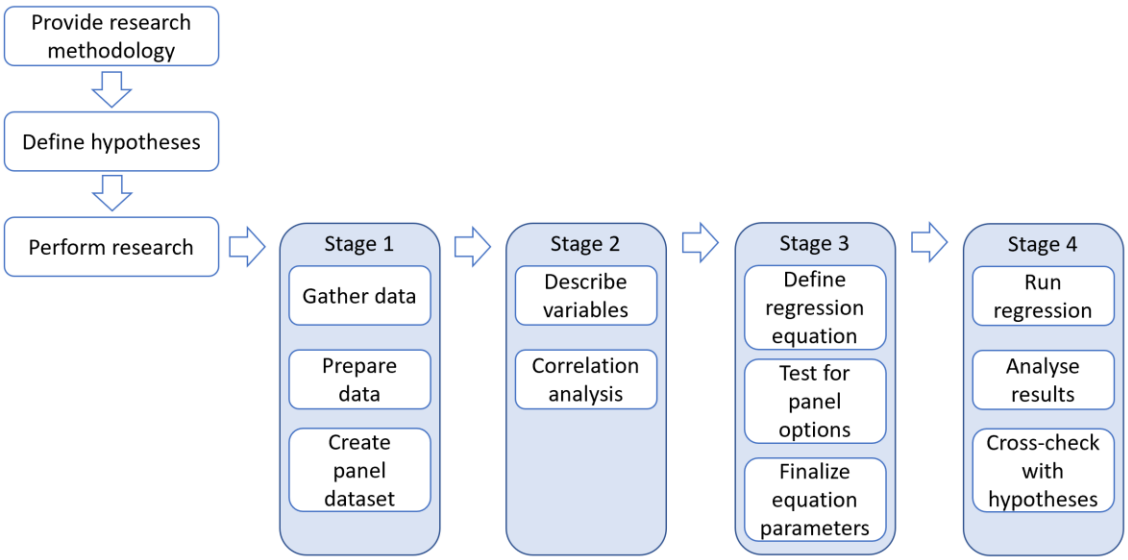
- Mentioned scientists are using single-country analysis and this thesis covers EU area thus, either panel data is needed or the single-country analysis should be performed on each EU member state.
- The calculations are less accurate since the fiscal parameters of each country are not taken into consideration. On the other hand, it could be argued that for the purpose of this thesis defined in introduction, these parameters do not play crucial role.
- This method shows changes in automatic stabilizers but does not show which ones are more effective than others.

Seeking to evaluate the effectiveness of the automatic stabilizers in EU member states during and after the economic fluctuations caused by the Great Recession, which is the aim of this research, both aforementioned methods are suitable for the task and combining them both would give a new perspective on the subject while at the same time allowing the author to exploit trusted and verified research methods used by the scientific community. Both methods are combined in creating a new regression-based model which would enable to see the effectiveness of each chosen automatic stabilizer in the EU.

To better visualize the flow of the research, it is presented in the following scheme which reflects the sequence of steps taken further.

Picture 8

Research scheme



Source: created by the author.

In order to fulfil the aim of the research and determine the effectiveness of automatic stabilizers, four hypotheses have been raised based on the scientific papers, articles and books of aforementioned authors. The following hypotheses will help determine which of the selected automatic stabilizers have direct impact on disposable household income:

H_1: Unemployment insurance impacts disposable household income.

H_2: Tax contributions impact disposable household income.

H_3: Social security contributions impact disposable household income.

H_4: Government spending impacts disposable household income.

The dependent variable is **disposable household income** which best reflects the changes in available income caused by the automatic stabilizers (Paulus & Tasseva, 2020; Mohl, Mourre & Stovicek, 2019). The independent variables are the chosen automatic stabilizers, as described in the theory overview section: **unemployment insurance, tax contributions, social security contributions and government spending**, as chosen by the mentioned authors. The latter variable is the only one non-cyclical.

The new model is based on a panel regression function which shows the relations between the dependent and independent variables and enables to identify which variable has the most significant effect on the disposable household income. Data for each variable is taken from Eurostat database, which ensures that data gathering methods are aligned and unified in each dataset. Units of measurement were available in euro per inhabitant for unemployment insurance and social security contributions, while tax contributions and government spending were provided in million euro and therefore had to be converted into euro per inhabitant. Statistics on number of inhabitants per country were obtained from Eurostat as well.

Following the scientific definition, the equation for the chosen model is as follows:

$$DHI = \beta_0 + \beta_1 UI + \beta_2 TC + \beta_3 SSC + \beta_4 GS + \varepsilon$$

In the model, β_0 is the constant, $\beta_{1,\dots,4}$ are the coefficients and ε is random error component. DHI is the abbreviated version of the disposable household income, while UI is unemployment insurance, TC is tax contributions, SSC is social security contributions and GS is government spending. Provided below is the summary table of variables.

Table 3

Summary of variables

	Dependent variable	**Independent variables**			
Name	Disposable household income	Unemployment insurance	Tax contributions	Social security contributions	Government spending
Abbreviation in model	DHI	UI	TC	SSC	GS
Unit of measure	Euro per household	Euro per inhabitant			
Data frequency	Annual				
Data period	2007-2020				

Source: created by author.

2.2. The logical sequence of the research and detailed variables' description

Empirical research has been performed in the following order. Stage 1 defined the preparation of data. In stage 2 the analysis of descriptive statistics and variables has been performed. Stage 3 defined the panel regression. Stage 4 initiated the empirical research and reviewed the results.

Stage 1. During the first stage the necessary data has been gathered, cross-checked to make sure the units of measurement and data frequency, euro per inhabitant and annual period respectively, are aligned across all variables and then combined into panel data spreadsheet. Initially, UI, TC and GS datasets were in million Euro while SSC and DHI were in Euro per inhabitant. In order to align the units of measurement additional dataset was obtained, total number of inhabitants per country, which allowed to convert variables into aligned unit of measurement – euro per inhabitant. All variables' datasets have annual data frequency.

In total, 25 EU member states were included into the dataset, excluding only Croatia and Luxembourg due to lack of data. Time period covers years from 2007 to 2020. 2021 were not included as the available data is very limited. Final dataset used for the research contains 350 rows. Appendix 1 contains the list of countries and references for the selected variables as well as supplemental dataset for demographic information.

Stage 2. For the second stage of the empirical research initial analysis of variables was performed. Descriptive statistics are provided in the Appendix 2.

DHI: Disposable household income (DHI) is a critical economic indicator that measures the amount of money available to households for spending and saving after taxes and other mandatory payments have been deducted from their gross income (OECD, 2022). The DHI provides insight into the financial capacity of households to engage in consumption, investment, and savings activities. It is also an essential measure of economic well-being as it reflects the ability of households to maintain their living standards and invest in their future. It also plays a significant role in shaping economic policies such as tax policies and social welfare programs. For instance, changes in tax rates, tax credits, or social welfare benefits can affect disposable income levels, which can, in turn, influence consumer spending, saving patterns, and overall economic growth (Eurostat, 2023a).

UI: Unemployment insurance is a social welfare program that provides financial assistance to eligible individuals who have lost their jobs involuntarily and are actively seeking employment. It is a form of temporary income support that aims to provide a safety net for workers who have been laid off or have lost their jobs due to economic reasons beyond their control. Unemployment insurance programs are typically funded through payroll taxes paid by employers or by a combination of employer and employee contributions. Some countries also provide additional funding from government general revenue (Esser, Ferrarini, Nelson, Palme, Sjöberg, 2013).

TC: Tax contributions refer to the amount of money paid by individuals, businesses, and other entities to the government in the form of taxes. Taxes are a primary source of government revenue and are used to fund various public goods and services such as education, healthcare, infrastructure, national defence, and social welfare programs. Tax contributions are a key measure of a government's fiscal health and are closely monitored by policymakers, economists, and the public. The distribution of tax burdens can also have important social and economic implications, as taxes can affect income inequality, economic growth, and the allocation of resources (Eurostat, 2023b).

SSC: Social security contributions serve as a primary source of funding for social security programs, which aim to provide financial assistance and support to individuals and families during times of need, such as retirement, disability, illness, or unemployment. These programs typically operate as public insurance systems, with contributions from current workers being used to fund benefits for current and future retirees, disabled individuals, and other eligible beneficiaries. The design and implementation of social security contributions vary widely across countries, reflecting

differences in social and economic conditions, political priorities, and cultural values. Some countries have highly developed and comprehensive social security systems, while others have more limited or fragmented systems (OECD, 2023).

GS: Government spending refers to the money that a government or its agencies allocate for public goods and services, such as education, healthcare, infrastructure, national defence, and social welfare programs. It is a critical tool for achieving policy objectives, such as promoting economic growth, reducing poverty and inequality, improving public health, and ensuring public safety. The level and composition of government spending vary across countries and are influenced by factors such as political priorities, economic conditions, and social and cultural values (OECD, 2021).

To make sure there is an actual relation between variables, correlation analysis has been performed and examined. To determine the appropriate correlation method, either the Pearson and Spearman correlation to be used, the descriptive statistics of the variables were investigated. The Jarque-Bera value was investigated for the variables and the results indicated that the probability value was less than 0.1, thus indicating that the Spearman correlation coefficient should be used for the analysis.

Correlation table has revealed strong connections among variables, although they all seem to be on a similar level. Based on the findings, disposable household income has the strongest relation with government spending (0.97) and social security contributions (0.96) while the less significant links in the selection are observed with tax contributions (0.91) unemployment insurance (0.89). Additionally, looking at the correlation coefficients between each of the dependent variables, there might be a suspicion of autocorrelation. Especially given the fact that panel data by nature tends to have autocorrelation, or serial correlation, issues (Van der Wijst, 1993). This is going to be checked at the later stage when the regression results will be viewed, by checking Durbin-Watson coefficient.

Stage 3. In this stage, regression equation and its parameters have been defined. The graphs and tests results are provided in Appendix 2.

Firstly, in equation specification field the independent variable was added, followed by its first row lagged version and all dependent variables. For this regression, traditional least squares (LS) method was applied. Since the variables have significantly positively skewed distribution, “dlogs” of variables were taken, as they help to “symmetrize” the residuals (Tukey, 1977). The equation was defined as follows:

dlog(dhi) c dlog(dhi(-1)) dlog(gs) dlog(ssc) dlog(tc) dlog(ui)

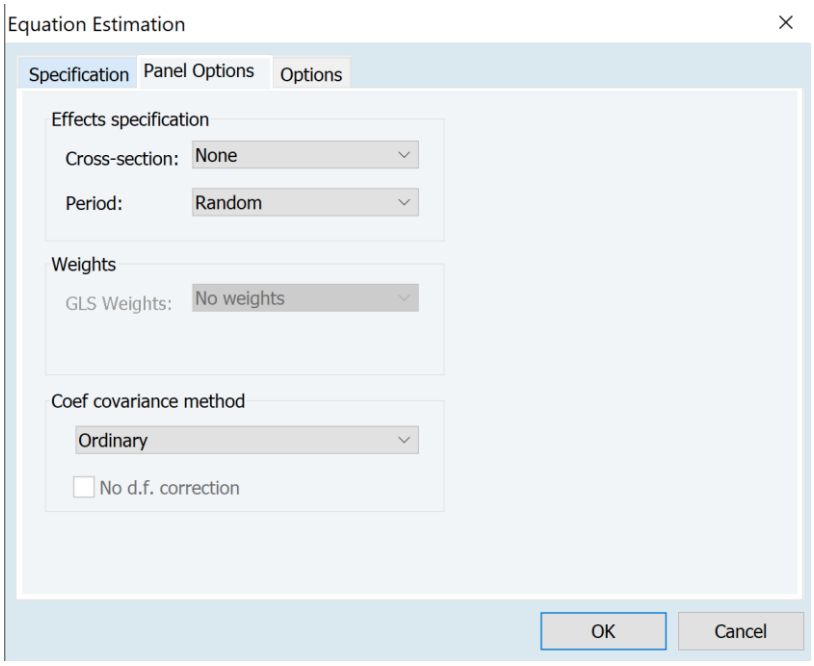
In terms of panel options, it was not yet clear at this stage which options should be chosen for effects specification. To determine the latter, the specific tests have been performed. Based on the literature, there are three tests for this purpose – Chow test, Hausman test and Lagrange Multiplier test (see Appendix 2). Performed Lagrange Multiplier test showed that Breusch-Pagan probability is less than 0.05 which suggests choosing random effect (RE) for the period option in panel regression settings.

After adjusting the settings to RE, additional Hausman test had to be performed to ensure that random effect is selected correctly and will not become fixed effect. Performed test showed that probability level is higher than 0.05 therefore the choice of RE is confirmed as correct one.

Lastly, Chow test can be performed to check whether the Common effect (CE) or the Fixed effect (FE) should be chosen under the Cross-section settings. Performed test showed the probability to be more than 0.05, indicating that FE cannot be chosen. In this case, CE is the correct option for the equation making the final parameter look as follows:

Picture 9

Panel regression equation options



Source: created by the author using eViews.

Stage 4. After setting the appropriate parameters and running the panel regression equation, the research analysis was conducted. The results obtained from the analysis were found

to be reliable, and there were no issues with autocorrelation, as indicated by the Durbin-Watson coefficient, which fell within the acceptable range of 1.6-2.4. The research findings are presented in the following section along with potential areas for further research and improvements.

3. THE ANALYSIS OF EMPIRICAL RESULTS

This section is divided into several parts which are organized as follows: First, the results of the empirical research are provided, including the variables that were found to be significant in testing the four hypotheses. Second, the research results are compared with households' income across the EU member states, helping evaluate the effectiveness of automatic stabilization measures on the disposable household income in the EU. Third, the different dynamics of disposable household income and automatic stabilizers across the EU member states are reviewed and analysed. Finally, changes in real GDP of EU member states are analysed to gain further insights into which countries were most affected by the Great Recession.

3.1. The statistical overview of variables

This section reviews each of the variables in terms of how the data is distributed and what are the differences from a statistical perspective.

DHI: Disposable household income variable, standard deviation indicates that data is widely spread out over the range of values which indicates that the DHI differs quite a lot across the EU countries. This is also visible in the histogram of the variable. There is a significant difference between minimum and maximum values, indicating that the statistically lowest DHI is 1 716 euro per household (Bulgaria, year 2007) while the highest is 34 346 euro per household (Denmark, year 2020). Skewness is close to zero, indicating the distribution is almost symmetrical. Kurtosis coefficient of 1.728 indicates leptokurtic kurtosis, meaning that data in the sides is distributed heavily.

UI: For unemployment insurance, similarly to previous variable, the difference between minimum and maximum values are high, indicating that unemployment insurance levels vary throughout the EU countries. Lowest value is 5.23 euro per inhabitant (Romania, year 2019) while highest UI is 1 584.03 euro per inhabitant (Austria, year 2020). Standard deviation shows that data is spread out as well, but not that wide as in previous variable. Skewness shows a positive skew, meaning the data values are concentrated towards the left side of the chart, and kurtosis shows heavy distribution of data towards the sides (especially the left side, based on the graph).

TC: Tax contributions variable's distribution of data values is nearly identical to the UI. Similarly, minimum and maximum values are different, showing the lowest values of 118.97 euro per inhabitant (Bulgaria, year 2007) and the highest of 14 621.13 euro per inhabitant (Denmark, year 2020). Standard deviation shows very widespread in the data range. Skewness shows no

symmetry in the distribution, data is skewed to the left side. Kurtosis indicates the data concentration towards the sides (especially the left side, based on the graph).

SSC: In social security contributions variable, standard deviation shows widely spread data. Minimum and maximum values have a significant gap, lowest value being 611.36 euro per inhabitant (Bulgaria, year 2007) and highest shows as 19 348.48 euro per inhabitant (Denmark, year 2020). Skewness is slightly asymmetrical, but positive therefore indicating that data is skewed to the left side of the chart, in this variable the data is clustered into two peaks. Kurtosis shows the data is heavier to the sides of the chart (especially the left side, based on the graph).

GS: Government spending variable has similar characteristics as the previous ones. Standard deviation is high, data is spread widely across. Minimum value is 1 621.86 (Bulgaria, year 2007) and maximum is 28 621.58 (Denmark, year 2020). Skewness is bent towards the left side, making the distribution slightly asymmetrical and just as in previous variable, concentrated into two peaks. Kurtosis coefficient shows heavy data clusters on the sides of the graph (especially the left side, based on the graph).

3.2. The results of the empirical research

Once the regression equation has been finalized and the correct parameters have been chosen, the empirical research has been successfully performed. Final results are obtained and provided in Appendix 2. The results of the regression analysis provide interesting insights into the relationship between disposable household income and various variables.

Interestingly, unemployment insurance and government spending show no significance whatsoever. This suggests that the regression did not identify any direct effect of these variables on the independent variable i.e., disposable household income. However, it is important to note that this does not necessarily mean that these variables have no indirect effect on disposable household income. It is possible that these variables may affect other variables in the model, which in turn affect disposable household income. Especially the government spending variable, as based on the analysed literature it commonly defines the size of the government, and effect of government size has already been proven to have a sizable effect on economic stabilization (Fatas, 2019, Sen & Kaya, 2019, Fournier & Johansson, 2016).

On the other hand, social security contributions and tax contributions are the variables that have a significant effect on disposable household income in this equation, based on their probability values. Social security contributions have a positive effect on disposable household income, indicating that an increase in social security contributions by one percent increases disposable household income by 0.3 percentage points. This suggests that social security

contributions can have a significant impact on the disposable income of households and corresponds to the findings of other authors (McKay & Reis, 2021, Sen & Kaya, 2019, Callan at al, 2018). However, to gain a comprehensive understanding of the relationship between social security contributions, tax contributions, and disposable household income, it is essential to consider additional factors that might interact with these variables. For instance, the level of employment and income distribution within a society can significantly shape the impact of social security and tax contributions on disposable income. Moreover, exploring how demographic factors, such as age, marital status, or number of dependents, interact with social security and tax policies can provide further insights into the complex dynamics at play.

In contrast, tax contributions have a negative effect on disposable household income. This means that an increase in tax contributions by one percent decreases disposable household income by 0.1 percentage points. This highlights the importance of tax policy in shaping the disposable income of households.

Having raised four hypotheses, the performed empirical research has confirmed two of them. Hypotheses 1 and 4 have been denied, as the results did not identify any significant effect between unemployment insurance and disposable household income or government spending and disposable household income. This suggests that these variables may not have a direct effect on disposable household income.

On the other hand, hypotheses 2 and 3 have been proven correct, as the results identified a significant effect between tax contributions and disposable household income and social security contributions and disposable household income. This provides valuable insights into the factors that influence disposable household income.

Overall, the results of the regression analysis provide important information for policymakers and economists. They suggest that social security contributions and tax policy can have a significant impact on the disposable income of households. However, further research is needed to explore the indirect effects of other variables on disposable household income. This will help policymakers to design more effective policies that can promote economic growth and improve the living standards of households.

3.3. The effectiveness of automatic stabilization measures in the EU

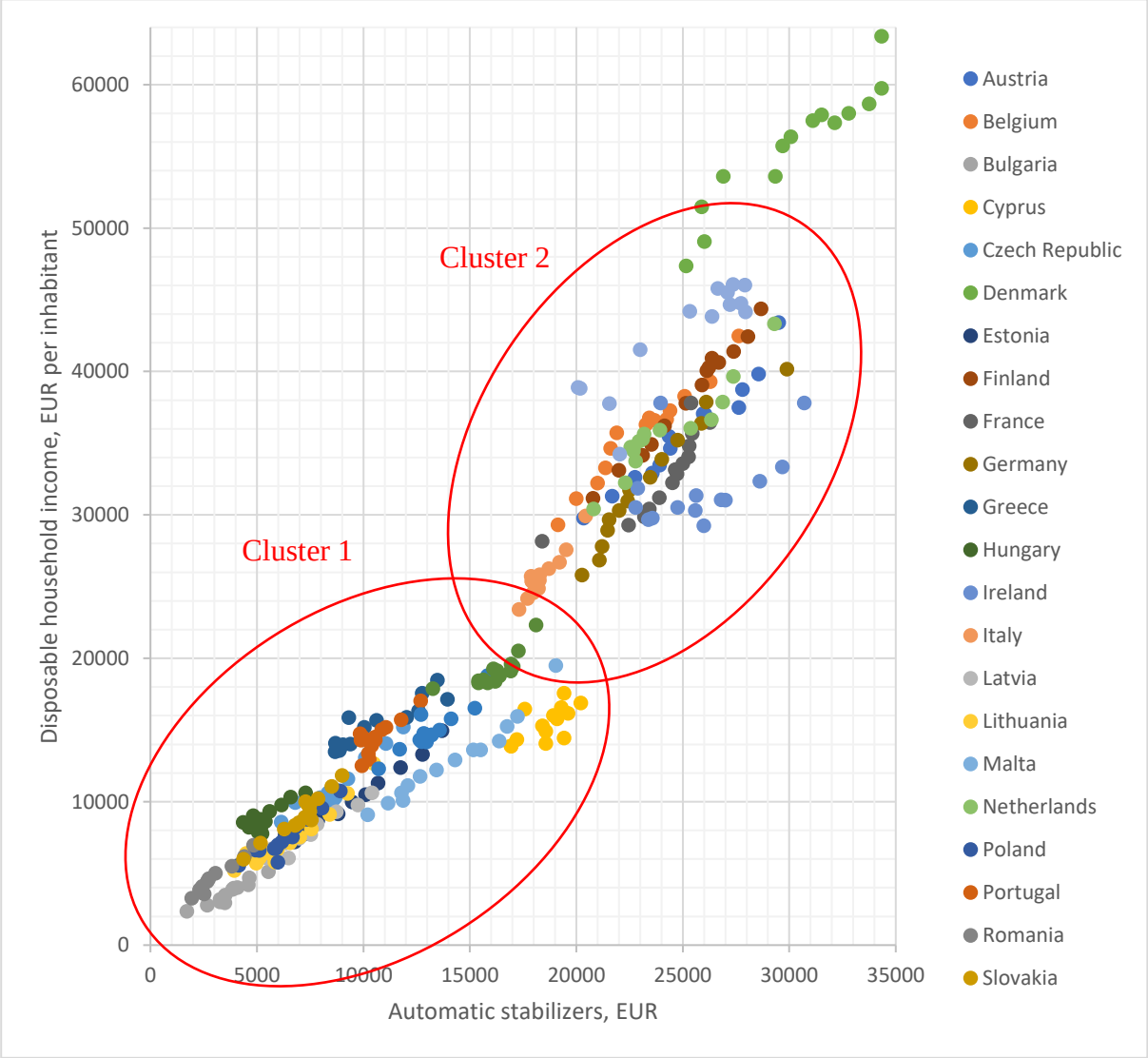
The visual representation provided in Picture 10 below provides valuable insight into the relationship between automatic stabilizers and disposable household income in the EU. The two clusters identified in the data distribution indicate that there are significant differences in the use and effectiveness of automatic stabilizers across the EU member states. The group of countries in

Cluster 1 with low disposable household income and low levels of automatic stabilizers are likely to experience greater economic volatility, as they have limited resources to mitigate the impact of economic shocks. In contrast, the group with higher disposable household income and higher levels of automatic stabilizers are more resilient to economic downturns, as they have greater access to government support.

Denmark's unique position as an outlier in this situation highlights the importance of effective macroeconomic policy. With the highest non-discretionary fiscal measures and disposable household income in the EU, Denmark has successfully implemented measures that support households during economic crises. This success can serve as a model for other EU countries to follow, as they seek to improve the effectiveness of their own automatic stabilizers. The graph demonstrates the importance of automatic stabilizers in supporting disposable household income and highlights the need for effective macroeconomic policies to mitigate the impact of economic shocks on households in the EU.

Picture 10

Comparison of selected automatic stabilizers to the disposable household income



Source: created by the author using data package for the research. Automatic stabilizers comprise of the research variables unemployment insurance (UI), tax contributions (TC), social security contributions (SSC) and government spending (GS).

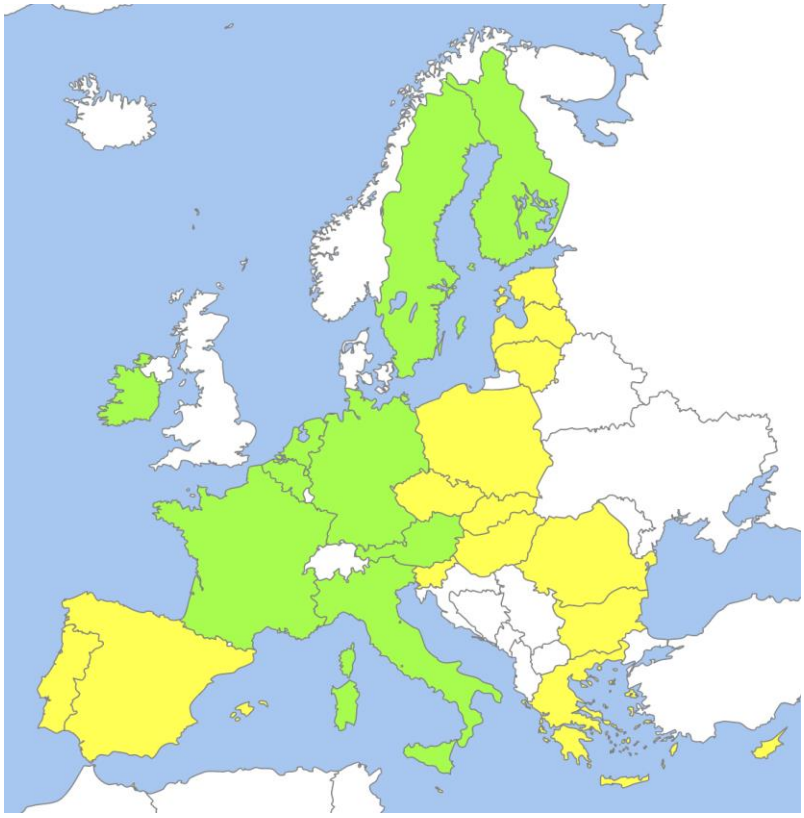
A more detailed examination of the two clusters of EU member states identified in Picture 10 reveals a clear pattern that highlights the economic disparities between different regions in the European Union (Picture 11). Cluster 1 is primarily made up of Eastern European countries, as well as several southern EU countries – Bulgaria, Cyprus, Czech Republic, Estonia, Greece, Hungary, Latvia, Lithuania, Malta, Poland, Portugal, Romania, Slovakia, Slovenia and Spain. These countries tend to have lower GDP per inhabitant and research and development (R&D) intensity compared to the rest of Europe (Eurostat, 2022c). This suggests that they may be facing structural challenges that make it more difficult for them to achieve sustained economic growth

and development. Moreover, the relatively weaker R&D intensity of these countries may limit their ability to innovate and compete in the global market.

In contrast, Cluster 2 is distributed around Central European countries and Scandinavia, containing Austria, Belgium, Finland, France, Germany, Ireland, Italy Netherlands and Sweden. These countries tend to have stronger and more dynamic economies, with higher levels of R&D intensity that attract more investments. This not only supports economic growth but also contributes to the creation of high-skilled jobs and increased competitiveness in the global market. The observed pattern emphasizes the need for targeted interventions and policies to support economic development and improve living standards in the EU. This could include measures to promote investment in R&D, enhance the efficiency of public spending, and support the development of human capital. Addressing these structural challenges can help improve the economic prospects and living standards of citizens in these countries, as well as contribute to more balanced and sustainable economic growth across the EU as a whole.

Picture 11

Distribution of country clusters in the EU



Source: created by the author. Visualisation of the aforementioned Cluster 1 (yellow) and Cluster 2 (green), in terms of relationship between the disposable household income and automatic stabilizers.

The graphs provided in Picture 12 below illustrate the distribution of automatic stabilizers by Cluster 1 and Cluster 2 countries before and after the economic recession. Denmark has been merged to Cluster 2 based on similarity of the results. The first column of data in the graphs represents the year 2007, which was before the beginning of the Great Recession. The second column shows the year 2018, which was a decade after the economic downturn, but prior to the Covid-19 pandemic's impact on the economy.

Picture 12

Changes in size and composition of automatic stabilizers in the EU, 2007 and 2018

Source: created by the author using data package for the research. Top graph shows Cluster 1 countries, lower graph shows Cluster 2 countries, including Denmark.

Upon comparing both clusters, it can be observed that the distribution of automatic stabilizers is fairly consistent across all member states. A significant proportion comprises of government spending, followed by social security and tax contributions. A relatively minor portion is allocated to unemployment insurance. One observed difference relates to tax contributions, where central European and Scandinavian countries tend to allocate a little more, compared to remaining countries of the EU. The consistency in the distribution of automatic stabilizers across both clusters suggests that member states may have similar economic goals and priorities. However, the relatively small proportion of funds allocated to unemployment insurance may indicate an area for improvement, as it plays a crucial role in supporting individuals who may be affected by economic downturns.

Cluster 1 countries, mainly located in eastern and southern Europe, have experienced an overall growth in the size of their automatic stabilizers. However, there were some contradictory changes within this group of countries. Six countries, namely Bulgaria, Cyprus, Estonia, Latvia, Lithuania, and Slovenia, significantly increased their unemployment insurance benefits since 2007, some even two or three times the size it was before the Great Recession. Estonia showed the most significant increase, rising from 16.5 euro per inhabitant in 2007 to 90.2 euro per inhabitant in 2018, which is more than five times.

On the other hand, Greece, Hungary, Malta, Poland, Portugal, Romania, and Spain decreased such benefits. Romania showed the most significant decline in unemployment insurance benefits, falling from 16 euro per inhabitant in 2007 to 5.6 euro per inhabitant in 2018. In contrast, the remaining automatic stabilizers increased similarly across all countries, with no contradictions identified.

Cluster 2 countries have shown more variation in their characteristics, despite experiencing successful overall growth in their automatic stabilizers during the years. In contrast to Cluster 1 countries, there is no clear trend in the changes made to unemployment insurance within this group. Some countries, such as Austria and Italy, have experienced significant growth in unemployment insurance, while others, like France, Germany, Ireland, and the Netherlands, have focused on increasing social security contributions. Belgium, Finland, Sweden and Denmark have prioritized increasing government spending. These differences in the distribution of automatic stabilizers among the Cluster 2 countries suggest that member states may have unique economic goals and priorities. By tailoring economic policies to meet the specific needs of their citizens, policymakers can promote growth and stability in their respective economies.

Overall, understanding the variations in the distribution of automatic stabilizers among different countries can provide insights into the effectiveness of economic policies and programs in mitigating the impact of economic downturns. The changes within EU countries may reflect the unique economic and political priorities of each member state. The increase in unemployment insurance benefits in some countries suggests a focus on providing support to individuals who may be impacted by economic downturns, while the decrease in benefits in other countries may indicate a shift towards other forms of automatic stabilizers and such changes in distribution could have potential implications for country's economy and welfare of its citizens.

3.4. Dynamics of disposable household income and automatic stabilizers across EU member states

Investigating and analysing the difference in automatic stabilizers across the different EU member states can give even more insights into their fiscal policy and its ability to reduce economic recession. The data presented in Picture 22 of Appendix 2 highlights interesting patterns in the dynamics of research variables across countries in the European Union during the period of 2007-2020. The variations observed across countries offer insights into the diverse fiscal policies adopted by different EU member states.

Cluster 2 countries, comprising central Europe and Scandinavia, exhibit a lower degree of variation in their disposable household income and automatic stabilizers during the years. In contrast, countries in eastern and southern Europe display wider distribution of the same variables, particularly in government spending. The highest change in disposable household income was observed in Bulgaria, Romania, and the Czech Republic, whereas Cluster 2 countries showed less variation in this variable.

Furthermore, there are noticeable differences in government spending and social security contributions between the two groups of countries. Bulgaria, Greece, Cyprus, and the Czech Republic have experienced significant fluctuations in these variables, whereas Cluster 2 countries have exhibited more stable trends. Tax contributions and unemployment insurance show similarities across the entire European Union, with no significant changes observed.

The findings suggest that EU member states have different priorities when it comes to their fiscal policies. Cluster 2 countries, which have more stable trends in their disposable household income and automatic stabilizers, may have more sophisticated fiscal measures in place. On the other hand, the remaining member states appear to be experimenting to find the suitable fiscal rules to achieve higher welfare for their citizens. Overall, the data presented in Picture 22 of Appendix 2 highlights the need for further research into the diverse fiscal policies of EU member

states. Understanding these policies and their impact on the welfare of citizens is crucial for policymakers to make informed decisions and foster economic growth and stability.

3.5. Changes in real GDP and the severity of the recession in the EU

To better understand the severity of the Great Recession across the European Union, it is important to evaluate various economic indicators, including the real (inflation-adjusted) GDP changes. It is worth noting that other indicators, such as unemployment rates, inflation, and consumer confidence, can also provide valuable insights into the economic conditions in a given country or region. While real GDP provides an important measure of economic activity, it is not sufficient on its own to fully capture the complexity of economic conditions but serves as one of the main indicators to raise concerns.

Moreover, it is important to consider the context of the recession, including the underlying causes and factors that contributed to the downturn. For example, the Great Recession was triggered by the collapse of the housing market and financial sector in the United States, which had global implications. Therefore, analysing the impact of the Great Recession in Europe also requires an understanding of how these external factors affected the region. However, this does not fall under the scope of this thesis and potentially could be analysed in other researches.

The International Monetary Fund (IMF) has defined economic recession as a situation where a country experiences two consecutive periods of declining real GDP (IMF, 2023). However, the magnitude of the decline is also important in determining the severity of the recession. For example, the IMF considers a 2% drop in GDP to be indicative of an economic recession, while a 5% drop is classified as a severe recession (IMF, 2023).

When considering the impact of the Great Recession on the European Union, it is useful to examine the dynamics of real GDP across different country groups. The data provided in Picture 13 below shows the dynamics of real GDP across the EU member states in period from 2007 to 2020. Countries are group in the same manner as previously, to Cluster 1 and Cluster 2 groups, based on their disposable household income and size of automatic stabilizers.

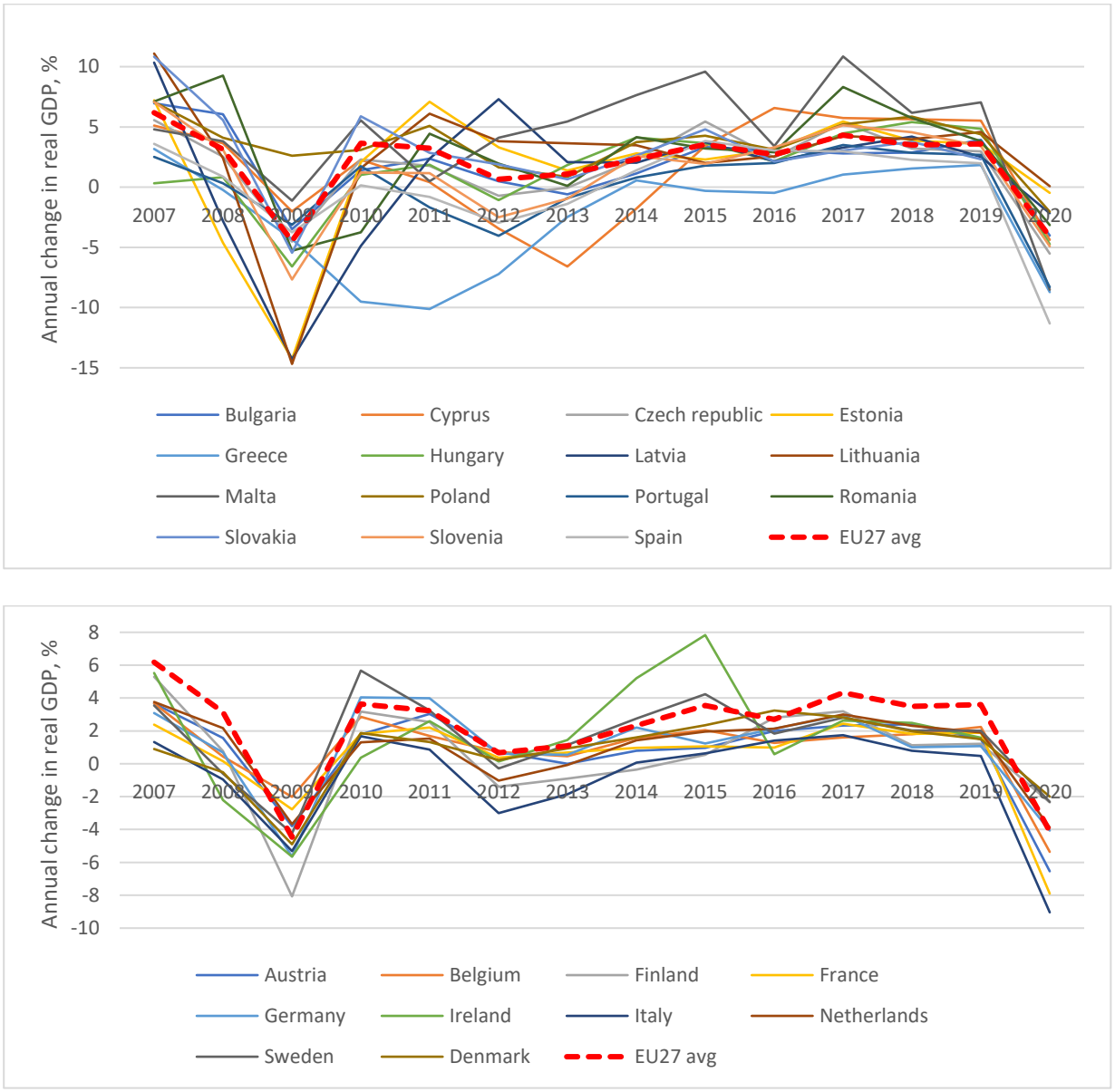
The data shows that the Great Recession was more severe in Cluster 1 countries, as indicated by the steeper decline in their real GDP. While both country groups experienced the sharpest decline in 2009, Cluster 2 countries did not suffer such a rapid drop in real GDP, with most facing a 4-5% decline, with Finland being an exception with an 8% GDP drop. In contrast, Cluster 1 countries experienced a stronger decline, especially in the Baltic countries where real GDP dropped by nearly 15%.

However, recovery patterns varied widely across the EU member states. While some countries, including Cluster 2 countries, were able to recover relatively quickly, others faced continued decline in real GDP for several years after the initial recession. For instance, Romania and Latvia continued to experience declining real GDP, although at a slower rate, and Greece sank even deeper into recession.

Additionally, there is a significant variance in the real GDP growth patterns among Cluster 1 countries, which are more disbalanced compared to Cluster 2 countries. This can be attributed to differences in economic structures, levels of integration with global markets, and the effectiveness of policy responses to the crisis. For instance, some Cluster 1 countries were heavily reliant on export-oriented industries that were hit hard by the global economic downturn, while others had weaker fiscal positions and were less able to implement effective policy responses.

Picture 13

Annual changes in real GDP, 2007-2020



Source: created by the author using Eurostat data (Eurostat, 2023c). Internet access: Eurostat. Top graph shows Cluster 1 countries, lower graph shows Cluster 2 countries, including Denmark.

In summary, it is important to note that the severity of the Great Recession varied across individual EU member states, with some countries experiencing more severe economic downturns than others. Factors such as the structure of the economy, the level of integration with global markets, and the effectiveness of policy responses played a role in determining the impact of the recession in each country. While real GDP changes are a useful metric for evaluating the severity of a recession, it is important to take into account the wider economic context and differences in recovery patterns among individual countries.

CONCLUSIONS AND RECOMMENDATIONS

Automatic stabilizers are tools that are built into the economic system to help mitigate the effects of economic recessions on households. The thesis aimed to determine the impact of four selected automatic stabilizers on the disposable household income (DHI) and prioritize target areas for fiscal policy reforms. The four automatic stabilizers examined in the study were government spending (GS), unemployment insurance (UI), social security contributions (SSC), and tax contributions (TC).

Research conclusions

The research findings indicate that while government spending and unemployment insurance may not have a direct impact on the disposable household income, they may have an indirect effect on household welfare. In fact, previous research has identified potential indirect effects of government spending on disposable household income, as confirmed by the scholars of this field. For example, government spending may lead to job creation, which can improve household income through increased employment opportunities. Similarly, unemployment insurance can help mitigate the impact of job loss on household income, thus indirectly supporting disposable household income.

In contrast, the research found that changes in social security contributions and tax contributions have a direct and significant impact on disposable household income. An increase in social security contributions, such as employer contributions to social security funds, can increase the disposable household income. Conversely, an increase in tax contributions, such as income taxes, can decrease the disposable household income. This gives valuable insights for policymakers when considering fiscal measures that increase social security contributions and reduce tax contributions to mitigate the impact of economic recessions on households.

Overall, this empirical research has provided important insights into the impact of selected automatic stabilizers on disposable household income. One significant finding is that changes in social security contributions and tax contributions have a direct effect on the disposable household income, making them of considerable importance in determining overall household welfare. Another finding is that government spending and unemployment insurance might have an indirect effect on disposable household income, making them nonetheless important factors to households' well-being. For instance, government spending on education, health, and infrastructure can improve the quality of life and increase access to opportunities, which can lead to increased household income and better living standards over time. Similarly, unemployment insurance can

provide a safety net for households during periods of job loss, helping to prevent income shocks and maintain overall economic stability.

Recommendations

As for recommendations, the insights provided by this empirical research have important implications for policymakers. In times of economic downturns, policymakers must prioritize measures of fiscal policy to ease the burden on households. However, as research showed, not all automatic stabilizers have the same effect on the economy and individual households. Therefore, it is essential to correctly prioritize the measures of fiscal policy and related reforms.

Policymakers need to consider short-term and long-term policy packages to address the different effects of automatic stabilizers. Short-term fiscal policy rules should consider the automatic stabilizers that directly affect the disposable household income, such as social security contributions and tax contributions, as they can quickly mitigate the negative impact of economic downturns on household welfare.

For the long-term policy package, policymakers must consider not only the aforementioned items but also the indirect effects of other variables. For instance, government spending and unemployment insurance can have an indirect effect on household living standards, which, in turn, can impact the economy over time. For example, investments in education and infrastructure can lead to long-term economic growth, leading to better employment opportunities and higher wages. Similarly, unemployment insurance can help households maintain their standard of living during economic downturns, leading to reduced poverty and improved economic stability. It is also important to note that the indirect effects of policy measures may not be immediately visible in the economy, but they will become apparent over time. Therefore, policymakers must take a long-term perspective when designing policy packages and assessing their potential impact on household welfare and the economy.

Research limitations and directions for future research

The performed empirical research is insightful, but it has some limitations that need to be addressed. One of the limitations is related to the regression model used in the analysis. The model focuses only on the direct relationships between the variables and does not consider the indirect effect of the automatic stabilizers.

To address this limitation, future research should aim to analyse the indirect links between the automatic stabilizers and household welfare. Analysing these indirect links can provide policymakers with a broader perspective and more valuable insights for long-term fiscal policy solutions. Future studies could explore the indirect effects of automatic stabilizers in more detail,

considering their interconnections with other economic factors. Additionally, further research could examine the effectiveness of automatic stabilizers in different regions or countries outside the EU, providing a broader perspective on their impact on disposable income during recessions.

Furthermore, other limitations of the empirical research could include the sample size and data availability. Policymakers and researchers should carefully consider these limitations when interpreting the results of the research and drawing policy recommendations.

To further advance the research in this area, it is crucial to recognize that the selected variables are also inherent to discretionary fiscal measures, and as such, their effect on household welfare may differ slightly from that of purely automatic stabilizers. The current research has demonstrated the significance of social security and tax contributions as measures of fiscal policy. In further research, it may be beneficial to separate discretionary measures from each of the variables in order to better understand the pure effect of automatic stabilizers. This information can help design more effective policy measures and reforms aimed at promoting sustainable economic growth and development.

Overall, it is important to acknowledge the limitations of any research and work towards addressing them to improve the accuracy and relevance of the results. Policymakers should continue to support research efforts aimed at understanding the complex relationship between automatic stabilizers and household welfare, and use the insights gained from such research to inform evidence-based policy decisions.

AUTOMATINIŲ STABILIZATORIŲ EFEKTYVUMAS EUROPOS SĄJUNGOJE

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Valstybės ekonominės politikos studijų programa

Vilniaus universitetas, Ekonomikos ir verslo administravimo fakultetas

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Vilnius, 2023

SANTRAUKA

70 lapų, 3 lentelės, 13 paveikslų, 57 šaltiniai.

Pagrindinis šio magistro baigiamojo darbo tikslas – nustatyti, kurie automatiniai stabilizatoriai turi didžiausią poveikį užtikrinant, kad ekonominiai šokai nuosmukio metu būtų kuo labiau sušvelninti ir kuo mažiau pakenktų disponuojamoms namų ūkių pajamoms.

Darbą sudaro trys pagrindinės dalys: mokslinės literatūros analizė, empirinis tyrimas ir jo rezultatai bei išvados ir rekomendacijos.

Mokslinės literatūros analizė apima išsamią aktualios informacijos apie automatinius stabilizatorius ir fiskalinę politiką apžvalgą. Šioje dalyje apžvelgiami teoriniai automatinių stabilizatorių pagrindai ir nagrinėjami šioje srityje atlikti empiriniai tyrimai, taip pat įvairūs fiskalinės politikos tipai, jos vaidmenys, funkcijos ir galimi apribojimai bei palengvinimai ekonomikos stabilizavimo požiūriu. Be to ši darbo dalis gilinasi į automatinio stabilizavimo efektyvumą ir nagrinėja skirtingus metodus, kaip matuoti, vertinti ir nustatyti optimalius automatinio stabilizavimo lygius, reikalingus siekiant sumažinti svyravimus atsirandančius įvairiais ekonomikos ciklais.

Sekančioje dalyje buvo atliktas empirinis tyrimas siekiant įvertinti automatinių stabilizatorių efektyvumą Europos Sąjungos valstybėse narėse Didžiosios recesijos sukeltų ekonominių svyravimų metu ir po jų. Šiame tyrime buvo naudojamas įprastų ir papildomų metodų derinys, kuriuos naudoja šios srities mokslininkai. Empirinis modelis rėmėsi paneline regresine analize, siekiant atrasti tiesioginį ryšį tarp disponuojamų namų ūkio pajamų ir pasirinktų automatinių stabilizatorių, taip nustatant, kurie stabilizatoriai daro didžiausią įtaką disponuojamoms namų ūkio pajamoms.

Empirinio tyrimo rezultatai parodė, kad nors vyriausybės išlaidos ir nedarbo draudimas gali neturėti tiesioginės įtakos disponuojamoms namų ūkio pajamoms, jie gali netiesiogiai paveikti namų ūkio gerovę. O tuo tarpu, socialinio draudimo ir mokesčių įmokų pokyčiai gali turėti tiesioginę ir itin žymią įtaką disponuojamoms namų ūkio pajamoms.

Galiausiai, tyrimo išvadose ir rekomendacijose apibendrinamos empirinio tyrimo įžvalgos, kurios turi lemiamos reikšmės politikos formuotojams tiek trumpuoju, tiek ilgalaikiu laikotarpiu. Be to, tyrime nagrinėjami galimų tolimesnių tyrimų kryptys, kur būtų galima išsamiau ištirti netiesioginį automatinių stabilizatorių poveikį ir išplėsti tyrimą, siekiant ištirti automatinių stabilizatorių veiksmingumą skirtinguose regionuose ar šalyse už ES ribų, suteikiant platesnę perspektyvą jų poveikiui disponuojamoms namų ūkių pajamoms recesijos metu.

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APPENDIX 1 - DATA

Table 5

Datasets used in the research

Variable name	Eurostat data code	Link to dataset	Comment for data filter
Disposable household income	ILC_DI04	Internet access: Income by household type	Type of household: *"Total"*
Unemployment insurance	SPR_EXP_FUN	Internet access: Unemployment function	
Tax contributions	GOV_10A_TAXAG	Internet access: Taxes on income	National accounts indicator: *"Taxes on individual or household income"*
Social security contributions	SPR_REC_SUMT	Internet access: Social protection receipts	
Government spending	GOV_10A_EXP	Internet access: Government expenditure	National accounts indicator: *"Total general government expenditure"*
Inhabitant per country	DEMO_GIND	Internet access: Demographic balance	Demographic indicator: *"Average population – total"*

Source: created by author.

Table 6

List of countries included in the research

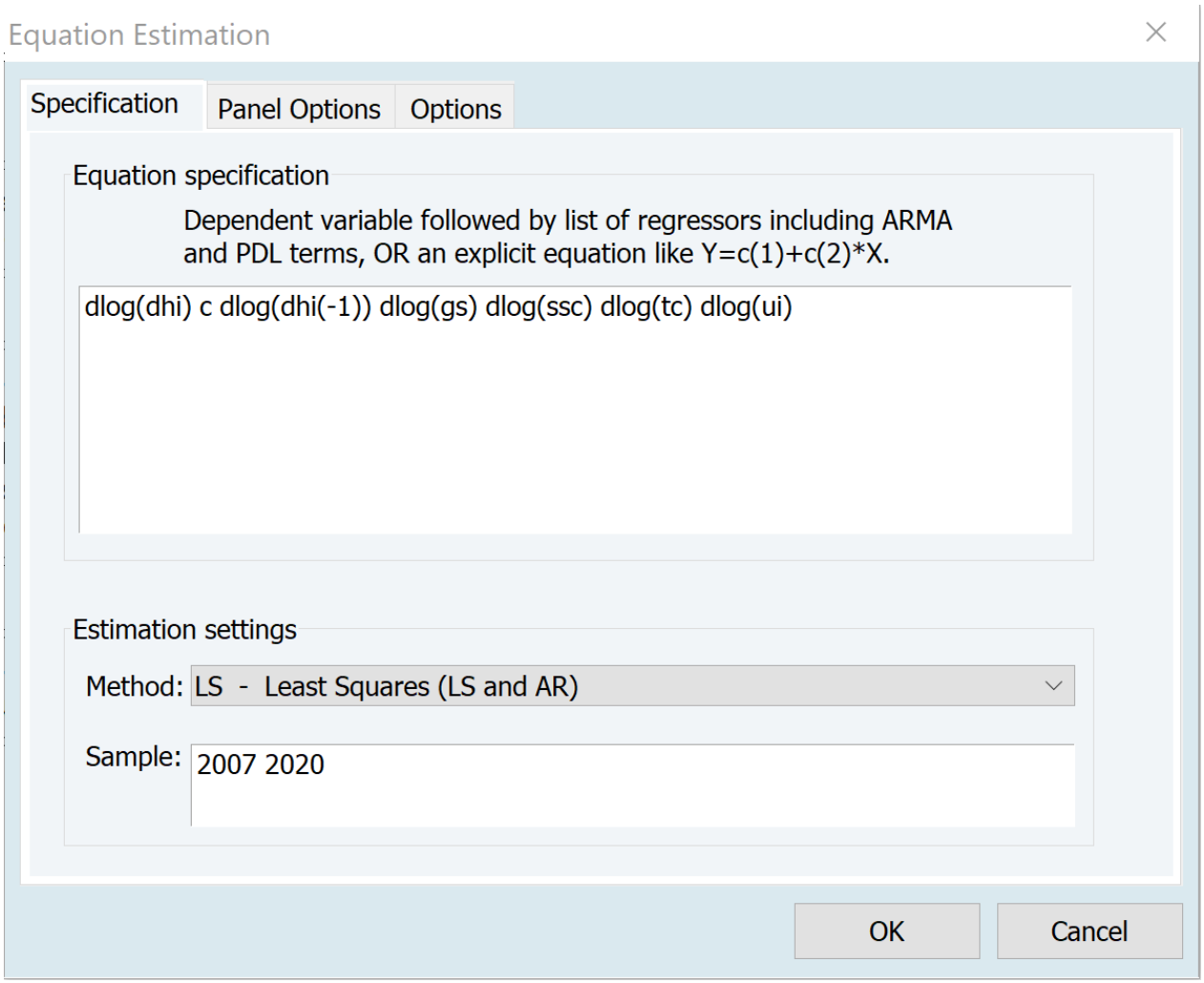
Countries included in the panel dataset				
Austria (AT)	Denmark (DK)	Greece (EL)	Lithuania (LT)	Romania (RO)
Belgium (BE)	Estonia (EE)	Hungary (HU)	Malta (MT)	Slovakia (SK)
Bulgaria (BG)	Finland (FI)	Ireland (IE)	Netherlands (NL)	Slovenia (SI)
Cyprus (CY)	France (FR)	Italy (IT)	Poland (PL)	Spain (ES)
Czech Republic (CZ)	Germany (DE)	Latvia (LV)	Portugal (PT)	Sweden (SE)

Source: created by author.

APPENDIX 2 – EMPIRICAL RESEARCH CALCULATIONS

Picture 14

Panel regression equation specification



Source: created by author via eViews.

Picture 15

Descriptive statistics of variables

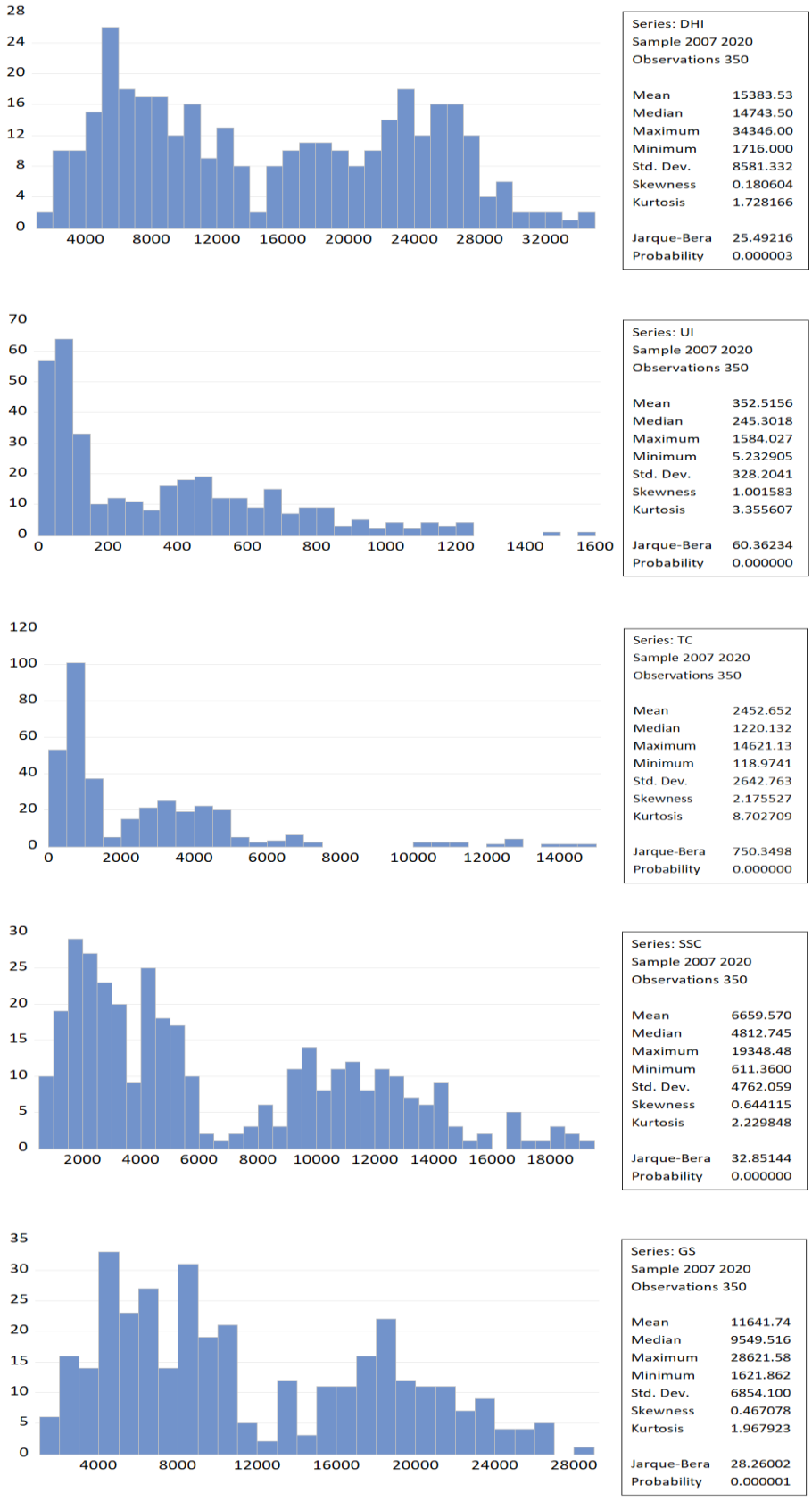
Sample: 2007 2020

	DHI	GS	SSC	TC	UI
Mean	15383.53	11641.74	6659.570	2452.652	352.5156
Median	14743.50	9549.516	4812.745	1220.132	245.3018
Maximum	34346.00	28621.58	19348.48	14621.13	1584.027
Minimum	1716.000	1621.862	611.3600	118.9741	5.232905
Std. Dev.	8581.332	6854.100	4762.059	2642.763	328.2041
Skewness	0.180604	0.467078	0.644115	2.175527	1.001583
Kurtosis	1.728166	1.967923	2.229848	8.702709	3.355607
Jarque-Bera	25.49216	28.26002	32.85144	750.3498	60.36234
Probability	0.000003	0.000001	0.000000	0.000000	0.000000
Sum	5384237.	4074610.	2330850.	858428.1	123380.5
Sum Sq. Dev.	2.57E+10	1.64E+10	7.91E+09	2.44E+09	37593555
Observations	350	350	350	350	350

Source: created by author via eViews.

Picture 16

Histogram and statistics of variables



Source: created by author via eViews.

Picture 17

Spearman correlation results

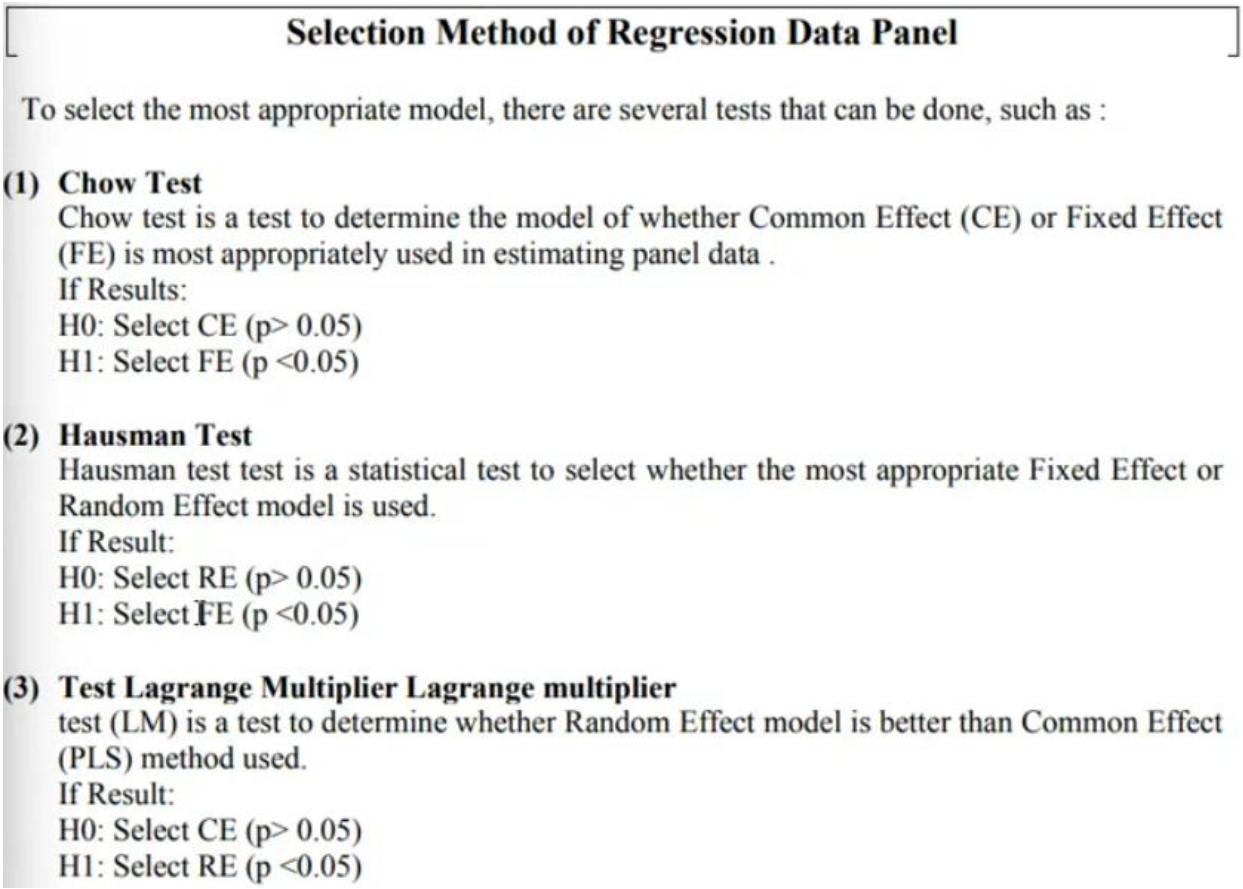
Covariance Analysis: Spearman rank-order
Date: 12/28/22 Time: 13:35
Sample: 2007 2020
Included observations: 350

Correlation	DHI	UI	TC	SSC	GS
DHI	1.000000				
UI	0.891573	1.000000			
TC	0.909133	0.841133	1.000000		
SSC	0.964353	0.884189	0.920874	1.000000	
GS	0.971090	0.905694	0.932337	0.983006	1.000000

Source: created by author via eViews.

Picture 18

Selection method of regression data panel



Selection Method of Regression Data Panel

To select the most appropriate model, there are several tests that can be done, such as :

(1) Chow Test

Chow test is a test to determine the model of whether Common Effect (CE) or Fixed Effect (FE) is most appropriately used in estimating panel data .

If Results:

H0: Select CE (p> 0.05)

H1: Select FE (p <0.05)

(2) Hausman Test

Hausman test test is a statistical test to select whether the most appropriate Fixed Effect or Random Effect model is used.

If Result:

H0: Select RE (p> 0.05)

H1: Select FE (p <0.05)

(3) Test Lagrange Multiplier Lagrange multiplier

test (LM) is a test to determine whether Random Effect model is better than Common Effect (PLS) method used.

If Result:

H0: Select CE (p> 0.05)

H1: Select RE (p <0.05)

Source: Zulfikar (2018).

Picture 19

Lagrange Multiplier test results

Lagrange Multiplier Tests for Random Effects
Null hypotheses: No effects
Alternative hypotheses: Two-sided (Breusch-Pagan) and one-sided (all others) alternatives

	Test Hypothesis		
	Cross-section	Time	Both
Breusch-Pagan	2.369818 (0.1237)	83.05489 (0.0000)	85.42471 (0.0000)
Honda	-1.539421 (0.9381)	9.113446 (0.0000)	5.355644 (0.0000)
King-Wu	-1.539421 (0.9381)	9.113446 (0.0000)	6.683632 (0.0000)
Standardized Honda	-1.430019 (0.9236)	10.55414 (0.0000)	1.463313 (0.0717)
Standardized King-Wu	-1.430019 (0.9236)	10.55414 (0.0000)	3.251194 (0.0006)
Gourieroux, et al.	--	--	83.05489 (0.0000)

Source: created by author via eViews.

Picture 20

Hausman test results

Correlated Random Effects - Hausman Test
Equation: Untitled
Test period random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Period random	1.723586	5	0.8859

Period random effects test comparisons:

Variable	Fixed	Random	Var(Diff.)	Prob.
DLOG(DHI(-1))	0.234060	0.228921	0.000069	0.5354
DLOG(GS)	0.067115	0.066223	0.000052	0.9015
DLOG(SSC)	0.296747	0.300401	0.000022	0.4333
DLOG(TC)	-0.106517	-0.103618	0.000028	0.5858
DLOG(UI)	0.010144	0.009857	0.000016	0.9432

Period random effects test equation:
Dependent Variable: DLOG(DHI)
Method: Panel Least Squares
Date: 12/28/22 Time: 12:13
Sample (adjusted): 2009 2020
Periods included: 12
Cross-sections included: 25
Total panel (balanced) observations: 300

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.013065	0.003536	3.694567	0.0003
DLOG(DHI(-1))	0.234060	0.048143	4.861790	0.0000
DLOG(GS)	0.067115	0.052701	1.273494	0.2039
DLOG(SSC)	0.296747	0.066925	4.434003	0.0000
DLOG(TC)	-0.106517	0.034888	-3.053106	0.0025
DLOG(UI)	0.010144	0.012858	0.788904	0.4308

Effects Specification

Period fixed (dummy variables)

R-squared	0.374307	Mean dependent var	0.030481
Adjusted R-squared	0.338932	S.D. dependent var	0.056403
S.E. of regression	0.045859	Akaike info criterion	-3.271481
Sum squared resid	0.595170	Schwarz criterion	-3.061600
Log likelihood	507.7221	Hannan-Quinn criter.	-3.187486
F-statistic	10.58115	Durbin-Watson stat	2.329733
Prob(F-statistic)	0.000000		

Source: created by author via eViews.

Picture 21

Chow test results

Redundant Fixed Effects Tests
Equation: Untitled
Test cross-section fixed effects

Effects Test	Statistic	d.f.	Prob.
Cross-section F	0.922719	(24,270)	0.5710

Cross-section fixed effects test equation:
Dependent Variable: DLOG(DHI)
Method: Panel EGLS (Period random effects)
Date: 12/28/22 Time: 12:30
Sample (adjusted): 2009 2020
Periods included: 12
Cross-sections included: 25
Total panel (balanced) observations: 300
Use pre-specified random component estimates
Swamy and Arora estimator of component variances

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.013108	0.008150	1.608434	0.1088
DLOG(DHI(-1))	0.228884	0.047595	4.809001	0.0000
DLOG(GS)	0.066217	0.052399	1.263725	0.2073
DLOG(SSC)	0.300428	0.067010	4.483304	0.0000
DLOG(TC)	-0.103598	0.034606	-2.993651	0.0030
DLOG(UI)	0.009856	0.012254	0.804312	0.4219

Effects Specification	S.D.	Rho
Period random	0.025456	0.2342
Idiosyncratic random	0.046030	0.7658

Weighted Statistics

R-squared	0.210068	Mean dependent var	0.010366
Adjusted R-squared	0.196634	S.D. dependent var	0.050884
S.E. of regression	0.045608	Sum squared resid	0.611534
F-statistic	15.63677	Durbin-Watson stat	2.327444
Prob(F-statistic)	0.000000		

Unweighted Statistics

R-squared	0.226037	Mean dependent var	0.030481
Sum squared resid	0.736207	Durbin-Watson stat	2.339303

Source: created by author via eViews.

Picture 22

Panel regression results

Dependent Variable: DLOG(DHI)
Method: Panel EGLS (Period random effects)
Date: 12/28/22 Time: 12:11
Sample (adjusted): 2009 2020
Periods included: 12
Cross-sections included: 25
Total panel (balanced) observations: 300
Swamy and Arora estimator of component variances

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.013108	0.008147	1.608871	0.1087
DLOG(DHI(-1))	0.228921	0.047423	4.827181	0.0000
DLOG(GS)	0.066223	0.052207	1.268472	0.2056
DLOG(SSC)	0.300401	0.066763	4.499542	0.0000
DLOG(TC)	-0.103618	0.034480	-3.005154	0.0029
DLOG(UI)	0.009857	0.012212	0.807143	0.4202

Effects Specification	S.D.	Rho
Period random	0.025468	0.2357
Idiosyncratic random	0.045859	0.7643

Weighted Statistics

R-squared	0.210049	Mean dependent var	0.010328
Adjusted R-squared	0.196614	S.D. dependent var	0.050878
S.E. of regression	0.045603	Sum squared resid	0.611413
F-statistic	15.63498	Durbin-Watson stat	2.327456
Prob(F-statistic)	0.000000		

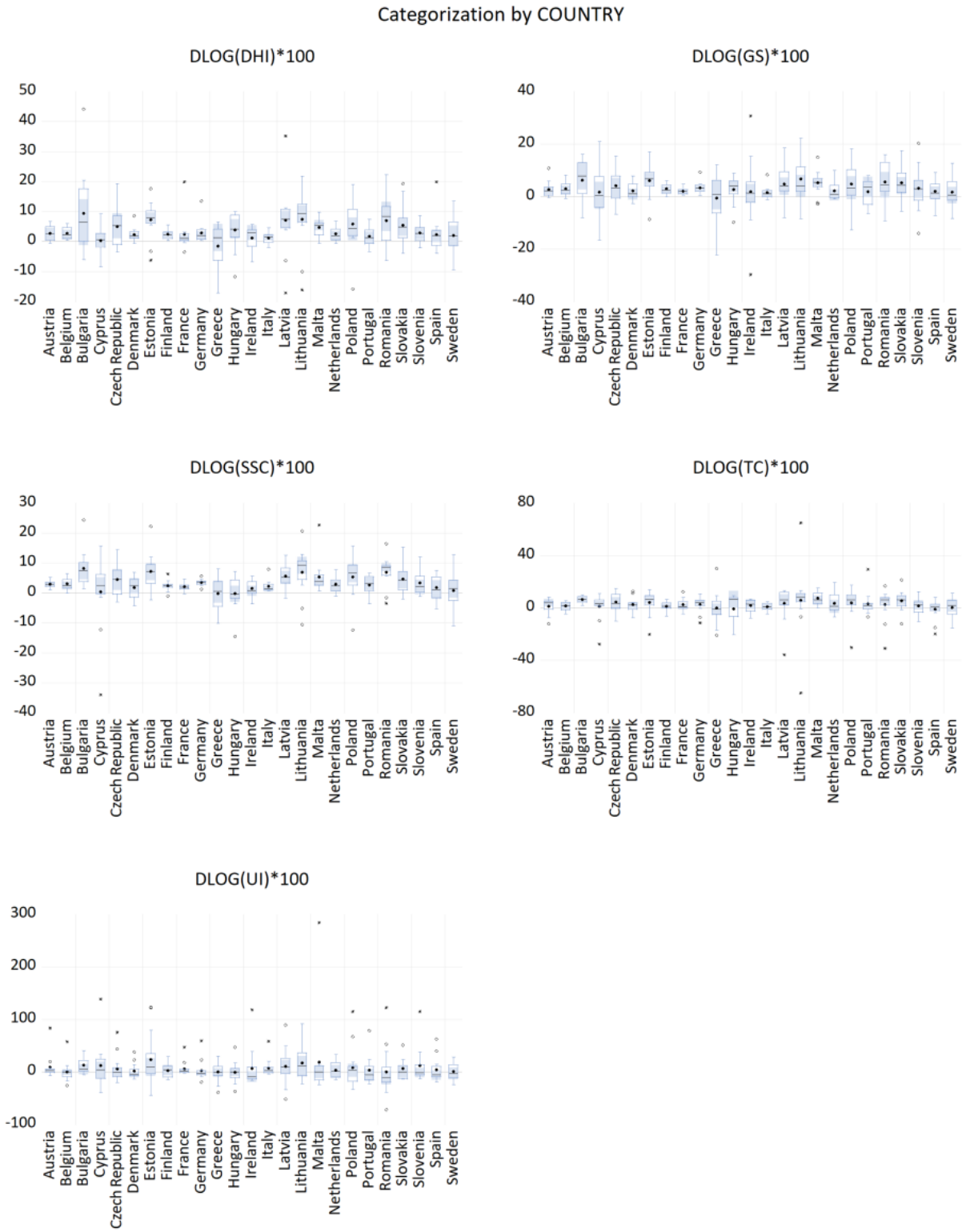
Unweighted Statistics

R-squared	0.226030	Mean dependent var	0.030481
Sum squared resid	0.736213	Durbin-Watson stat	2.339313

Source: created by author via eViews.

Picture 23

Categorization by country



Source: created by author. Charts show the cross-country comparison expressed in changes in variables to make countries comparable.