European Commission

JRC SCIENCE FOR POLICY REPORT

# The resilience of EU Member States to the financial and economic crisis

*What are the characteristics of resilient behaviour?*


EUR 29221 EN

Joint Research Centre

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JRC111606

EUR 29221 EN

PDF ISBN 978-92-79-85746-1 ISSN 1831-9424 doi:10.2760/840532

Luxembourg: Publications Office of the European Union, 2018



How to cite this report: The resilience of EU Member States to the financial and economic crisis: What are the characteristics of resilient behaviour?, EUR 29221 EN, Publications Office of the European Union, Luxembourg, 2018, ISBN 978-92-79-85746-1, doi:10.2760/840532, JRC111606.



**Title** The resilience of EU Member States to the financial and economic crisis. What are the characteristics of resilient behaviour?

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## ACKNOWLEDGEMENTS

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The authors would like to thank Vladimir Šucha, Enrico Giovannini, Sven Langedijk, Hedvig Norlen, Eleni Papadimitriou, Marco Petracco Giudici, Borek Vasicek, Slavica Zec, and seminar participants at the JRC, OECD, the Research Network on the Measurement of Resilience and the World Bank for their comments and useful discussions.

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## Executive summary

This study presents an empirical analysis of the resilience of European countries to the financial and economic crisis that started in 2007.[1] The analysis addresses the following questions: Which countries showed a resilient behaviour during and after the crisis? Is resilience related only to the economic dimension? Has any of the EU countries been able to use the crisis as an opportunity and 'bounce forward'? Is it possible to identify any particular country characteristics linked to resilience?

The analysis is based on the JRC conceptual framework for resilience (Manca *et al.*, 2017) which places at its core the wellbeing of individuals, thus going beyond the merely economic growth perspective.

The study carefully **selects a number of key economic and social variables** that aim to capture the resilience capacities of our society. Resilience is measured by investigating the dynamic response of these variables to the crisis in the short and medium run. In particular, we define **four resilience indicators**: the *impact* of the crisis, the *recovery*, the *medium-run*, and the *'bouncing forward'*.

Results from a narrow exercise focusing on macroeconomic and financial variables confirm the **validity of the proposed measurement approach**: Germany appears to be among the most resilient countries; Ireland, after having been severely hit, shows a good absorptive capacity; Italy seems to be still struggling with the recovery, while Greece remains the most affected.

After measuring resilience, we identify **underlying country characteristics** that may be **associated with resilient behaviour**. As such, these could indicate entry points for policies to increase countries' resilience to economic and financial shocks.

The exercise has led to the following results and conclusions.

- Ranking countries according to their resilience is not trivial. Their resilience performance depends on the indicator of reference: **countries that are more resilient in their short-term** response **may not necessarily be the ones that perform better in the medium term**. For example, while Germany and Poland appear to be among the most resilient countries both in the short and medium run, Bulgaria and the Baltics score better in the medium run than in the short run.
- **Broadening** the perspective **from a purely economic to a socio-economic viewpoint has an impact** on the resilience assessment of a number of countries. For instance, Bulgaria proves more resilient when social variables such as social exclusion, happiness, health expenditures and wages are included in the analysis. Conversely, Hungary becomes less resilient when the social dimension is factored in. The importance of this broader perspective further **reinforces the case for the European Pillar of Social Rights**, and for the inclusion of the social dimension in the work of the European Semester.
- We assess whether countries have been overall able to **'bounce forward'**, i.e. to improve their situation compared to the pre-crisis period. Countries'

[1] We work under the simplified assumption that the crisis can be viewed as a common exogenous shock that hit all EU countries at the same time. Resilience then also encompasses domestic imbalances that have been built up and that one can view as vulnerabilities, e.g. the fiscal situation, private sector indebtedness, housing bubble, banking sector and current account imbalances.

performance in this respect is substantially heterogeneous: while **Croatia, Cyprus, Greece, Italy and Spain still lag behind** their pre-crisis performance in the majority of relevant socio-economic dimensions, countries like **Germany and Malta managed to bounce forward** in many areas.

- In most countries, active labour market measures, productivity and R&D expenditures have increased compared to their pre-crisis level. Countries **have been generally able to 'bounce forward' more as far as monetary aspects of wellbeing** (GDP, consumption and income) are concerned, compared to non-monetary aspects of wellbeing (e.g. happiness, inequality, social exclusion and the share of young people not in employment, nor education, nor training). This latter finding confirms the need to consider the social dimension.
- The analysis tested over 200 candidate characteristics for their association with resilience. Relevant country characteristics can differ in their association with short- and medium-run resilience. In particular:
- High values of **pre-crisis government expenditures on social protection** turn out to be the most important feature in predicting the country absorptive capacity (lower impact). [2]
- When focusing on the medium run, the countries performing better are those that exhibit higher **political stability**.
- As for the capacity of countries to 'bounce forward', what becomes critical is the **business environment** and in particular **the perception of wages being related to productivity**.
- More generally, data show that countries that are net creditors vis-`a-vis the rest of the world tend to be more resilient than net debtors in all dimensions analyzed.

[2] The significant role of expenditures on social protection is in line with results obtained in a previous JRC analysis on the quality of life.

# 1 The policy context

Resilience is a key concept in the current narrative for the European Union (EU). Interest in resilience has been rising rapidly during the last twenty years, as a response to increasing uneasiness about potential shocks that would test the limits of the coping capacities of individuals, regions, countries and institutions, and that we cannot hope to eliminate (e.g. digital innovation, demographic change, climate change, globalization or immigration). They are the "new normal".

In the Rome Declaration of 2017, the EU institutions and Member States (MS) clearly stated that the goal is to "…. make the EU stronger and more resilient, through even greater unity and solidarity amongst us and the respect of common rules".

Similarly, the reflection paper on Harnessing Globalisation[3] calls for domestic policies that "boost our resilience at home". It stresses the importance of social, tax and education policies to ensure resilience, as well as strong and competitive economies that can finance a fair re-distribution of wealth. By the same token, the Joint Communication "A Strategic Approach to Resilience in the EU's External Action"[4] emphasizes that a strategic and political approach for external policies will help increasing resilience inside the EU. It speaks of resilience as "a broad concept encompassing all individuals and the whole of society" that features "democracy, trust in institutions and sustainable development, and the capacity to reform".

Most often, the concept of resilience is considered from an economic perspective. In March 2017, the G20 adopted a list of principles to strengthen economic resilience and policies.[5] In September 2017, the Eurogroup started thematic discussions on enhancing economic resilience in the EMU, in the context of the growth and jobs agenda (European Commission, 2017). A similar focus on economics has dominated the significant efforts undertaken by other international organisations in this area, such as the OECD,[6] the International Monetary Found (2016) or the ECB.[7]

However, it is also more often recognized that understanding and building resilience requires taking a broader perspective and considering society as a whole. Such a 'system view' should encapsulate the entire production process of societal well-being, to ensure that not only economic, but natural, social and environmental resources are also harnessed in an efficient, sustainable, fair and responsible manner.

While the discussion on resilience has started in several policy fora, there is still no commonly agreed definition, nor a unified approach towards its measurement. It is therefore no surprise that resilience has not yet become an overarching policy objective.

In 2015, the Joint Research Centre (JRC) and the European Political Strategy Centre started a common reflection on resilience and established a Commission-wide network to discuss resilience in the policy context.[8] This effort led the JRC to a notion of resilience that focuses on individual well-being, and to a framework for its assessment and measurement (Manca

[3] https://ec.europa.eu/commission/sites/beta-political/files/reflection-paper-globalisation_en.pdf
[4] https://ec.europa.eu/europeaid/2017-joint-communication-strategic-approach-resilience-eus-external-action_en
[5] http://www.bundesfinanzministerium.de/Content/DE/Standardartikel/Themen/Schlaglichter/G20-2016/Note-Resilience-Principles-in-Economie.pdf?__blob=publicationFile
[6] These include Duval and Vogel (2008), Caldera-Sanchez *et al*. (2016), Sutherland and Hoeller (2014).
[7] These include European Central Bank (2016) and Sondermann (2016).
[8] Commission-wide Research Network on Measuring Resilience, Resil.net.

*et al.* (2017)). The JRC framework is particularly suitable for policy design, and comes at a time when citizens' concerns call for strong policy actions. Indeed, our society is constantly hit by shocks of various types and at the same time is facing long-term challenges. Financial and economic crisis, migration, terrorism, globalization, Brexit are key examples.

The present study builds on the JRC resilience framework and assesses the response of EU Member States to the 2007-2012 global financial and economic crisis, addressing the following questions. Which countries showed a resilient behaviour during and after the crisis? Is resilience related only to the economic dimension? Has any of the EU countries been able to use the crisis as an opportunity and 'bounce forward'? Is it possible to identify any particular country characteristics linked to a more resilient behaviour?

The financial and economic crisis originated in the US in 2007 and shortly became a full-blown economic crisis, known as the Great Recession. By 2010, the crisis and the economic downturn developed into a sovereign crisis in some vulnerable EU countries. The severe recession reflected in a drop of the EU-28 real Gross Domestic Product (GDP) by as much as 4.4% in 2009, with its unemployment rate peaking at 11% in 2013. Unlike in the US, where the real GDP has surpassed its pre-crisis level by 2011, the recovery was quite sluggish in the EU, with the 2016 real GDP of 10 Member States still being below their 2007 level.

Such a coexistence of financial, economic and sovereign crises offers an unprecedented 'social experiment' for assessing the resilience of socio-economic systems. Indeed, one can reasonably assume that the European crisis originated from a common exogenous shock, which impacted the whole continent. At the same time, owing to the different structural vulnerabilities of the various EU countries, the shock amplified to various degrees across EU countries, which in turn reacted differently based on their socio-economic characteristics. This offers a unique natural experiment for the study of resilience.

By exploiting the variation in the responses of Member States to the shock, we are able to assess their resilience. For example, the steadily rising employment rate in Germany throughout the crisis (from 73% in 2007 to 79% in 2016) contributes to its characterization as a particularly resilient country. Conversely, as an example from the opposite end of the spectrum, one may take the stagnant economy of Italy, where average real GDP growth was -0.6% between 2006 and 2016, against 0.7% for the EU28.

The dynamic perspective of our measurement approach also allows for distinguishing short-term from medium-term resilience, and identifying those countries that have been rather heavily hit, but have also been able to recover quite well. Lithuania, where the unemployment rate rose to more than 18% in 2010, but is now down to 7%, is one such country.

Our proposed methodology for the measurement of resilience yields very reasonable results when applied to strictly economic and financial indicators. We also expand our focus to the socio-economic system as a whole, by including in the analysis indicators which relate to all parts of the system, in particular to social and human capital, institutions and infrastructures, as well as 'beyond GDP' measures of prosperity and well-being, covering social aspects such as health and poverty. Finally, we study the underlying factors that are associated with resilient behaviour.

# 2 Resilience: how to interpret and measure it

## 2.1 The JRC conceptual framework

According to the JRC framework (Manca *et al.* (2017)), a resilient system (or society) can face shocks and persistent structural changes in such a way that it does not lose its ability to deliver societal well-being in a sustainable way (i.e., deliver current societal well-being, without compromising that of future generations).

The link between this definition of resilience and the concept of sustainability is very close. Nevertheless, if sustainability is the goal to be reached, resilience is the means to remain on or return to a sustainable development path of a complex system in the presence of distress.

We have identified three different capacities that make societies resilient, depending on the interaction between the time of exposure and the intensity of distress.

As shown in the left panel of Figure 1, when both the persistence and intensity of a shock are relatively low, the optimal coping strategy is that of absorption, without significant changes in behaviour. For example, when considering the individual-level shock of a job loss, the absorptive capacity would consist of relying on government transfers or private savings to face the initial period of unemployment.

As either the intensity, the persistence of distress, or both increase, some degree of flexibility and a change in behaviour are required to allow the system to function without major disruptions. This adaptive capacity, when applied to our previous example, could involve relying on different strategies such as reducing consumption or taking on temporary jobs of lesser qualification requirements.

Ultimately, as the distress becomes unbearable, the degree of flexibility required for the system to continue functioning necessitates a major change or transformation. This transformative capacity requires learning from past events and implementing changes ideally towards a better development path, given the current constraints.

It is important to note that these capacities are by no means mutually exclusive. In fact, the boundaries between absorptive, adaptive and transformative capacities are rather blurred, and the way a certain response to a shock can be interpreted naturally depends on the way the system is defined, as well as on the time horizon, risk aversion, performance metrics etc. considered. This implies that both the resilience strategies themselves, as well as their ranking and desirability are to be assessed on a case-by-case basis.

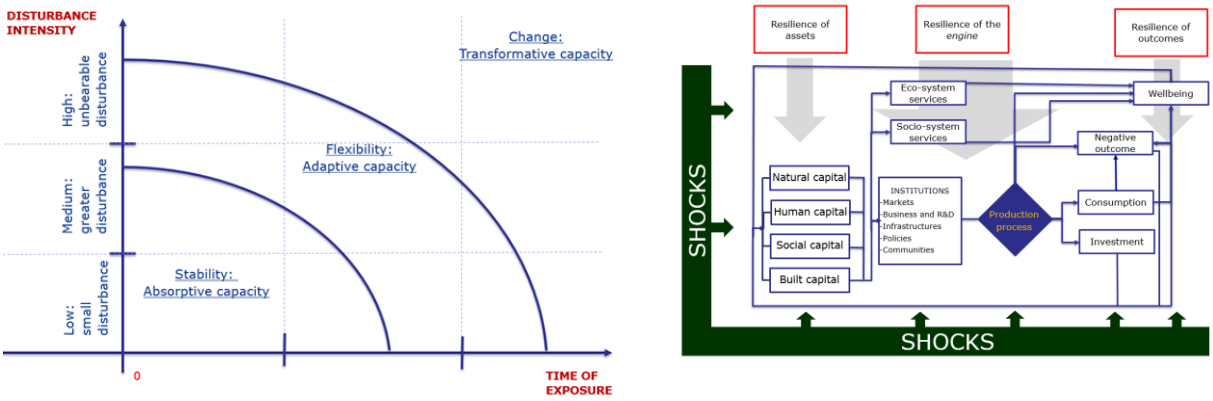
The conceptual framework of resilience presents additional key elements. It focuses on individuals, takes a societal perspective, and considers individual and societal well-being as the ultimate goal. In this concept, societal well-being does not simply amount to the sum of individual well-being, but also includes aspects related to the structure and fabric of society, such as community values or social capital.

The framework breaks the silos of thematic approaches, and looks at the socio-economic-environmental nexus as a whole. This approach, or *system view*, distinguishes three elements of the system. (i) *Assets* include various forms of human, social, natural and built capital. (ii) *Outcomes* represent determinants of individual well-being (e.g. health, employment, trust and happiness), consumption, investment, as well as some adverse systemic fallouts (e.g. social exclusion, poverty, inequality, waste in general). (iii) *The*

*engine* transforms assets into outcomes through societal institutions and processes such as governments, markets, enterprises, or communities.

The right panel of Figure 1 shows a schematic visualization of the system view, building on the "materially closed Earth system" model by Costanza *et al.* (1997). The system view allows measuring resilience by assessing how shocks impact the various components of our society.

Figure 1 Shocks and capacities (left). Ingredients of resilience in the materially closed Earth system (right).




By taking a dynamic perspective, the JRC framework fits the policy needs. Having identified the resilience capacities of absorption, adaptation and transformation, it allows for a formulation of different types of *policy interventions* in a structured way. While none of these would be adequate in all situations, well-targeted policies tailored to specific needs and in support of specific resilience capacities have a great chance to succeed. The creation of a safety net in the Banking Union is an example of *prevention* but also *preparation* measures, which aim at reducing the incidence and size of damages, in this case as a consequence of the financial crisis.

*Protection* measures are required to mitigate their impact, and to provide relief from potential deprivation or a loss of the standard of living. For example, unemployment benefits act as an (income) buffer, supporting the standard of living for a time period sufficient to find a new job and to recover a suitable income. This provision becomes crucial for individuals that cannot rely on their own savings.

While protection aims at supporting absorptive capacities (stability), *promotion* measures serve to invoke the adaptive capacity (flexibility) necessary to cope with more persistent and/or severe distress. Investment in innovation, flexible labour market policies, vocational training for the unemployed are all examples of promotion measures. Finally, *transformative* measures may be required to deal with acute distress. They typically correspond to a learning process. The shift towards a Genuine Financial Union (starting with the Capital Market Union) as a consequence of a persistent financial crisis is an example.

The conceptual framework also puts forward the idea that shocks should be considered as windows of opportunity, and utilized to "bounce forward". Policy-makers, for their part, should assist in providing citizens with the right means to benefit from such opportunities.

Annex 1 lists the main definitions introduced in the conceptual framework and used in the report.

## 2.2 Measurement strategy

The conceptual framework for resilience, with its system view, is the basis for operationalizing resilience for policy and monitoring purposes. Due to the complex and multidimensional nature of the concept, the idea is to place 'resilience sensors' on observable system variables corresponding to *assets*, to the ecological, institutional and socio-economic functionalities of the *engine*, and finally to *outcomes*. These sensors would then be able to track the behaviour of various *entities*, such as people, communities, cities, regions or countries.

Given that resilience is related to the dynamic response of a system to disturbances, its direct monitoring would require a continuous re-assessment of such responses. For example, one would need to re-estimate how the unemployment rate responds to new shocks. In the absence of new shocks every year, this continuous assessment would not be possible. Moreover, such dynamic responses (e.g., how unemployment responds to shocks) would not provide direct guidance on how policies can foster resilience, or how a system would deal with unknown future disturbances.

The alternative we propose is to identify *resilience characteristics*, i.e. features that differentiate resilient entities (individuals, communities, cities, regions or countries) from non-resilient ones. These characteristics are meant to be indicative of an entity's fundamental ability to respond to disturbances in general. Thus, they are different from the specific policies and actions taken during an actual period of distress. They can be monitored on a regular basis and used to build a dashboard.

Resilience characteristics can be identified by the following steps:

1) Collect data on **relevant system variables** for assessing the resilience of various entities to various shocks and slow-burn processes (defined as long-run changes and stress).
2) Build **resilience indicators**, which quantify the dynamic response of a system to the shocks of interest. These indicators would measure, for example, how long it took for an economy to recover, or the magnitude of the consequences of the shock.
3) Identify **resilience characteristics**, i.e. factors that prove to be influential and robust determinants of resilience, as measured by the multitude of indicators derived in the previous step.

Such a **dashboard of resilience characteristics** offers entry points for policy interventions and lends itself to multiple applications to support the full policy cycle, i.e. the monitoring, designing, implementing and assessment of policies. In particular, it

- allows for a continuous monitoring of socio-economic resilience within the EU,
- helps assessing the intended or unintended consequences of specific policies,
- serves as a guide for identifying and implementing resilience-enhancing structural reforms,
- facilitates the design and evaluation of societal stress tests.

# 3 Measuring resilience to the financial and economic crisis

## 3.1 System variables

To analyse Member States' response to the crisis and assess their resilience, we focus on potentially relevant systemic variables from the socio-economic domain. We first selected a list of approximately 100 variables from various existing indicator sets,[9] and then restricted our sample to those with sufficient data coverage both in the cross-section and over time. Our final set consists of 34 system variables, including both objective and subjective (i.e., opinion survey-based) ones.

The choice of these variables is guided by our conceptual framework. The first objective is to span the entire socio-economic-institutional system in a balanced way, and select variables that adequately describe each part of the system. Second, the selected variables need to exhibit a substantial variation in the wake of the crisis. Finally, we put emphasis on the determinants of individual and societal well-being, often going "beyond GDP".

Table 1 provides a list of the variables we include in the analysis. It distinguishes between a set of *core-economic and financial* variables and a set of non-core variables, i.e. social variables as well as economic variables that link comparatively more to the social sphere. Though some variables are related to each other by construction (like GDP and investment), their observed dynamic behaviour are typically quite different. Table 1 also shows how we classify these variables into assets, engine and outcomes, according to the *system view.*[10] Table 4 in Annex 2 provides details on the variables considered, including their definition, data source and time span.

Table 1: List of system variables.

| | **ASSETS** | **ENGINE** | **OUTCOMES** |
|---|---|---|---|
| **CORE** | - Investment | - Government deficit<br>- Government debt<br>- Household loans<br>- House prices<br>- Inflation<br>- Labour productivity<br>- Corporate loans<br>- Private debt<br>- Stock prices | - Employment rate<br>- Gross Domestic Product<br>- Unemployment rate |
| **NON-CORE** | - Dwellings<br>- Expenditures on education<br>- Expenditures on health<br>- Fairness<br>- Trust in people | - Social activity<br>- Trust in European Parliament<br>- Trust in legal system<br>- Expenditures on active and on passive labour market programs<br>- Expenditures on R&D<br>- Incidence of temporary work<br>- Wages | - Happiness<br>- Health<br>- Household consumption<br>- Income inequality<br>- Not in employment, education or training (NEET)<br>- Social exclusion<br>- Household income<br>- Satisfaction |

[9] E.g. Macroeconomic Imbalance Procedure indicators, EU 2020, Sustainable Development Indicators, Employment and Social Policy indicators, Social Pillar indicators, and ingredients of Quality of Life.

[10] For some of the variables, there is some ambiguity in their mapping to the system. This is particularly true about some variables that we have allocated to assets, as data on various capital stocks is more difficult to obtain. The main objective was to ensure that no major part of the system is left uncovered.

## 3.2 Resilience indicators

Starting from the variables described in the previous section, we derive the following resilience *metrics* by suitably transforming the raw data: (i) impact of the crisis, (ii) recovery from the crisis, (iii) medium-run performance, and (iv) bounce forward. The metrics are computed by assuming that the crisis was a single, common episode hitting all Member States in 2007.

This is clearly a simplifying assumption. Though the global financial crisis undoubtedly originated in the US and hit Europe as an exogenous shock, the degree to which each European country was exposed and vulnerable to this common shock varied, depending on some structural features of the countries. When it comes to the actual measurement of resilience, one could work with the assumption that countries were hit by shocks of different magnitude. Unfortunately, we cannot adopt this interpretation, as the magnitude of the shocks would be difficult to pin down. Rather, we simply acknowledge that a less vulnerable country will appear to be also more resilient, particularly in the early, crisis impact phase. Reducing a country's vulnerability is therefore tantamount to increasing its absorptive capacity. Certain resilience characteristics, however, might be more naturally linked to vulnerability or absorption, offering some separation of the two from each other.

Based on the above interpretation, we compare countries' resilience performance taking the 2007 level of each variable as its reference pre-crisis level.[11] The metrics we compute answer the following questions. How much has a certain country worsened relative to its pre-crisis level? Has it already returned to its pre-crisis level, or by how much is it still below? Did the situation significantly improve over the medium-run?[12] Table 2 summarizes the definitions of the metrics and the system capacities they are mainly associated with, while Figure 2 shows an example.[13]

These metrics are computed for each of the 34 system variables described in the previous section. In a second step, they are combined into aggregated *resilience indicators* in order to assess the system-wide behaviour. Hence, we obtain for each country four aggregate indicators.

As for the first three metrics, they are aggregated into indicators that describe the resilience performance of each given country relative to the performance of the other countries, by averaging their normalized values.[14] The bouncing forward metric, on the other hand, assesses the resilience performance of countries in absolute terms. A country *bounces forward* with respect to a certain variable if its post-crisis level exceeds the pre-crisis level significantly (considering the typical fluctuations of that variable in the pre-crisis

[11] This way we do not make a distinction between the cyclical and the trend behaviour of country performance. In fact, it would be quite difficult to assess the pre-crisis trend and its potential change after the crisis, given the relatively short time that has passed since the onset of the crisis. Moreover, though the timing and the exposure to the crisis might have varied across countries, it would also be hard to estimate these differences precisely.

[12] The meaningfulness of such questions was another selection guide among candidates for system variables. For example, the comparison to the pre-crisis levels of real price or per GDP variables is more meaningful than that of nominal versions.

[13] Beqiraj *et al.* (2017) uses a macroeconomic model to obtain the response to a set of Central and Eastern states to the crisis, and analyse their resistance (impact) and recovery performance.

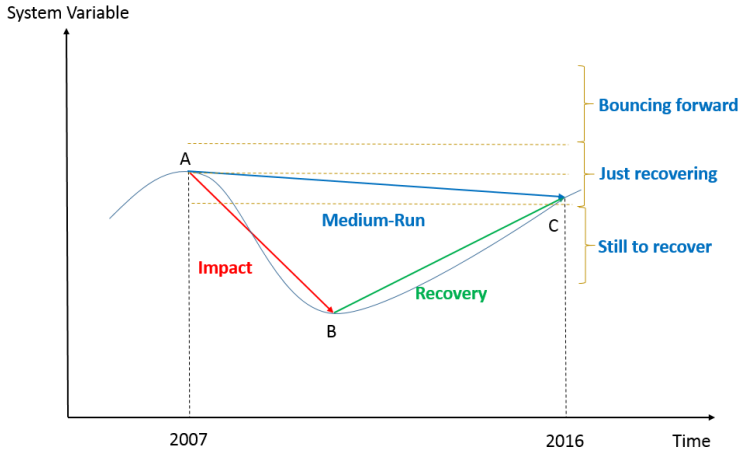
[14] Metrics are normalized across countries by using a z-score transformation, which subtracts the cross-country average of the indicator from every single value, and then divides them by the cross-country standard deviation of the indicator. Very similar results are obtained with mean normalization also, where the normalized variable is calculated as follows: $x' = (x - \min(x))/(\max(x) - \min(x))$. Additional variants, like winsorizing, or the use of alternative weighting schemes across system variables yield indicators that are highly correlated with the baseline ones.

period). It is *still recovering* if the medium-run level is substantially below the starting level. In every other case, it is *just recovering* (as the case in Figure 2).[15]

Table 2: The list of metrics used (see also Figure 2)

| Metrics | Definition | Capacity |
|---|---|---|
| **Impact of the crisis**<br>How much has the financial and economic crisis affected European countries? | Difference between the worst level and 2007 | Mostly absorption |
| **Recovery from the crisis**<br>How much have countries recovered from the crisis? | Difference between the worst level and the most recent available data | Absorption and adaptation |
| **Medium-run performance**<br>What is the situation in the countries compared to the pre-crisis one? | Change between the beginning of the crisis and the latest available data | Mostly adaptation |
| **Bounce forward**<br>Did the situation significantly improve or deteriorate in the medium-run? | Assessment of the statistical significance of the 'medium-run performance' metrics | Adaptation and partly transformation |

Figure 2: Schematic representation of the evolution of a system variable and the resilience metrics




The bouncing forward metric is also aggregated across variables to yield an overall bouncing forward indicator for each country. This indicator is positive if a country has bounced forward in more dimensions than in which it has significantly worsened, and negative otherwise. Notice that it is possible that a country exhibits a high degree of medium-run resilience, if it has done better than many other countries in many respects, and yet it does not bounce forward, if for most of the variables the medium-run improvement is not significant. Of course, in this case most of the other countries would not bounce forward, either.

[15] Formally, the metric takes value +1 (-1) if the medium term level is above (below) the 2007 level by at least one standard deviation of the observed values around a trend during the pre-crisis period (2000-2007). It is equal to 0 otherwise.

## 3.3 Resilience characteristics

Resilience characteristics are variables that prove to be robust, significant and meaningful predictors of countries' resilient behaviour.[16] Key candidates include variables linked to various aspects of governmental quality and other institutional features, economic performance, government expenditures, government indebtedness, gender equality, trust and more generally the 'health' of a society.

We have collected data on about 200 potential resilience characteristics.[17] A broad classification of variables is as follows:

- Digital development (e.g. connectivity, digital public services, …)
- Education (e.g. country average PISA scores (Programme for International Student Assessment) in the various disciplines, share of people with primary, secondary and tertiary education, …)
- Gender equality
- Government expenditures by type (e.g. social, education, employment, health, …)
- Innovation and R&D (eco-innovation index, R&D expenditures, innovation and sophistication factors, technological readiness, …)
- Labour market policies and support (active and passive instruments and further components, Employment Protection Legislation)
- Macroeconomic and financial performance (average GDP growth, investment share, trade openness, government indebtedness, …)
- Market development and regulation (market size, financial market development, product market regulation, labour, product and financial market efficiency, …)
- Quality of government (e.g. political stability, control of corruption, government efficiency, …)
- Quality of life (health status, rates of chronic illness, fertility rate, poverty, living conditions, …)
- Regulatory environment (e.g. ease of doing business index, regulatory quality, …)
- Trust in the society and institutions (trust in parties, the legal system, civic engagement index, community attachment index, trust in institutions, …)

Data sources are the World Bank, the OECD, the Global Competitiveness Index of the World Economic Forum, the Gallup World Poll Survey, the Macroeconomic Imbalance Procedure Scoreboard, Eurostat, the EC digital scoreboard, and the European Institute for Gender Equality. Annex 2 provides details on the variables considered, including their definition, data sources and availability.[18]

We also consider additional characteristics suggested by various recent JRC studies. In particular, we include the share of non-routine manual and of non-routine cognitive workers in employment, as well as the degree of automatic income stabilization due to fiscal instruments. Annex 3 provides further details on these characteristics.

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[16] In parallel work, Brůha and Kucharčukova (2017) follow a similar two-step methodology. In their first step, they characterize commonalities and differences in macroeconomic developments (GDP growth and unemployment) across countries. The second step is to look for characteristics to explain the differences.

[17] To ensure a meaningful and homogenous country coverage, variables which were not available for at least 26 of the EU-28 were omitted. With the exception of special indices (like those of digital connectivity or ease of doing business), we also restricted our attention to variables which were available from at least 2000.

[18] For the Global Competitiveness Index, we only include those 16 variables which are discussed in the main text or reported as additional results in Annex 7. Thus, we present a total of 85 characteristics.

In order to study which candidate characteristics are indeed associated with better resilience performance, we construct multi-year average values of these variables and compare these average levels with the resilience indicators described in the previous section. In particular, we take the 2000-2007, 2005-2007 and the 2008-2010 averages. The first two averages are pre-determined to and unaffected by the crisis shocks. In order to assess the relevance of the candidate characteristics with respect to the resilience performance in the immediate aftermath of the shock (impact indicator), we only consider these two averages.[19] Finally, to assess the relevance of the candidate characteristics in the medium run (recovery indicator, medium-run performance and bounce forward indicator), we also look at the 2008-2010 average values.[20]

It is important to stress that these characteristics do not necessarily correspond one-to-one to potential policy tools to be utilized in a crisis. Instead, they generally capture some underlying, pre-existing features of countries that enable them to act resiliently in a crisis. Some of those features may relate directly to policies, while others can be more deeply seated, often influenced by policies only indirectly. By the same token, the general, broad and deep nature of these characteristics makes it more likely that they would not be too specific to the current crisis episode.

[19] For some variables, data coverage only starts around 2012. If it is unlikely that the variable was directly affected by the crisis, and its level is likely to reflect an underlying feature of the country, then we also consider such variables. Items from the EC Digital Scoreboard, or the `Ease of doing business' index are such examples.

[20] Notice that some candidate characteristics are also system variables. When used as candidate resilience characteristics, these variables are taken in their level (average pre-crisis value); the resilience metrics are instead based on their change relative to 2007. This aims to ensure that there is no mechanical or spurious relationship between indicators and candidate characteristics.

# 4 Results

## 4.1 Indicators of resilience

Resilience performance is first assessed using the first three indicators described in Section 3.1: impact of the crisis, recovery from the crisis and medium-run performance.

Through a series of heat-maps and a correlation table (see Annex 4), we present the response of each system variable to the crisis. In each heat-map, countries are ranked according to their aggregate resilience indicator.

The first result is that the most resilient countries show high resilience in the majority of the individual dimensions (i.e. underlying variables) and all three parts of the system (i.e. assets, engine, outcomes). This is also confirmed by the large number of high (at least 0.5) correlation values in the correlation table (Annex 4), and the analysis of the bar charts of the resilience indicators broken down by assets/engine/outcomes (Annex 5, Figure 14). This finding is in line with one crucial conclusion based on the theoretical framework, i.e. that a system cannot be resilient in its outcomes unless it is resilient in its assets and engine.

The second result is that in most cases, any statement on the resilience performance of a country crucially depends on the indicator of reference. Indeed, countries that are more resilient in their short-term response are not necessarily the ones better recovering in the medium-term. This is shown in the scatterplots in Figure 3, which compare the way countries react at different time horizons. The top panel shows the comparison of the impact indicator versus the recovery indicator, while the bottom one shows the impact indicator versus the medium-run performance.

In both panels, countries in the bottom-left quadrant are those that suffered the most and recovered the least from the crisis (e.g. Greece and Cyprus). Looking at the upper panel, countries in the top-left quadrant experienced a high impact, but were able to recover quite well (e.g. Ireland and the Baltics). As shown in the bottom panel, however, these latter countries display only an average overall performance in the medium-run. In other words, their recovery was just enough to offset the initial drop and to yield an average medium-run performance.

As for the countries that have been impacted relatively little, their recovery indicator is more difficult to interpret, since they had comparatively little to recover from. For this reason, for these countries it is more informative to look at their medium-term performance (bottom panel). Among these countries, the best performing also in the medium-run (top-right quadrant) are Germany, Malta, Bulgaria and Poland.

To visualize the resilience of the EU 28 further, Figure 4 presents three heat-maps of the impact, recovery and medium–run indicators. This view highlights additional cross-indicator patterns. Germany, Malta and Poland managed to be strongly resilient in the impact and medium-run indicators (they had little to recover from, so their recovery indicator is not so high). Similarly, Hungary, Slovakia, Sweden and the United Kingdom had a moderately high level of resilience (light green); Denmark, Portugal and Spain exhibited a medium level of resilience (light yellow), while Cyprus and Greece shows an overall low level of resilience (red and orange).

Figure 3: Scatterplots of resilience indicators for the full system

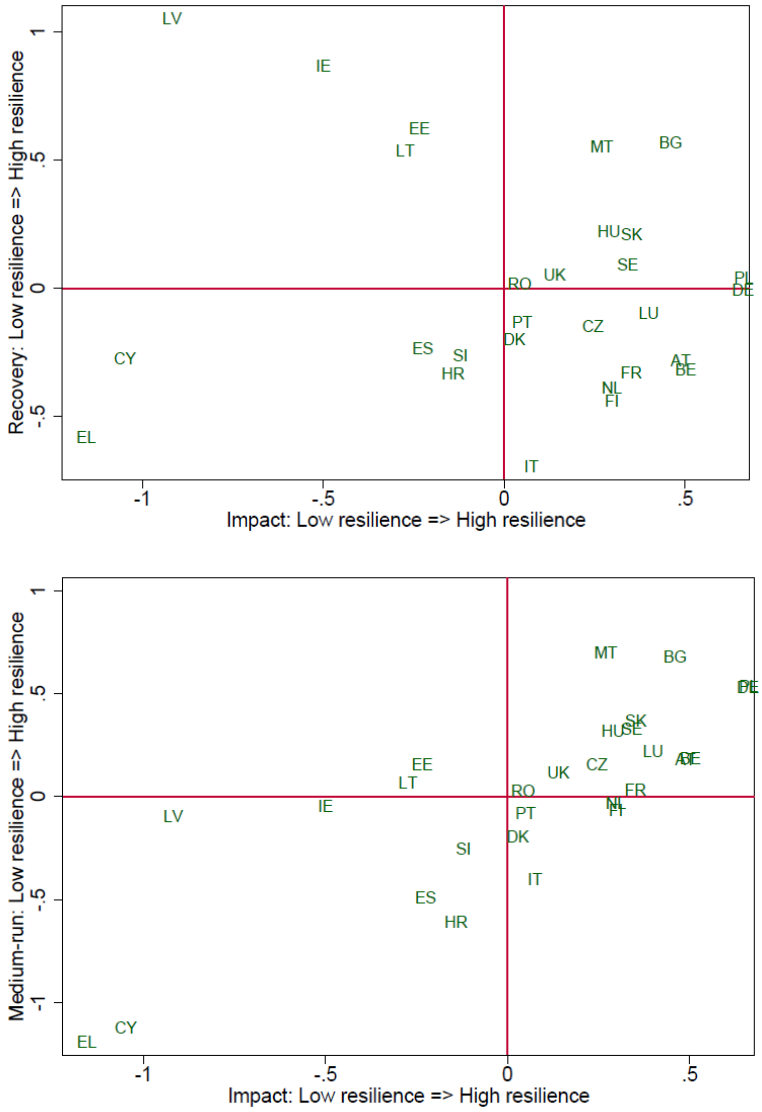
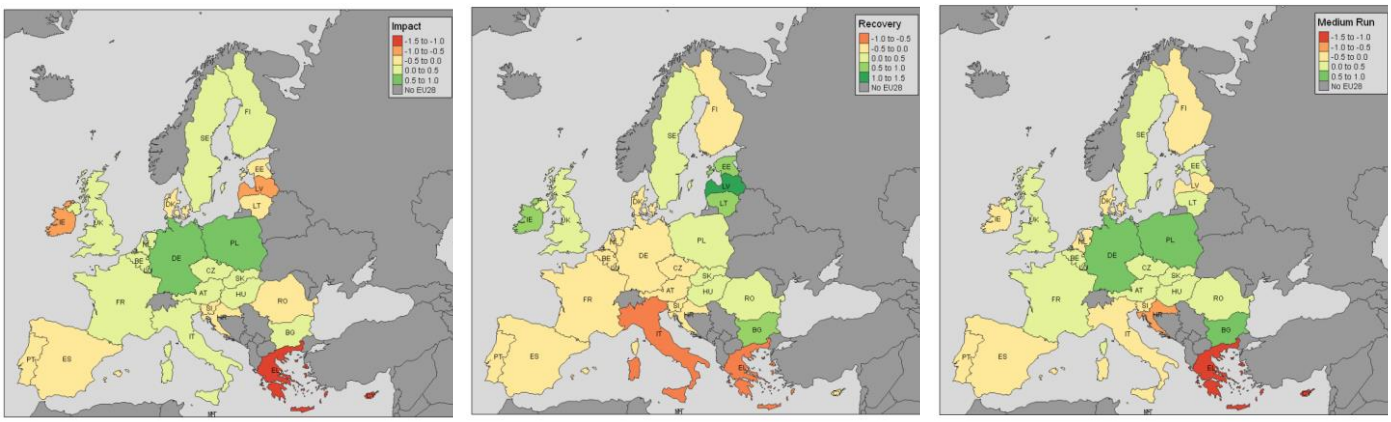



Figure 4: Impact, Recovery and Medium Run indicators in the EU 28

Impact Recovery Medium Run



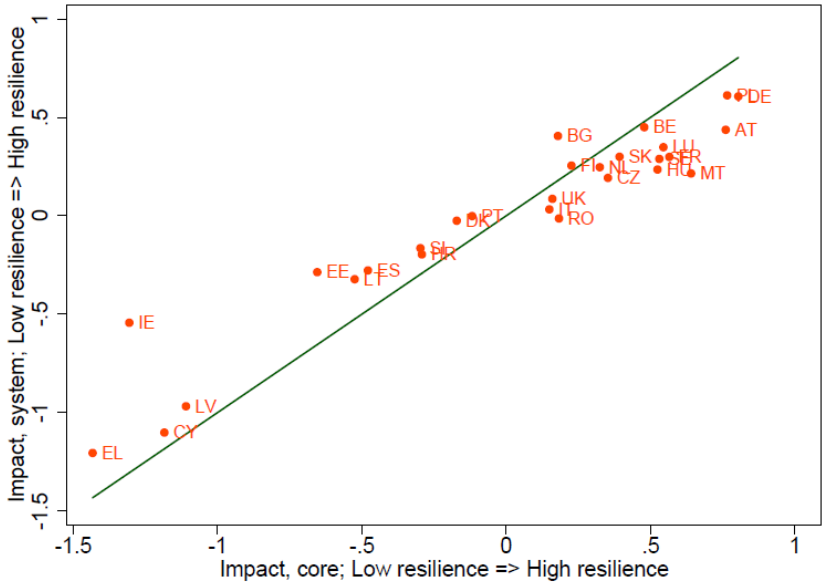

Shade of green indicates high resilience, shade of yellow medium resilience and shades of red low resilience. Malta is light green on impact (0.215), light green on recovery (0.551) and green in the medium run (0.699).

The results discussed above are based on the analysis of the full system, i.e. including both the strictly economic and financial variables as well as the variables that focus on individuals and relate to the social dimension. Indeed, a key contribution of our work is to broaden the perspective to including also aspects that are traditionally neglected in the economic literature. To evaluate the importance of considering the social dimension, we have also derived the resilience indicators only based on the smaller set of core economic and financial variables, and compared the results.

Figure 5 contrasts the indicators based on the full system, with those computed only based on the economic and financial core, focusing on the impact indicator.[21] Countries below the 45° line perform worse when we adopt the system view, compared to when we take a narrow strictly economic angle. In other words, looking only at the economic performance of this group of countries would yield biased results, by making them appear more resilient than they have actually been. Notably, Malta, the United Kingdom and Hungary fall in this group of countries, for which the full picture is not as nice as the purely economic one. In case of Malta and Hungary, this applies to all the three indicators.

Notice also that considering the whole system or the economic core (as presented in Table 1) yields a different ranking of countries. For example, based on purely economic and financial variables (i.e. looking at the ranking of the countries along the x-axis), Hungary appears to have performed better than some other countries, namely Finland, the Netherlands, Slovakia, Bulgaria and Belgium. At the same time, considering also variables with a more social connotation (i.e. looking at the ranking along the y-axis), it has done worse.

Figure 5: Comparison between the system view and the core- economic view.




For some countries, broadening the horizon of the analysis changes the picture considerably. When this is the case, the question that comes next is which variables are responsible for the different performance. We investigate this issue by pinning down the

[21] Annex 5 (Figure 15) presents the respective graphs for the recovery indicator and the medium-run performance indicator.

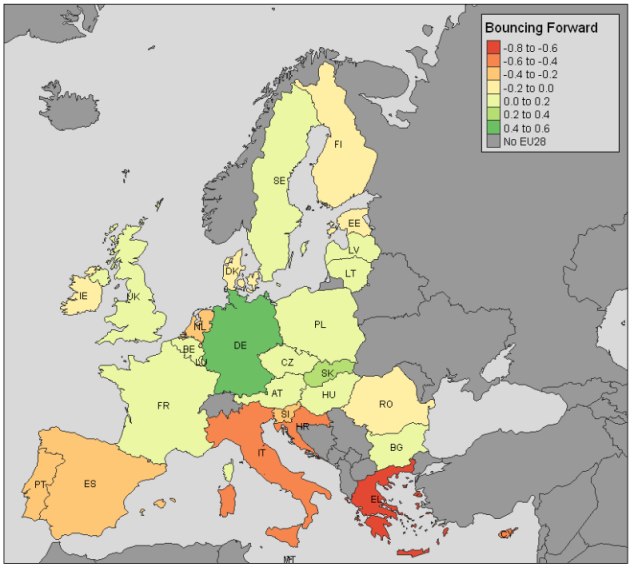
contribution of each single variable outside of the economic and financial core. Results for selected countries are presented in Annex 5 (Figure 16). For example, in the case of Belgium and Bulgaria, the recovery is more marked when expenditures on health and changes in the income distribution (inequality and social exclusion) are taken into account, compared to when they are not. As for the United Kingdom, the crisis brought about a worsening in self-perceived health of citizens and wages. When these aspects are taken into account, on top of the core economic indicators, the impact of the crisis looks more sizable. For Hungary, in order to be able to grasp fully the negative consequences of the crisis, one cannot ignore in particular the rise in income inequality, as well as the decreases in health and education expenditures (all in relative terms to other countries).

## 4.2 Measuring bouncing forward

The bouncing forward indicator is computed as the average of the bouncing forward metric (see Section 3.2) over the variables. The closer the value is to one, the more a country has bounced forward in the various socio-economic dimensions considered. Conversely, the closer to minus one, the more a country is still in recovery phase.

Figure 6 shows the bouncing forward performance of EU countries on a heat-map. One can see that the Mediterranean countries (Cyprus, Greece, Italy, Portugal and Spain), Croatia, the Netherlands and Slovenia were the least able to bounce forward (an indicator value of -0.2 or below). At the same time, Germany, Malta and Slovakia managed to bounce forward in quite many areas.

Figure 6: The bounce forward indicator in the EU 28




Shade of green indicates high resilience, shade of yellow medium resilience and shades of red low resilience. The value for Malta is 0.333 (light green).

Figure 7: Bouncing forward in the full system and its main ingredients

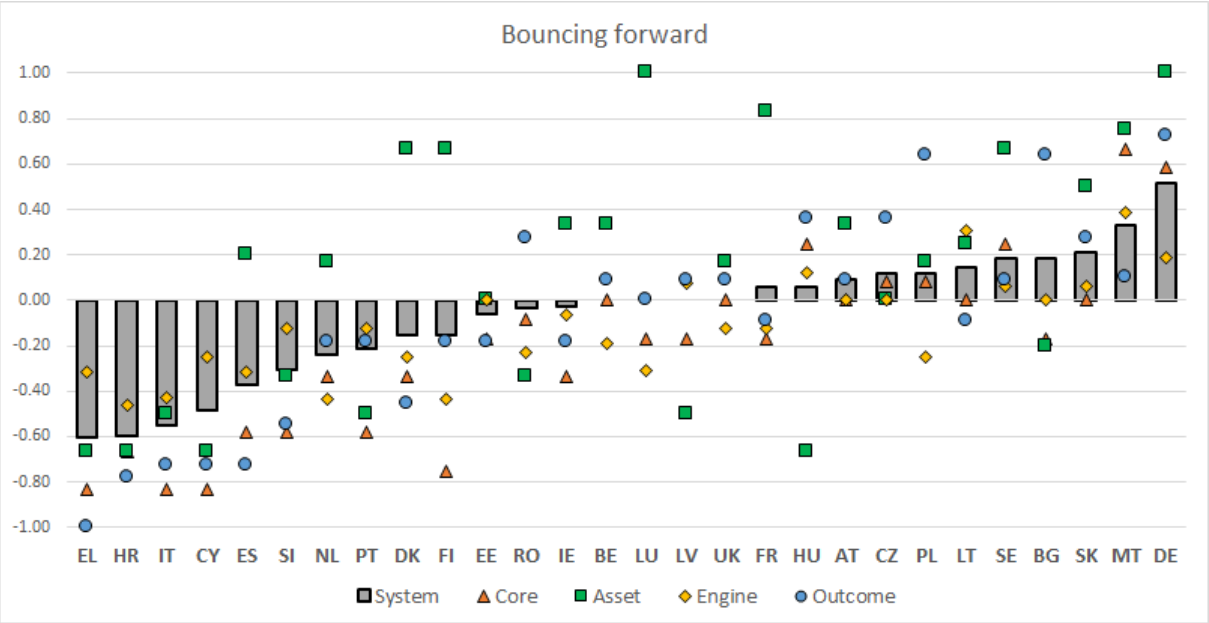



Figure 7 further reveals that countries with a similar overall bouncing forward score might have in fact bounced forward in different respects. For example, Hungary and Malta have performed a great deal better in the core-economic dimensions relative to the more social ones, while the opposite is true for countries like Cyprus, Finland, Greece, Italy or Portugal.

Large heterogeneity across countries is also apparent when the system is broken down into its three parts. Member States such as Denmark, Finland, France or Luxemburg, managed to bounce forward relatively more in their assets than in their engine or outcomes. Typically, the engine turned out to be more resilient than assets and outcomes in countries with a weak overall recovery, such as Cyprus or Greece. On the other hand, the recovery of Bulgaria, Poland, and Romania was mostly driven by strong performance in terms of outcomes. It means that in some cases, outcome variables bounced forward more than variables from the assets or the engine group.[22]

It is also interesting to contrast the value of the bouncing forward indicator with the impact and medium-run resilience indicators presented in the previous section. As Figure 17 in Annex 5 shows, considering the bouncing forward performance further refines the conclusions about the resilience ranking of Member States.

First, it substantiates the previous finding that a relatively high resilience in terms of impact does not necessarily imply the capacity to bounce forward, as for example is the case for Finland and the Netherlands (see the left panel of Figure 17, bottom-right quadrant).

Second, the statistical association between bouncing forward and medium-run resilience is very strong, corresponding to a correlation of 0.9 (see the right panel of Figure 17). This may be due to the fact that most of the times, a strong (or weak) relative performance in the medium-run also meant an absolute improvement (worsening) relative to the pre-crisis situation. Hence, in most cases the medium-run performance indicator and the bounce forward indicator are significantly positive or negative. However, in some cases the two

[22] It seems to violate the "rule" that resilience in outcomes requires resilience also in assets and the engine. The finding however might also point to an imbalanced recovery and signal further difficulties in the future. At the same time, it is also possible that our measure for the bounce forward did not capture all aspects of the recovery process perfectly.

indicators tell slightly different stories. For example, Germany, the country that ranks only fourth in terms of medium-run resilience, displays the best bouncing forward performance by a wide margin. On the other end of the spectrum, Croatia, Spain and Italy seem to have done much better than Greece and Cyprus based on the medium-run resilience indicator. However, the bouncing forward performance of the former three countries is very similar to that of the latter two.

Annex 6 offers a heat-map that describes the behaviour of each individual system variable in terms of the bouncing forward indicator. The following patterns emerge:

- For the majority of the countries, some specific parts of the engine have not fully recovered yet. These are public finances (government debt, and to a lesser extent government deficit) and household balance sheets (owing to weaker loan dynamics for households and lower house prices).
- At the same time, the majority of the countries have bounced forward in relation to some other variables belonging to the engine, namely labour market measures, productivity and R&D expenditures.
- Most of the assets are just recovering, except for expenditures on health and on education, which have bounced forward compared to their pre-crisis levels.
- Among the variables related to the outcomes, monetary-wellbeing variables (GDP, consumption and to a smaller degree income) have bounced forward more than the ones describing non-monetary aspects of wellbeing (e.g. happiness, inequality, social exclusion, NEET and unemployment).
- Countries have bounced forward much more in terms of their GDP (with an average score of 0.43) than overall (with an average score of minus 0.06). Looking only at aggregate performance may hide many underlying processes, for example the ineffectiveness of the necessary reallocation process, or non-monetary aspects of well-being. The system view, on the other hand, can detect such hidden features.

## 4.3 Resilience characteristics

Characteristics relate to various aspects of countries, such as the quality of government, gender equality, government expenditures in key dimensions, the level of government indebtedness, the employment rate by type of occupation[23] and various measures of economic performance.[24]

In this section, we analyse the association between candidate resilience characteristics and the resilience indicators (impact, medium-run and bouncing forward) for the system as a whole. We exclude the recovery indicator from the analysis because its quantitative interpretation is less clear than that of the other three, since a country could have experienced a low recovery simply as a consequence of a weak impact.[25]

[23] From the employment rate by type of occupation, we have considered the non-routine manual tasks (service and sales workers and elementary occupations –isco08: 5, 9) and the non –routine cognitive tasks (managers, professionals, and technicians and associate professionals –isco08: 1, 2, 3).

[24] Some characteristics (e.g. the ones on economic performance) are also considered in the computation of the resilience indicators, considering their behaviour during the crisis. When they are used as characteristics, we instead consider their level, to describe e.g. the general economic stance of a country pre-crisis, and not its response to the crisis.

[25] Annex 7 nevertheless reports some results for the recovery indicator as well.

Through univariate regressions, we identify those characteristics that exhibit the highest explanatory power for each resilience indicator. We then explore whether adding a second variable leads to a much-improved statistical fit.[26] Depending on the type of the resilience indicator, the characteristics identified may signal the strength of the absorptive (impact), the adaptive (medium-run, bouncing forward), and even the transformative capacity of countries (bouncing forward).

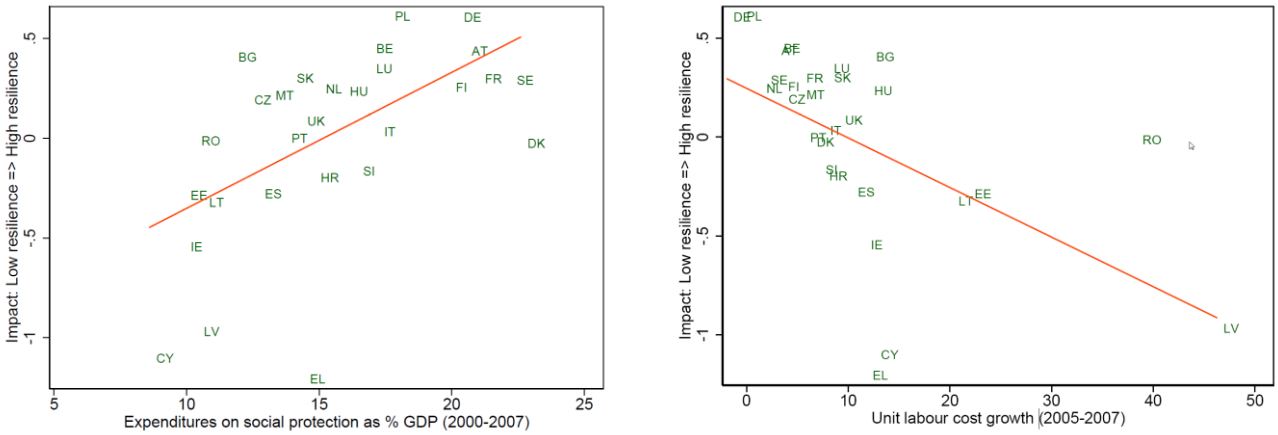
Considering resilience at impact, we find that the pre-crisis average values of the following variables rank first in terms of explanatory power:

- government expenditures on social protection (as a share of GDP),
- unit labour cost growth (3 year % change),
- net international investment position (assets minus liabilities, % of GDP).

This means that high values of expenditures on social protection, low growth of unit labour costs and a positive and large net external investment position of a country are associated with higher resilience to the crisis in the short term (a smaller impact). The current account balance ranks fourth. Notice that this latter variable, unit labour costs and the net international investment position are among the key indicators monitored in the context of the Macroeconomic Imbalance Procedure (MIP). As such, these variables may be seen as more closely related to the concept of vulnerability (see discussion in Section 3.2), while expenditures on social protection would be more related to the concept of absorptive capacity.

Figure 8 plots the impact indicator against the level of social expenditure in the first panel, and unit labour cost growth in the second panel, while the top of Panel A of Table 3 shows the results of the most meaningful univariate regressions.

Figure 8: Scatterplot for the most significant characteristics for the impact indicator.




[26] It certainly remains possible that certain variables are only proxying the influence of some other, neglected explanatory variable ("omitted variable bias"). However, this issue should be alleviated by the large number of candidate characteristics we test in the first place. In our follow-up, regional resilience analysis, we will apply more elaborate methodologies to tackle this problem.

Table 3: Results of the analyses of resilience characteristics, univariate and bivariate regressions.

| **Panel A: Impact of the crisis** | | | |
|---|---|---|---|
| **Univariate** | | Adjusted $R^2$ | Coefficient |
| C14 | Expenditures on social protection (00-07) | 0.30 | 0.07*** |
| C48 | Unit labour cost % change (05-07) | 0.29 | -0.03*** |
| C43 | Net int'l. investment position (05-07) | 0.26 | 0.007*** |
| | | | |
| **Bivariate** | | | |
| C42 | Current account balance (05-07) | 0.52 | 0.09*** |
| C16 | GDP per capita (05-07) | | -0.99*** |
| | | | |
| **Panel B: Medium-run** | | | |
| **Univariate** | | Adjusted $R^2$ | Coefficient |
| C65 | Political stability (08-10) | 0.18 | 0.50** |
| C82 | Wages related to productivity (08-10) | 0.17 | 0.42** |
| C52 | Financial sector liabilities (08-10) | 0.14 | -0.02** |
| | | | |
| **Bivariate** | | Adjusted $R^2$ | |
| C43 | Net int'l investment position (05-07) | 0.38 | 0.008*** |
| C44 | Export market share (05-07) | | 0.009*** |
| | | | |
| C65 | Political stability(08-10) | 0.30 | 0.68*** |
| C16 | GDP per capita (05-07) | | -0.43** |
| | | | |
| **Panel C: Bouncing forward** | | | |
| **Univariate** | | Adjusted $R^2$ | Coefficient |
| C82 | Wages related to productivity (08-10) | 0.28 | 0.32*** |
| C70 | Efficacy of corporate boards (08-10) | 0.22 | 0.27*** |
| C80 | Intensity of local competition (08-10) | 0.18 | 0.28** |
| | | | |
| **Bivariate** | | Adjusted $R^2$ | |
| C80 | Intensity of local competition (08-10) | 0.49 | 0.40*** |
| C44 | Export market share (08-10) | | 0.007*** |

*** significant at 1%, ** significant at 5% and * significant at 10%.
The period in parenthesis corresponds to the time window where the level of the characteristic is computed, e.g. the average of expenditures on social protection in the period 2000-2007 is considered.

Annex 7 reports selected additional regressions. Interestingly, among the characteristics that are able to explain the resilience performance of countries at impact, we also find the share of manual workers over the labour force and gender inequality, both affecting resilience negatively. Other significant (and positive) characteristics include the current account balance, foreign market size (exports and imports), an innovation capacity measure, and the availability of local suppliers to meet business needs.

For bivariate regressions, the best fit is obtained by featuring the current account balance and GDP per capita on the right hand side (see the bottom of Panel A of Table 3). These two variables together are able to explain over half of the variation in the impact indicator across countries. Although the negative sign attached to GDP per capita might appear somewhat surprising, it is probably due to the fact that Central and Eastern Member States did relatively better during the crisis, and they also exhibit lower per capita GDP levels.

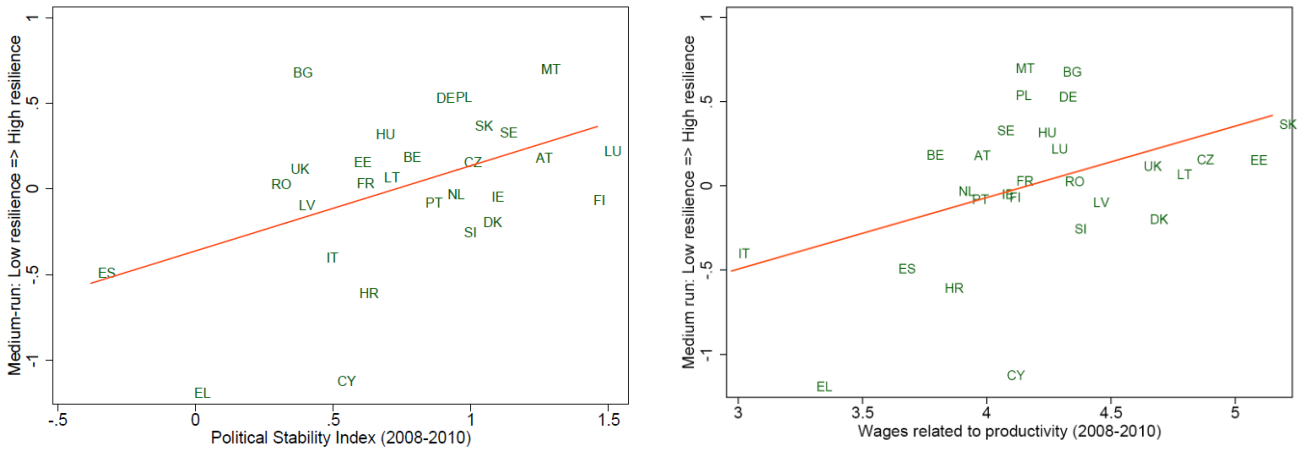
Finally, expenditures on social protection show up in many of the best bivariate regressions, coupled with the real effective exchange rate (also an indicator in the MIP),

the net international investment position, unit labour costs, the current account balance and the share of manual workers (see Annex 7 for details). In particular, when paired with unit labour costs or the net international asset position (the other best univariate performers), expenditures on social protection remain the most significant from the three, with its coefficient changing little.

Overall, the variable of expenditures on social protection clearly stands out in terms of its explanatory power and correlation with the impact indicator. It is important to stress that this finding is not about the degree of using such expenditures as a tool during the crisis. Instead, it means that their high pre-crisis levels are associated with a good absorption capacity. This variable was also found to be highly correlated with measures of quality of life in previous JRC studies (see Joint Research Centre, 2016). Annex 8 elaborates further on the importance of expenditures on social protection as established by the literature and provides a short overview of available relevant works.

When it comes to explaining the medium-run resilience performance of countries (Panel B of Table 3 and Annex 7), the most significant variables are political stability, the extent to which wages are perceived to be linked to productivity, and the size of financial sector liabilities. With the exception of the last variable, correlations are positive, i.e. the more stable the government is, and the more wages are perceived to be well-related to productivity, the higher the medium term resilience of a country (see Figure 9). At the same time, a relatively sustained growth of financial sector liabilities (e.g. bank deposits and debt securities), which is also monitored in the context of the MIP, is associated with lower resilience in the medium term.

Figure 9: Scatterplots for the most relevant characteristics for the medium-run indicator.




Focusing on the most relevant variable, the importance of a stable and predictable political landscape to foster medium-term resilience does not come as a surprise. Indeed, political instability is conducive to a generally uncertain environment, where for example investment decisions tend to be postponed, dragging on the economic recovery.

When adding a second regressor, the explanatory power increases often quite substantially.[27] The most meaningful specification, which includes the net international investment position and the growth of the export market share (5 year % change, also an indicator in the MIP), is reported in Panel B of Table 3, while other relevant ones are in Annex 7. This bivariate regression shows that to determine the medium-run trajectory of a country, not only domestic factors count. In fact, the relative position of a country vis-à-vis its global competitors seems to matter even more.

Finally, as for the bouncing forward indicator (Panel C, Table 3), we do not find standard macroeconomic indicators among the ones which yield the best fit. On the contrary, the perception about wages being related to productivity is the single variable that is able to best explain the ability of a country to bounce forward. It is followed by an index of the efficacy of corporate boards, i.e. the perception about country management being accountable to investors and boards of directors. The third-best explanatory variable is the perception about the intensity of competition in the local market. All these three variables point to the key role of a country's business environment in promoting its adaptive and transformative capacities.

Moving to bivariate regressions, the combination of the intensity of local competition and the growth of the export market share is able to explain almost half of the variation in the bouncing forward indicator, with both coefficients strongly significant. Annex 7 reports some additional interesting specifications, where the variables discussed in relation to the medium-run indicator prove again to be significant.[28]

Overall, the explanatory power of the regressions is in some cases remarkably good, when e.g. a single variable is able to explain 30% of the variance of the resilience indicator of relevance, or only two variables explain more than half of the variation. In other cases, particularly in univariate specifications, the goodness of fit is not breath-taking. This suggests that resilience is ultimately the outcome of a complex interplay of various factors, which is difficult to describe by simple regressions. This is particularly true when looking at medium-run resilience and bouncing forward. Moreover, for these two latter indicators, the relevant characteristics are related to more structural features of the system, namely political stability and business conditions.

It is worth noting that the net international investment position is highly correlated with all the resilience indicators.

Finally, there are some variables exhibiting no, or no strong correlation with resilience indicators, tough one could expect the opposite. Examples include some of the variables measuring the quality of governance (for example, government efficiency or the control of corruption), measures of educational attainment or the income stabilization ability of the fiscal system. This result surely deserves further investigation.

[27] It means that there are many variables that bring in additional explanatory power only once political stability (or one of the other best performing regressors in the univariate model) has already been controlled for.

[28] We have also experimented with running separate regressions for resilience indicators defined only for the core-economic variables. In general, the results are fairly similar, with some noticeable changes. In particular, for the impact, expenditures on social protection remain the best single characteristic, while investment becomes much more important for the core-economic variables. For the medium-run, there is some improvement in the fit. Finally, for the bouncing forward, two out of the top ten performers drop in their predictive power when switching between the two sets of variables (foreign competition index and trust in the financial system).

# 5 Additional analyses at the regional level

This section reports some additional findings that emerged from JRC studies conducted at the regional level, pointing to important future research directions.

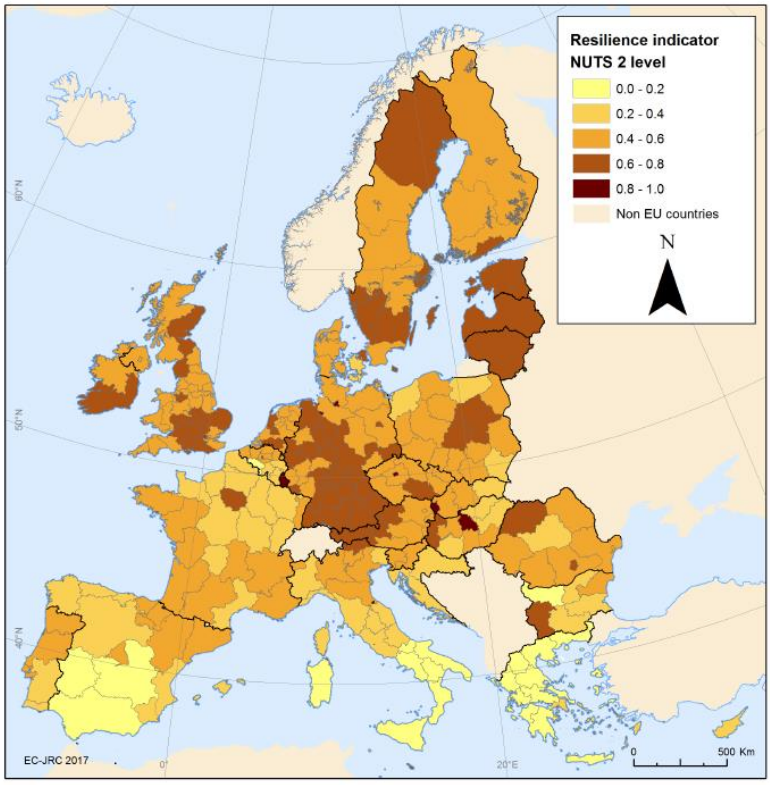
The first contribution relates to a JRC study aimed at measuring economic resilience at the regional level. It opens a major avenue for future research, which could extend the detailed analysis on socio-economic resilience and its characteristics from the country to the regional or even city level.

The second part of this section presents an ongoing analysis looking at the short- and long-run impact of globalization on regional income inequality and economic performance, which will help understanding how and how much regions can harness globalization and bounce forward.

## 5.1 Economic resilience of the EU regions

The JRC has developed a preliminary indicator of resilience at the regional level, building on the behaviour of GDP per capita, employment and productivity (see Pontarollo and Serpieri, 2017, and Joint Research Centre, 2017a). This composite index has been constructed for 263 NUTS-2 regions. Figure 10 illustrates the resilience of these regions to the financial crisis. The regional resilience indicator varies between 0 and 1, where the smaller values (lighter) indicate the less resilient regions, and the higher (darker) the more resilient ones.

Figure 10: Regional resilience over the period 2000-2015 by NUTS2.




Source: JRC calculations, using Cambridge Econometrics European Regional Database data.
Light indicates low, dark indicates high resilience.

As expected, the consequences of the crisis were not uniform across EU regions. Strong disparities in the impact and recovery can be observed. Regions in Mediterranean countries were the most affected by the crisis, and the least able to recover owing to their structural problems. At the same time, Germany and Northern countries exhibited stronger absorptive and adaptive capacities.

The lack of competitiveness, heavy indebtedness, and large exposure to financial markets have plunged Greece, Italy, Portugal and Spain into a recession deeper than in many other European countries. However, the effects are not uniform even across regions of the same country, as some of them have shown a much lower resilience than others. For example, a combination of strong economic activity, more stable public finances and a favourable political environment helped Germany to recover faster overall. Its western regions, however, were substantially more resilient than the eastern ones.

The construction of these regional indicators shares many features of the approach presented in the previous Sections, but there are also differences. Most importantly, while in the country level analysis we distinguish between different aspects and capacities of resilience, the regional indicator is a single composite one. When comparing its country-level average values to the indicators used for the country-level analysis, it is quite similar to the recovery and medium run measures, but there are some differences. It is left for future work to synthetize these different approaches.

The 2017 edition of the European Territorial Trends (Joint Research Centre, 2017a) presents a further analysis of regional competitiveness. Building an indicator using regional characteristics of GDP, employment, productivity and demography, regional competitiveness is shown to depend not only on the features of each individual region, but on those of surrounding regions (neighbouring effects). These spillovers go beyond national borders, and also affect regional resilience. This points to the need to evaluate regional (e.g. sub-national) imbalances, not only in terms of GDP, but also productivity, employment and demography.

The development of the Regional Resilience and Regional Competitiveness indicators is part of a wider framework in support to European territorial policies, carried out in the LUISA Territorial Modelling Platform.

## 5.2 The resilience of regions to competition shocks

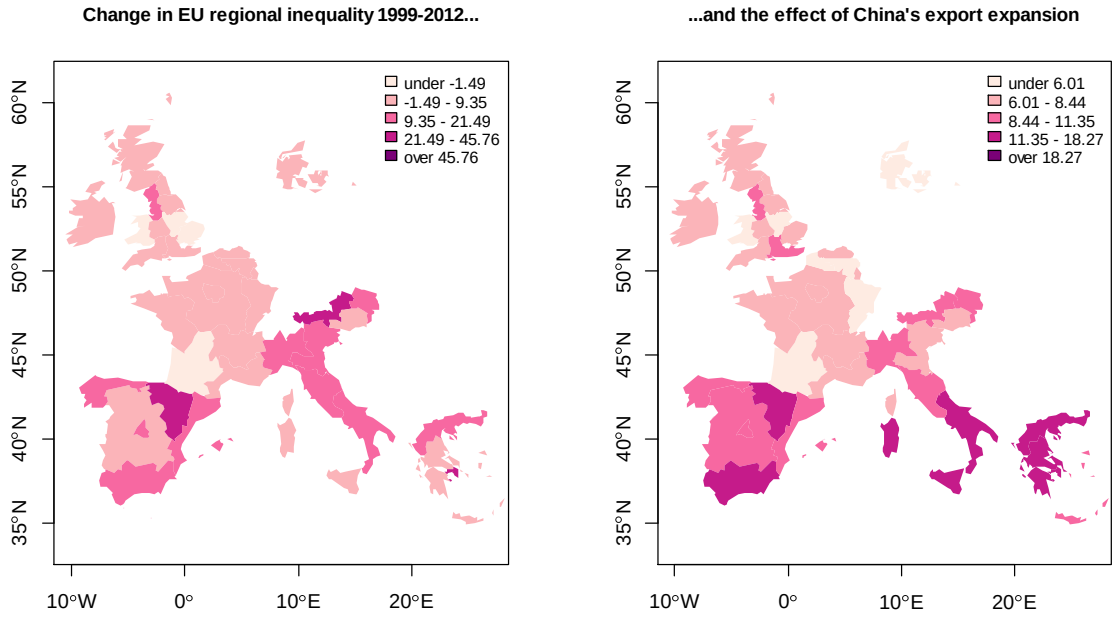
In a recent paper, Cseres-Gergely and Kvedaras (2018) look at regional income inequality in EU15 countries during the 2000s, and analyse the role of China’s entry into the World Trade Organisation (WTO) at the end of 2002. China's exports increased dramatically after its entry into the WTO. The analysis seeks to uncover how much of the change in regional household income inequality over time can be attributed to the implied trade pressure. It follows similar ideas as Autor *et al.* (2016).

The units of the analysis are NUTS1 regions within the EU15. Two channels through which the competitive pressure reaches firms are analysed. First, pressure can change the income distribution *within a sector* in a way that is not obvious to foresee: wages can either rise or drop at different points of the income distribution (*within* sector channel). This depends on whether the importance of a given type of occupation is more valuable in staying competitive or slated to be laid off to cut costs. Second, the employment share of the

affected sector in regional employment decreases if it cannot withhold the pressure, through both layoffs and the exit of firms (*between* sector channel). Such selection happens at the firm level, but can be seen as part of the process through which regional economies transform.

The study captures competitive pressure dynamics by the share of China in global trade and the ratio of Chinese exports to regional economic activity.[29] Then it uses panel regressions to model its effect on regional inequality and industry labour shares. Results show that inequality within regions would have increased in any case, but the trade pressure contributed explaining about half of the changes (mostly increases), through both channels described above. Figure 11 shows that the effect of the trade pressure explains a considerable part of the change in inequality from 1999 to 2012, especially in some regions of the Mediterranean countries and the United Kingdom.

Figure 11: Change in the log variance of net household income from 1999 to 2012, total (left panel) and the part attributable to the expansion of Chinese exports as explained by the model (NUTS1 regions.




Source: JRC calculations from microdata of the European Community Household Panel (1999 figures) and the EU SILC (2012 figures). Preliminary results, Germany not included.

The current research stops at household income inequality as an outcome, but the setup promotes future analyses extended towards the resilience of regional economies, in particular their ability to take advantage of the competition pressure and bounce forward. Competition pressure is a shock affecting the engine of the economy, in particular the operation of the firms, through which the local economy reconfigures itself. The current analysis can be interpreted as a first step, where the resilience of a single system variable, inequality, is assessed.

[29] The analysis considers both "global" trade pressure from China on the country (ratio between the Chinese exports worldwide and the country exports worldwide) and "domestic" trade pressure from China on the country (ratio between the Chinese exports in the country and the value added of manufacturing in the country).

Research on the effects of globalisation is ongoing, and resilience to the shock of external competition on the global market is its main theme. Consumers usually gain from globalisation. Opening to international trade was however shown to be capable of inducing large and lasting drops in employment and wages if the reconfiguration of regional markets is slow – see Dix-Carneiro and Kovak (2017) for evidence from Brazil. This is in line with the more general result of Pascali (2017), showing that globalisation seems to benefit only countries with well-functioning institutions.

Firms of opening economies, at least those that are able to export and actually do so, could gain more than a quarter of their productivity by switching to importing better quality intermediate goods – see Halpern *et al.* (2015) for results from post-socialist transition. The long-term survival of firms seems to require a change of technology as well, both in the form of increased innovation activity, and as an increased preference for a more skilled workforce – see Bloom *et al.* (2016) for an analysis of the reconfiguration process during the recent rise of China. The shock yields in this case more efficient operation and hence a bouncing forward, but only for the survivors of the process.

# 6 Conclusions

This paper has shed some light on how EU countries have responded to the crisis. In particular, it has addressed the following questions. Which countries showed a resilient behaviour during and after the crisis? Is resilience related only to the economic dimension? Has any of the EU countries been able to use the crisis as an opportunity and 'bounce forward'? Is it possible to identify any particular country characteristic linked to resilience?

The exercise has led to the following main results and conclusions.

- Results from a narrow exercise focusing on macroeconomic and financial variables confirm the validity of the measurement approach. For instance, and not surprisingly, Germany appears to be among the most resilient countries. Ireland has been severely hit by the crisis but also showed a good absorptive capacity. Italy seems to be still struggling with the recovery, while Greece suffered the most serious consequences of the crisis.
- Ranking countries according to their resilience is not obvious. Their resilience performance depends on the indicator of reference: countries that are more resilient in their short-term response may not necessarily be the ones better performing in the medium-term. For example, while Germany and Poland appear to be among the most resilient countries both in the short and in the medium run, Bulgaria and the Baltics score better in the medium than in the short run.
- For a deep understanding of resilient behaviour and the associated underlying country characteristics, the social dimension needs to be taken into account. Broadening the perspective has an impact on the resilience assessment of a number of countries. For instance, when considering social variables such as social exclusion, happiness, health expenditures and wages, Bulgaria looks more resilient than when focussing only on economic and financial aspects. On the opposite, Hungary looks less resilient when the social dimension is factored in. The importance of this broader perspective further reinforces the case for the recent endorsement of the European Pillar of Social Rights,[30] and for the inclusion of the social dimension in the work of the European Semester.
- We assess whether countries have been overall able to bounce forward, i.e. to improve their situation compared to the pre-crisis period. Countries' performance in this respect is substantially heterogeneous across Member States: while Croatia, Cyprus, Greece, Italy, the Netherlands, Slovenia and Spain still lag behind their pre-crisis performance in the majority of relevant socio-economic dimensions, countries like Germany, Malta and Slovakia managed to bounce forward in many areas.
- When looking at the bouncing forward performance by individual variables, some patterns emerge. In most countries, active labour market measures, productivity and R&D expenditures have increased compared to their pre-crisis level. Countries have been generally able to bounce forward more as far as monetary aspects of wellbeing (GDP, consumption and income) are concerned, compared to non-monetary aspects of wellbeing (e.g. happiness, inequality, social exclusion and the share of young people not in employment, nor education, nor training). This latter finding confirms the need to consider the social dimension.

[30] https://ec.europa.eu/commission/sites/beta-political/files/social-summit-european-pillar-social-rights-booklet_en.pdf

- The analysis tested around 200 candidate resilience characteristics. Some result to be associated with resilient behaviour, and therefore could indicate entry points for policies to increase countries' resilience to economic and financial crises.
- Country characteristics differ in their association with resilience in the short- and the medium-run. Countries thus need to use a combination of different policies to enhance both their short- and medium-run resilience.
- No single characteristic can explain resilience alone. This is even truer when trying to characterize resilient behaviour over the medium-run, including the capacity of a system to bounce forward. This confirms that the absorption, and even more the adaptation and transformation processes, are shaped by multiple factors.
- High values of pre-crisis government expenditures on social protection are associated with a less dramatic crisis impact. The importance of the expenditure on social protection is in line with results obtained in a previous JRC analysis on the quality of life.
- Countries that, in the early period of the crisis, were characterized by higher political stability performed better in the medium run.
- Countries that were better able to 'bounce forward' tend to be characterized by a better alignment of wages and productivity, and more generally by a more effective business environment.
- Countries that are net creditors vis-`a-vis the rest of the world tend to be more resilient than net debtors in all dimensions analysed.
- Some of the candidate characteristics related to the quality of government and institutions, the educational system, and the income stabilization ability of the fiscal system do not show up among the most relevant in determining the resilience of a country. This may call for further investigation.

At a more general level, the analysis contributes to resilience thinking in the following four respects:

- We develop a measurement framework for the quantitative assessment of resilience.
- We broaden the perspective by considering the socio-economic system as a whole, beyond purely economic aspects.
- We emphasize the concept of 'bouncing forward', linked to a definition of resilience where crises are taken as opportunities to actually transform and improve.
- We identify some underlying resilience characteristics that may be associated with resilient behaviour.

Extending this analysis to a regional level is a major future research line. A territorial analysis has already revealed a large degree of regional heterogeneity in the levels of resilience to the crisis. Moreover, regional resilience may vary even within countries.

Research is currently ongoing on the effects of globalisation and the resilience of regions to the shock of increased competition on the global market. While preliminary results stop at income inequality as an outcome, showing that globalisation plays a role in increasing income inequality at the level of regions, future analyses will extend towards the overall resilience of regional economies, in particular their ability to take advantage of the competition pressure, harness globalization and bounce forward.

## References


Alesina, A., O. Barbiero, C. Favero, F. Giavazzi, and M. Paradisi (2017). 'The Effects of Fiscal Consolidations: Theory and Evidence', *NBER Working Paper* No. 23385

Alessi, A., and C. Detken (2011). 'Quasi Real Time Early Warning Indicators for Costly Asset Price Boom/Bust Cycles. A Role for Global Liquidity', *European Journal of Political Economy*, Vol. 27, Issue: 3, 520-533.

Alessi, A., and C. Detken (2017). 'Identifying excessive credit growth and leverage', *Journal of Financial Stability*, available online July 2017.

Arjona, R., M. Ladaique, and M. Pearson (2002). 'Social Protection and Growth', *OECD Economic Studies*, Vol. 2002/2.

Autor, D. H., D. Dorn, and G. H. Hanson (2016). 'The China Shock: Learning from Labor-Market Adjustment to Large Changes in Trade', *Annual Review of Economics,* 8(1), 205–240.

Beqiraj, E., G. Di Bartolomeo, M. Di Pietro and C. Serpieri (2017). 'Resilience, crisis contagion, and vulnerability in Central Europe and the Baltics', *JRC Technical Reports* 109632.

Bloom, N., M. Draca, and J. Van Reenen (2016). 'Trade Induced Technical Change? The Impact of Chinese Imports on Innovation, IT and Productivity', *The Review of Economic Studies,* 83 (1), 87–117.

Brůha, J. and and O. B. Kucharčukova (2017). 'An Empirical Analysis of Macroeconomic Resilience: The Case of the Great Recession in the European Union', *Czech National Bank Working Papers*, 10/2017.

Caldera-Sanchez, A., A. de Serres, F. Gori, M. Hermansen and O. Röhn (2016). 'Strengthening economic resilience: insights from the post-1970 record of severe recessions and financial crises', *OECD Economic Policy Papers* No. 20.

Cingano, F. (2014). 'Trends in Income Inequality and its Impact on Economic Growth', *OECD Social, Employment and Migration Working Papers*, No. 163, OECD Publishing, Paris.

Costanza, R., J. Cumberland, H. Daly, R. Goodland, and R. Norgaard (1997). 'An Introduction to Ecological Economics', St. Lucie Press, Boca Raton.

Cseres-Gergely, Z., and V. Kvedaras (2018). 'Trade Pressure from China and Regional Income Inequality in Europe in the 2000s', *JRC Technical Reports*, forthcoming.

Dix-Carneiro, R., and B. K. Kovak (2017). 'Trade Liberalization and Regional Dynamics', *American Economic Review*, 107 (10), 2908–2946.

Dolls, M., C. Fuest, and A. Peichl (2012). 'Automatic Stabilizers and Economic Crisis: EU vs. US', *Journal of Public Economics* 96 (3), 279-294.

Duval, R. and L. Vogel (2008). 'Economic resilience to shocks: The role of structural policies', *OECD Journal: Economic Studies*, Vol. 2008/1.

European Commission (2017). 'Economic resilience in EMU. Thematic discussions on growth and jobs', Note for the Eurogroup, Directorate General Economic and Financial Affairs. https://www.consilium.europa.eu/media/23535/eurogroup-15-september-item1-com-note-economic-resilience-in-emu.pdf

European Central Bank (2016). 'Increasing resilience and long-term growth: the importance of sound institutions and economic structures for euro area countries and EMU', *Economic Bulletin*, Issue 5.

Fan, S., and N. Rao (2003). 'Public spending in developing countries: trends, determination, and impact', *EPTD discussion papers* No. 99, International Food Policy Research Institute (IFPRI).

Halpern, L., M. Koren, and A. Szeidl (2015). 'Imported Inputs and Productivity', *American Economic Review,* 105 (12), 3660–3703.

International Monetary Fund (2016). 'A Macroeconomic Perspective on Resilience', Note to the G20.

Johansson, Å. (2016). 'Public Finance, Economic Growth and Inequality: A Survey of the Evidence', *OECD Economics Department Working Papers*, No. 1346, OECD Publishing, Paris.

Joint Research Centre (2016). 'Public spending targeting social outcomes', *JRC Report* 104919.

Joint Research Centre (2017a). 'European Territorial Trends - Facts and Prospects for Cities and Regions Ed. 2017', *JRC Science for Policy Report*, JRC107391. http://publications.jrc.ec.europa.eu/repository/bitstream/JRC107391/jrc107391_ett-2017_v11_online.pdf

Joint Research Centre (2017b). 'Final report on automatic stabilisation mechanisms in the EU', *JRC Science for Policy Report* JRC109150, forthcoming.

Manca A. R., P. Benczur, and E. Giovannini (2017). 'Building a Scientific Narrative Towards a More Resilient EU Society', *JRC Science for Policy Report,* JRC28548. http://publications.jrc.ec.europa.eu/repository/bitstream/JRC106265/jrc106265_100417_resilience_scienceforpolicyreport.pdf

Martinez Turegano D. and R. Marschinski (2017). 'Exploratory work on drivers of labour income inequality within EU countries', *JRC Technical Report*, forthcoming.

Mourre, G., C. Astarita and S. Princen (2014). 'Adjusting the budget balance for the business cycle: the EU methodology', *European Economy Economic Papers* 536, November 2014.

OECD (2017). 'How technology and globalisation are transforming the labour market', *OECD Employment Outlook 2017*, 3, 81-124. http://dx.doi.org/10.1787/empl_outlook-2017-7-en

Ostry, J. D., A. Berg, and C. G. Tsangarides (2014). 'Redistribution, Inequality, and Growth', *IMF Staff Discussion Note* 14/02.

Pascali, L. (2017). 'The Wind of Change: Maritime Technology, Trade, and Economic Development', *American Economic Review* 107 (9), 2821–2854.

Pontarollo, N. and C. Serpieri (2017). 'A Composite Policy Tool to Measure Territorial Resilience Capacity', *JRC Technical Report*, forthcoming.

Roca, T. and H. Ferrer (2016). 'Resilience to crisis through social protection: Can we build the case?', *WIDER Working Paper*, No. 2016/96.

Sondermann, D. (2016). 'Towards more resilient economies: the role of well-functioning economic structures', *ECB Working Paper Series*, No 1984.

Sutherland, D. and P. Hoeller (2014). 'Growth Policies and Macroeconomic Stability', *OECD Economic Policy Papers* No. 8.

## Annex 1. Glossary of definitions

**Ingredients of the system**: the main elements of the system. The first element is *assets*, i.e., the inputs of the system, including natural, human, social and built capital (as in the "four capitals" approach to sustainability). The second element is the *'engine'* of the entire socio-economic, political and environmental system, which connects assets with the third element, outcomes. The engine includes eco system services, socio system services, and institutions in a very general sense (markets, infrastructures, businesses and research, policies and communities), shaping the production process and utilizing the available capitals to produce outputs. *Outcomes* include variables that are ingredients or proxies of individual and societal wellbeing (including negative outcomes like waste), and also investment in the assets.

**Resilience characteristics**: observable and measurable features of a system that prove to be positively associated with a resilient behaviour.

**Resilience indicators**: composite indicators based on the aggregation of resilience metrics across certain groups of system variables.

**Resilience metrics**: quantitative properties of the response of a system variable to a shock, related to resilience. In this study, we have considered the depth of the impact, the extent of the recovery, the medium-run performance and the bouncing forward capacity. Others can include the time to recover, the difference between the pre-shock and the post-shock trend, or the cumulated difference between the actual response and a no-shock counterfactual.

**System variables**: observable variables that describe the functioning of a certain part of the system. For assets, examples could be the value of residential real estate (dwellings), government expenditures on education, self-perceived fairness and trust. For the engine: firm productivity, R&D expenditures, labour market policies, trust in the legal system; while for outcomes: quality of life measures, GDP, consumption, unemployment.

**Core-economic variables:** the set of variables describing the most important financial and economic aspects of system (see Annex 2 for the complete list).

**System view**: set of variables describing the system including both the core-economic variables and the socio-economic ones (see Annex 2 for the complete list).

## Annex 2: Detailed information on the variables

### Core-economic variables

The group of *core-economic* and financial variables comprises 13 variables. This set is of course very small compared to the innumerable variables related to the real economy and financial markets, whose developments have been influenced by the crisis. However, it is large enough to cover various parts of the economic and financial system, including output, consumer prices, the labour market, asset prices, financial markets, and public finances.

As for economic developments, to measure the output loss over the crisis period we use the real Gross Domestic Product (GDP) as a reference variable, which is classified as an outcome according to the *system view*. We also include (real) investment, i.e. one of the components of GDP, which is at the same time an output and an asset.[31] To account for price developments, we consider upside and downside deviations of consumer price inflation from the 2% target level.

Turning to the labour market, we consider both the unemployment rate and the employment rate, which are both classified as outcomes according to the *system view*. However, while the former has a clearly negative connotation, the latter can be positively related to the concept of wellbeing.[32] A third variable related to the labour market is labour productivity, which is expressed as real output per total hours worked in a year.

Asset prices are a crucial ingredient when assessing resilience in the context of economic and financial crises. In fact, the literature shows that asset price booms, in particular when they are leverage-fuelled, are good early warning indicators of future crises (see Alessi and Detken 2011, 2017). Hence, we include in our analysis stock prices, which started plummeting at the end of 2007, and house prices, which have also seen a huge drop at the aggregate European level after having grown substantially in the run-up to the crisis. Following years in which excessive credit growth was fuelling booming asset prices, a severe credit crunch hit the real economy. To measure the depth of the credit crunch, and general credit market developments and conditions, we used three measures. The first is the level of the aggregate private sector debt (as a ratio to GDP), i.e. debt securities and loans held by households and non-financial corporations. The second and the third measures are more disaggregated, and correspond to lending to non-financial corporations and lending to households, respectively. Asset prices and financial markets more in general belong to the engine, according to the *system view*.

Finally, we consider public finances, which have worsened due to the crisis in particular in some vulnerable countries. To do so, we include in the analysis the two reference variables, i.e. government debt (in percentage of GDP) and the government budget balance (also as a percentage of GDP). The government, as an institution, belongs to the engine according to the *system view*.

Further details are reported in Table 4 below.

[31] In the analyses distinguishing the three system components, we classify investments as an asset.

[32] It is worth recalling that while the unemployment rate corresponds to the share of unemployed persons over the labour force (i.e. the total number of people employed or actively seeking work), the employment rate is computed as the number of persons employed over the total population. Hence, the two variables are not the plain mirror image of each other.

**The system view**

This group contains 21 additional variables, spanning the entire system in a balanced way, and shifting the emphasis towards individuals, and individual and societal wellbeing. Table 4 provides detailed definitions, data sources and specific information on each system variable included in the analysis. Here we only briefly present their list, according to their place in the system (though the classification of some of the variables is not straightforward).

*Assets*

Social capital: perceived fairness in the society, the level of trust among people, government expenditures on health.

Human capital: government expenditures on education.

Built capital: (real) value of the dwelling stock.

*Engine*

Markets: share of temporary contracts, (real) compensation per employee, labour market policies (active and passive).

Business and research: total expenditures on R&D.

Communities and social ties: intensity of social activities.

Institutions: citizens' level of trust in the EU Parliament and in the legal system.

*Outcomes*

Wellbeing: self-perceived health, life satisfaction, happiness, (real) household consumption, household (real) disposable income.

Negative outcomes: poverty and social exclusion, income inequality, NEET (share of young people who are Not in Education, Employment, or Training).

The data source for the vast majority of the system variables, particularly for the standard economic and financial indicators, is Eurostat. Stock prices are from Bloomberg. To cover social and wellbeing aspects, we use various questions from the European Union Statistics on Income and Living Conditions (EU-SILC), the European Social Survey (ESS) and the European Quality of Life Survey (EQLS).

**Table 4: List of system variables**

| Nr. | System Variables | | Source | Definition/Construction | Time period | System part | Core view | Adjustment |
|---|---|---|---|---|---|---|---|---|
| | Shorthand | Name | | | | | | |
| **V1** | CORP. LOANS | Loans to Non-Financial Corporations | Eurostat | Loans to Non-Financial Corporations (million Euros) | 2004-2016 | Engine | 1 | % difference from 2007 level (see notes) |
| **V2** | DWELLINGS | Value of dwellings | Eurostat | Balance sheets for non-financial assets dwellings in current prices million euros divided by consumer price index | 2000-2014 | Asset | 0 | Log transformation of deflated measure |
| **V3** | EMPLOYMENT | Employment Rate | Eurostat | Number of persons aged 20 to 64 in employment by the total population of the same age group | 2000-2016 | Outcome | 1 | |
| **V4** | EXP. EDUCATION | Government Expenditures on Education | Eurostat | Government Expenditures on Education, per GDP value multiplied by GDP, chain linked volumes (2010), million euro | 2000-2015 | Asset | 0 | Log transformation |
| **V5** | EXP. HEALTH | Government Expenditures on Health | Eurostat | Government Expenditures on Health, per GDP value multiplied by GDP, chain linked volumes (2010), million euro | 2000-2015 | Asset | 0 | Log transformation |
| **V6** | EXP. R&D | Total expenditures on R&D | Eurostat | Government Expenditures on R&D, million purchasing power standards (PPS) at 2005 prices | 2003-2015 | Engine | 0 | Log transformation |
| **V7** | FAIRNESS | Self-perceived fairness | ESS | Survey based –subjective measure. The survey question "Most people try to take advantage of you if they got the chance, or try to be fair". The variable is the share of those answering 7 to 10 (agree with fairness) out of a scale of 10. | 2002-2014, biannual | Asset | 0 | |
| **V8** | GDP | Gross Domestic Product | Eurostat | Real GDP volume, index 2010 = 100 | 2000-2016 | Outcome | 1 | Log transformation |
| **V9** | GOV. DEBT | Government debt | Eurostat | Government debt as percentage of GDP | 2000-2016 | Engine | 1 | |
| **V10** | GOV. DEFICIT | Government budget balance | Eurostat | Government budget balance as percentage of GDP | 2000-2016 | Engine | 1 | |
| **V11** | HAPPINESS | Happiness | EQLS | Survey based –subjective measure. The survey question "How happy are you?" The variable is the share of those answering 7 to 10 ( the happiest) out of a scale of 10 | 2003, 2007, 2011, 2016 | Outcome | 0 | |
| **V12** | HEALTH | Self-perceived health | EU SILC | Survey based –subjective measure. Share of respondents indicating a level of "good" or "very good" (the top two out of 5) | 2006-2015 | Outcome | 0 | |
| **V13** | HH CONSUMPTION | Household Consumption | Eurostat | Household Consumption, volume index 2010=100 | 2000-2016 | Outcome | 0 | Log transformation |

| Nr. | System Variables | | Source | Definition/Construction | Time period | System part | Core view | Adjustment |
|---|---|---|---|---|---|---|---|---|
| | Shorthand | Name | | | | | | |
| **V14** | HH INCOME | Household disposable income | Eurostat | Household real gross disposable income, PPS per capita | 2002-2015 | Outcome | 0 | Log transformation |
| **V15** | HH LOANS | Household loans | Eurostat | Loans to Households as percentage of GDP | 2000-2016 | Engine | 1 | (see notes) |
| **V16** | HOUSE PRICES | House Prices Index | Eurostat | House Prices Index, 2015=100 | 2000-2016 | Engine | 1 | Log transformation |
| **V17** | INEQUALITY | Inequality | Eurostat | The S80/S20 ratio. The S80 is the share of income held by the 80-10 percentile of the income distribution; while S20 is the share held by the 0-20. | 2006-2015 (HR 2010-, ROM 2007-) | Outcome | 0 | Log transformation |
| **V18** | INFLATION | Inflation deviation | Eurostat | Absolute deviation of inflation from 2 percent. | 2000-2016 | Engine | 1 | |
| **V19** | INVESTMENT | Investment | Eurostat | Gross fixed capital formation, volume index 2010=100. It includes capital formation of resident producers' acquisitions, less disposals, of fixed tangible or intangible assets. This covers in particular machinery and equipment, vehicles, dwellings and other buildings. | 2000-2016 | Asset | 1 | Log transformation |
| **V20** | LABOUR PROD. | Labour productivity | Eurostat | Labour productivity index, 2010=100. Real output per total hours worked in a year. | 2000-2016 | Engine | 1 | Log transformation |
| **V21** | LMP ACTIVE | Active Labour Market Policies | Eurostat | Total active labour market policies (LMP measure 2-7), per GDP value multiplied by GDP, chain linked volumes (2010), million euro | 2000-2015 | Engine | 0 | Log transformation |
| **V22** | LMP PASSIVE | Passive Labour Market Policies | Eurostat | Total passive labour market policies (LMP support 8-9), per GDP value multiplied by GDP, chain linked volumes (2010), million euro | | Engine | 0 | Log transformation |
| **V23** | NEET | Not in employment nor in education and training | Eurostat | Young people (15-24 years) neither in employment nor in education and training, percentage of the total population in the same age group | 2002-2016 | Outcome | 0 | |
| **V24** | PRIVATE DEBT | Private debt | Eurostat | Private debt (loans and securities) as percentage of GDP | 2003-2015 | Engine | 1 | |
| **V25** | SATISFACTION | Life Satisfaction | EQLS | Survey based –subjective measure. The survey question: "How satisfied would you say you are with your life these days?" The variable is the share of those answering 7 to 10 on a scale from 1 (very dissatisfied) to 10 (very satisfied) | 2003, 2007, 2011, 2016 | Outcome | 0 | |
| **V26** | SOCIAL ACTIVITY | Social ties | ESS | Survey based –subjective measure. The survey question: How often people socially meet with friends, relatives or colleagues. The variable includes those answering they meet every day. | 2002-2014, biannual | Engine | 0 | |

| Nr. | System Variables | | Source | Definition/Construction | Time period | System part | Core view | Adjustment |
|---|---|---|---|---|---|---|---|---|
| | Shorthand | Name | | | | | | |
| **V27** | SOCIAL EXCLUSION | At risk of poverty or social exclusion | Eurostat | Share of people at risk of poverty or social exclusion (AROPE), as percentage of total population. AROPE refers to the situation of people either at risk of poverty, or severely materially deprived or living in a household with a very low work intensity. | 2006-2015 | Outcome | 0 | |
| **V28** | STOCK PRICES | Stock Price Index | Bloomberg | Stock Price Index | 2000-2016 | Engine | 1 | Log transformation |
| **V29** | TEMPORARY WORK | Temporary contracts | Eurostat | Share of people having a temporary contracts, from 20 to 64 years, as percentage of total employment | 2003-2016 | Engine | 0 | |
| **V30** | TRUST EP | Trust in the European Parliament | ESS | Survey based- subjective measure. The share of respondents answering 7-10 on a scale from 0 (not trust at all) to 10 (complete trust) | 2002-2014, biannual | Engine | 0 | |
| **V31** | TRUST LEGAL | Trust in the legal system | ESS | Survey based- subjective measure. The share of respondents answering 7-10 on a scale from 0 (not trust at all) to 10 (complete trust) | 2002-2014, biannual | Engine | 0 | |
| **V32** | TRUST PEOPLE | Self-perceived trust | ESS | The survey question "Most people can be trusted or you can't be too careful". The variable is the share of those answering 7 to 10 (agree with trust). | 2002-2014, biannual | Asset | 0 | |
| **V33** | UNEMPLOYMENT | Unemployment | Eurostat | Unemployed persons as a percentage of the labour force (15-74 years) . The labour force is the total number of people employed and unemployed. | 2000-2016 | Outcome | 1 | |
| **V34** | WAGES | Real Wage | Eurostat | Compensation of employees per hour worked in Purchasing Power Standard (PPS) deflated by EU28 Consumer Price Index | 2000-2016 | Engine | 0 | Log transformation |

Notes. ESS: European Social Survey, EQLS: European Quality of Life Survey, EU SILC: European Union Statistics on Income and Living Conditions. Data for Belgium is available until 2015 for V20. Data for Croatia is available since 2002 for variables (V4, V5, V9, V10, V14, V15 and V28), since 2003 for variable V34, and since 2010 for variable V17. Data for Cyprus is available since 2001 (V5), 2002 (V14), and 2004 (V16). Data for Estonia is available since 2005 for V16. Data for Hungary is available since 2007 for V16. Data for Ireland is available since 2012 (V15) and until 2015 (V16, V1). Data for Latvia is available since 2004 for V15. Data for Lithuania is available since 2004 for V14. Data for Malta is available since 2004 for V15 and missing entirely for V14. Data for Luxemburg is missing entirely for V14. Data for Poland is available since 2002 (V4, V5) and 2008 (V16). Data for Romania is available since 2008 (V16) and 2007 (V17). Data for Slovenia is available since 2002 (V15) and 2003 (V16, V28). Data for Slovakia is available since 2016 for V16.
Due to measurement issues, the value of new corporate and household loans can be negative (in case of more repayments than new disbursements). For this reason, we could not define the percentage drop in household loans relative to its 2007 level. Instead, we resorted to the slightly less informative per GDP variant.

**List of candidate resilience characteristics**

Data sources are the World Bank, the OECD, the Global Competitiveness Index of the World Economic Forum, the Gallup World Poll Survey, the Macroeconomic Imbalance Procedure Scoreboard, Eurostat, the EC digital scoreboard, and the European Institute for Gender Equality.

Data used from the World Bank are: (i) Worldwide Governance Indicators, which aggregate individual governance indicators for six dimensions: voice and accountability, political stability and absence of violence, government effectiveness, regulatory quality, rule of law, control of corruption (http://info.worldbank.org/governance/wgi/#home); (ii) ease of doing business index, which measures business regulations and the protection of property rights. (http://www.doingbusiness.org/reports/global-reports/doing-business-2018)

Data from the OECD are: (i) the Programme for International Student Assessment (PISA), which is a triennial international survey which aims to evaluate education systems worldwide by testing the skills and knowledge of 15-year-old students (http://www.oecd.org/pisa/aboutpisa/); (ii) indicators of employment protection legislation which measure the procedures and costs involved in dismissing individuals or groups of workers and the procedures involved in hiring workers on fixed-term or temporary work agency contracts. (http://www.oecd.org/els/emp/oecdindicatorsofemploymentprotection.htm); (iii) indicators of product market regulation, which measure the degree to which policies promote or inhibit competition in areas of the product market where competition is viable. (http://www.oecd.org/eco/growth/indicatorsofproductmarketregulationhomepage.htm#indicators)

For the Global Competitiveness Index, all variables and pillars related to 2007, 2008-2010 have been included in the analysis. Due to limited country coverage and/or irrelevance, the following details items had to be excluded though: Business Impact of Malaria, Malaria Prevalence, Country Credit Ranking, Effect of taxation on incentives to invest, Effect of taxation on incentives to work, Country capacity to retain and Country capacity to attract talents, International Internet bandwidth, Mobile broadband subscription, PCT patents. For the following, we could only use their 2010 values: Irregular payments and bribes, Efficiency of legal framework in settling disputes, Efficiency of legal framework in challenging regulations, Quality of railroad infrastructure, Transport infrastructure, Electricity and telephony infrastructure, Affordability of financial services, Financial services meeting business needs, Technological adoption and ICT use. (https://www.weforum.org/reports/the-global-competitiveness-report-2017-2018)

The Gallup World Poll measures key indicators such as law and order, food and shelter, job creation, migration, financial life, personal health, civic engagement and evaluative well-being, that are related to other world development indicators. Indicators are supported by individual questions on the same topics.

The indicators in the Macroeconomic Imbalance Procedure (MIP) Scoreboard are used to identify emerging or persistent macroeconomic imbalances in a country. It consists of fourteen scoreboard indicators measuring internal and external imbalances as well as social and labour market developments. (http://ec.europa.eu/eurostat/web/macroeconomic-imbalances-procedure/indicators)

The digital scoreboard measures the performance of Europe and the Member States in a wide range of areas, from connectivity and digital skills to the digitisation of businesses and public services. (https://ec.europa.eu/digital-single-market/en/policies/scoreboard)

The Gender Equality Index of the European Institute for Gender Equality is a composite indicator that measures differences between women and men across the domains of work, money, knowledge, power, time and health (http://eige.europa.eu/gender-equality-index).

Table 5 lists the code, label, source, definition and data availability for our characteristics. For the Global Competitiveness Index, we only include those 16 variables that are discussed in the main text or reported as additional results in Annex 7. Thus, we present a total of 85 characteristics. The variables are first alphabetized by their data source, and then by their label. The symbol * refers to indicators based on European Commission (2017).

**Table 5: List of candidate resilience characteristics**

| Code | Label | Source | Definition | Data availability |
|---|---|---|---|---|
| C1 | Public and private debt | AMECO* | Public and private debt is measured as the sum of consolidated general government gross debt and private sector debt, as a percentage of GDP. | 2007-2016 |
| C2 | Real wages change 07-10 | AMECO* | Change in real wages in percentage points from 2007 to 2010. | 2002-2016 |
| C3 | Unemployment change 07-10 | AMECO* | Change in unemployment in percentage points from 2007 to 2010. | 2000-2017 |
| C4 | Gender Equality Index | European Institute for Gender Equality | Overall index, based on the following dimensions (work, money, knowledge, time, power, health). | 2005, 2010, 2012, 2015 |
| C5 | Active Labour Market Policies | Eurostat | Government expenditures on labour market policy as log of millions euro of LMP measures. Includes training, employment incentives, supported employment and rehabilitation, direct job creation, start-up incentives. | 2000-2015 |
| C6 | At risk of poverty or social exclusion | Eurostat | Share of people at risk of poverty or social exclusion (AROPE), % total population. AROPE refers to the situation of people either at risk of poverty, or severely materially deprived or living in a household with a very low work intensity. | 2005-2016 |
| C7 | Eco-innovation index | Eurostat | Composite index which measures how well individual MS perform in eco-innovation compared to the EU average, which is equated with 100. The index is based on 16 sub-indicators in five thematic areas: eco-innovation inputs, eco-innovation activities, eco-innovation outputs, resource efficiency outcomes and socio-economic outcomes. The overall score of an EU MS is calculated by the unweighted mean of the 16 sub-indicators. | 2010-2012, 2013-2016 |
| C8 | Employment incentive | Eurostat | Labour market policy (LMP) : employment incentives. | 2000-2016 |
| C9 | Fertility rate | Eurostat | Ratio of the number of live births to mothers in their fertility age to the average female population of the same age. | 2000-2015 |
| C10 | GDP Growth | Eurostat | Annual percentage change of real GDP. | 2001-2016 |
| C11 | General government expenditures on education | Eurostat | Total government expenditures on education as percentage of GDP. | 2000-2015 |

| Code | Label | Source | Definition | Data availability |
|---|---|---|---|---|
| C12 | Government Debt | Eurostat | Government debt as percentage of GDP. | 2000-2016 |
| C13 | Government expenditures on health | Eurostat | Total government expenditures on health as percentage of GDP. | 2000-2015 |
| C14 | Government expenditures on social protection | Eurostat | Government expenditures on social protection as percentage of GDP. Its subcategories are sickness and disability 2.8%, old age 10.3%, survivors 1.4%, family and children 1.7%, unemployment 1.3%, housing 0.5%, social exclusion n.e.c. 0.8%, R&D social expenditure 0.0%, social protection not elsewhere classified (n.e.c.) 0.3%. | 2000-2015 |
| C15 | Government expenditures on social protection, excluding pension | Eurostat | Government expenditures on social protection as percentage of GDP ( includes all dimensions but pensions). | 2000-2015 |
| C16 | Gross Domestic Product | Eurostat | Real GDP per capita (expenditure approach), purchasing power parity adjusted, in logs. | 2000-2016 |
| C17 | Investment share | Eurostat | Gross fixed capital formation as percentage of GDP. | 2000-2016 |
| C18 | Non-routine cognitive tasks | Eurostat | Employment rate by type of contract occupation: non –routine cognitive tasks (managers, professionals, and technicians and associate professionals –isco08: 1, 2, 3). | 2000-2016 |
| C19 | Non-routine manual tasks | Eurostat | Employment rate by type of contract occupation : non-routine manual tasks (service and sales workers and elementary occupations –isco08: 5, 9). | 2000-2016 |
| C20 | Out of income maintenance and support | Eurostat | Labour market policy (LMP): expenditures on out of income maintenance and support. | 2000-2015 |
| C21 | Passive Labour Market Policies | Eurostat | Government expenditures on labour market policy as log of millions euro of LMP supports : Out-of-work income maintenance and support, Early retirement. | 2000-2015 |
| C22 | Routine tasks | Eurostat | Employment rate by type of contract occupation : routine manual tasks (service and sales workers and elementary occupations –isco08: 4, 7 and 8). | 2000-2016 |
| C23 | Support to training programmes | Eurostat | Labour market policy (LMP): expenditures on training. | 2000-2015 |
| C24 | Tertiary educational attainment | Eurostat | Percentage of the total population with a tertiary education aged 25-34. | 2000-2015 |
| C25 | Total government expenditures | Eurostat | Total general government expenditures as a percentage of GDP (COFOG classification). | 2000-2015 |
| C26 | Total R&D expenditures | Eurostat | Total R&D expenditures as percentage of GDP. | 2000-2016 |
| C27 | Unemployment | Eurostat | Unemployed persons as a percentage of the labour force (15-74 years). The labour force is the total number of people employed and unemployed. | 2000-2016 |
| C28 | GDP Peak to trough decline | Eurostat* | Peak to trough decline defined as the percentage difference between the maximum level of real GDP in 2007 or 2008 and the level in 2009. | 2000-2016 |
| C29 | Civic Engagement Index | Gallup | The Civic Engagement Index assesses respondents' inclination to volunteer their time and assistance to others. It is designed to measure a respondent's commitment to the community where he or she lives. | 2006-2017 |

| Code | Label | Source | Definition | Data availability |
|---|---|---|---|---|
| C30 | Community Attachment Index | Gallup | The Community Attachment Index measures respondents' satisfaction with the city or area where they live and their likelihood to move away or recommend that city or area to a friend. | 2006-2017 |
| C31 | Community Basics Index | Gallup | The Community Basics Index evaluates everyday life in a community, including environment, housing and infrastructure. Higher values indicate more elevated degree of satisfaction. | 2006-2017 |
| C32 | Ease of finding job | Gallup | This variable contains the percentage of people who affirm favorable conditions for finding a job. | 2006-2017 |
| C33 | Educational system satisfaction | Gallup | This variable contains a percentage of people that are satisfied with the educational system or the schools. | 2006-2017 |
| C34 | Financial Life Index | Gallup | The Financial Life Index measures respondents' personal economic situations and the economics of the community where they live. Higher values of index indicate more people living comfortably on their present income. | 2006-2017 |
| C35 | Food and Shelter Index | Gallup | The Food and Shelter Index assesses the ability people have to meet basic needs for food and shelter. Lower scores on this index indicate that more respondents reported struggling to afford food and shelter in the past year, while higher scores indicate fewer respondents reported such struggles. | 2006-2017 |
| C36 | Food security | Gallup | This variable contains the percentage of people who had enough money for food expenditures. | 2006-2017 |
| C37 | Job Climate Index | Gallup | The Job Climate Index measures the attitudes about a community's efforts to provide economic opportunities, in particular whether there is a positive perception of economic conditions evolution, or favourable conditions to find a job. | 2006-2017 |
| C38 | Living standard evolution | Gallup | The variable contains the percentage of people who declare that their living standard is getting better. | 2006-2017 |
| C39 | National Institutions Index | Gallup | The National Institutions Index reflects citizens' confidence in key institutions prominent in a country's leadership: the military, the judicial system, the national government and the honesty of elections. | 2006-2017 |
| C40 | Automatic Income stabiliser | JRC | Level of automatic income stabilization for households in EU countries (see Annex 3 for detailed description). | 2014 |
| C41 | Activity rate | Macroeconomic Imbalance Procedure | The activity rate is the percentage of economically active population aged 15-64 on the total population of the same age. | 2003-2016 |
| C42 | Current account balance | Macroeconomic Imbalance Procedure | Current account provides information about the transactions of a country with the rest of the world. It covers all transactions (other than those in financial items) in goods, services, primary income and secondary income which occur between resident and non-resident units. Here It is expressed as % of GDP and taken as a 3 year average. | 2007-2016 |
| C43 | Net intl. investment position | Macroeconomic Imbalance Procedure | Net international investment position is based on the difference between an economy's external financial assets and liabilities.It provides an aggregate view of the net financial position (assets minus liabilities) of a country vis-à-vis the rest of the world. It is expressed as % of GDP | 2006-2016 |
| C44 | Export market share | Macroeconomic Imbalance Procedure | Export market share measures the degree of importance of a country within the total exports of the region/world. For the calculation at current prices, the market share refers to the world trade (world export market share). The indicator is Export market shares (goods and services) - 5 year % change. | 2008-2016 |

| Code | Label | Source | Definition | Data availability |
|---|---|---|---|---|
| C45 | Government gross debt | Macroeconomic Imbalance Procedure | Total gross debt at nominal value at the end of the year and consolidated between and within the sectors of general government, as a percentage of GDP. In this context, the stock of government debt is equal to the sum of liabilities, at the end of year, of all units classified within the general government sector in currency and deposits, debt securities and loans. | 2000-2016 |
| C46 | Real house price index | Macroeconomic Imbalance Procedure | Real house price index is the ratio between the house price index and the national accounts deflator for private final consumption expenditures (households and non-profit institutions serving households). This indicator therefore measures inflation in the house market relative to inflation in the final consumption expenditures of households and NPISHs. The MIP scoreboard indicator is the year-on-year growth rate of the deflated house price index. | 2008-2016 |
| C47 | Long term unemployment rate | Macroeconomic Imbalance Procedure | The long-term unemployment rate is the number of persons unemployed for 12 months or longer as a percentage of the labour force (i.e. economically active population). The MIP Scoreboard indicator is the three years change in percentage points. | 2007-2016 |
| C48 | Net international investment position | Macroeconomic Imbalance Procedure | Net international investment position is based on the difference between an economy's external financial assets and liabilities. It provides an aggregate view of the net financial position (assets minus liabilities) of a country vis-à-vis the rest of the world. It is expressed as a percentage of GDP. | 2005-2016 |
| C49 | Nominal unit labour cost | Macroeconomic Imbalance Procedure | Nominal unit labour cost is the percentage change over three years of nominal unit labour cost, where the unit labour cost is defined as the ratio of labour costs to labour productivity. It is expressed as 3 years percentage change. | 2003-2017 |
| C50 | Private sector credit flow | Macroeconomic Imbalance Procedure | The private sector credit flow represents the net amount of liabilities in which the sectors non-financial corporations and households and non-Profit institutions serving households have incurred along the year. Data are presented in consolidated terms, i.e. data do not take into account transactions within the same sector and expressed as a percentage of GDP. | 2002-2016 |
| C51 | Private sector debt | Macroeconomic Imbalance Procedure | Private sector debt is the stock of liabilities held by the sectors Non-Financial corporations and Households and Non-Profit institutions serving households. The instruments that are taken into account to compile private sector debt are Debt securities and Loans. Data are presented in consolidated terms, i.e. do not taking into account transactions within the same sector, and expressed as a percentage of GDP. | 2001-2016 |
| C52 | Real effective exchange rate | Macroeconomic Imbalance Procedure | Real effective exchange rate aims to assess a country's price or cost competitiveness relative to its principal competitors in international markets. A positive value means real appreciation. The data are presented as 3 years percentage change. | 1997-2017 |
| C53 | Total financial sector liabilities | Macroeconomic Imbalance Procedure | The total financial corporations sector liabilities measure the evolution of the sum of all liabilities (Currency and deposits, Debt securities, Loans, Equity and investment fund shares, Insurance, pensions and standardized guarantees, Financial derivatives and employee stock options and Other accounts payable) of the financial corporations sector . Data are presented in non-consolidated terms, i.e. data take into account transactions within the same sector. The MIP indicator is expressed as year over year growth rate. | 2000-2016 |

| Code | Label | Source | Definition | Data availability |
|---|---|---|---|---|
| C54 | Unemployment rate | Macroeconomic Imbalance Procedure | The unemployment rate is the number of unemployed persons as a percentage of the labour force (the total number of people employed and unemployed) based on International Labour Office (ILO) definition. The MIP scoreboard indicator is the three-year backward moving average. | 2002-2017 |
| C55 | Youth unemployment rate | Macroeconomic Imbalance Procedure | The youth unemployment rate is the unemployment rate of people aged 15 - 24 as a percentage of the labour force of the same age. The MIP Scoreboard indicator is the three years change in percentage points. | 2003-2017 |
| C56 | Change in Credit-to-GDP | Macroeconomic Imbalance Procedure* | Change in Credit-to-GDP is measured as non-consolidated private sector credit flow, in percentage points in 2009. | 2007-2016 |
| C57 | Budget balance elasticity | Mourre at al. (2014)* | Semi-elasticity of the budget balance to the output gap. | 2007-2016 |
| C58 | PISA mathematics score | OECD | Average PISA mathematics score. | 2006, 2009, 2012, 2015 |
| C59 | PISA reading score | OECD | Average PISA reading score. | 2006, 2009, 2012, 2015 |
| C60 | Employment protection legislation | OECD* | The OECD indicator for Employment Protection Legislation refers to individual and collective dismissals. Higher values indicated more regulated labour markets. | |
| C61 | Product market regulation | OECD* | The OECD indicator for Product Market Regulation measure the economy-wide regulatory and market environments. It has higher values for more restricted product markets. | 1998, 2003, 2007, 2013 |
| C62 | Ease of doing business | World Bank | Overall distance to frontier (DTF) dimensions used : depth of credit information(credit information to facilitate lending decisions), private credit coverage, public credit coverage, Procedures required to connect to electricity, Time to resolve insolvency, Credit: Strength of legal rights index, Time required to start a business , Procedures required to start a business, Time to prepare and pay taxes, Tax payments(the total number of taxes and contributions paid by a medium-size business over the course of a yea), Total tax rate (measures the amount of taxes payable by medium-size businesses after accounting for deductions and exemptions). | 2010, 2011-2015 |
| C63 | Trade openness | World Bank | Trade is the sum of exports and imports of goods and services measured as a share of gross domestic product. | 2000-2016 |
| C64 | Worldwide Governance Indicator: Control of corruption | World Bank | Reflects perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests. (ranges from approximately -2.5 (weak) to 2.5 (strong) governance performance). | 2000-2015 |
| C65 | Worldwide Governance Indicator: Government Effectiveness | World Bank | Perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies. It ranges from approximately -2.5 (weak) to 2.5 (strong) governance performance. | 2000-2015 |
| C66 | Worldwide Governance Indicator: Political Stability and Absence of Violence/Terrorism | World Bank | Political Stability and Absence of Violence/Terrorism measures perceptions of the likelihood that the government will be destabilized or overthrown by unconstitutional or violent means, including politically-motivated violence and terrorism. It ranges from approximately -2.5 (weak) to 2.5 (strong) political stability. | 2000-2015 |

| Code | Label | Source | Definition | Data availability |
|---|---|---|---|---|
| C67 | Worldwide Governance Indicator: Regulatory Quality | World Bank | Perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development. It ranges from approximately -2.5 (weak) to 2.5 (strong) regulatory quality. | 2000-2015 |
| C68 | Worldwide Governance Indicator: Rule of Law | World Bank | Measure of the perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular, the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence. It ranges from approximately -2.5 (weak) to 2.5 (strong) confidence. | 2000-2015 |
| C69 | Worldwide Governance Indicator: Voice and Accountability | World Bank | Perceptions of the extent to which a country's citizens are able to participate in selecting their government, as well as freedom of expression, freedom of association, and a free media. It ranges from approximately -2.5 (weak) to 2.5 (strong) participation. | 2000-2016 |
| C70 | Capacity for innovation | World Economic Forum | Perception about the country companies' capacity to innovate, where higher score represent greater extent of innovation perceived. | 2007-2017 |
| C71 | Efficacy of corporate boards | World Economic Forum | Perception about country management being accountable to investors and boards of directors, where higher score represent greater extent of accountability perceived. | 2007-2017 |
| C72 | Exports as a percentage of GDP | World Economic Forum | Exports of goods and services as a percentage of gross domestic product, where the total exports is the sum of total exports of merchandise and commercial services. | 2007-2017 |
| C73 | FDI and technology transfer | World Economic Forum | Perception about the potential of foreign direct investment (FDI) in bringing new technology into the country. Higher scores reveal higher extent of perceived potential. | 2007-2017 |
| C74 | Foreign competition | World Economic Forum | The reported value encompasses the prevalence of non-tariff barriers, trade tariffs, complexity of tariffs, efficiency of customs clearance and services trade openness | 2007-2017 |
| C75 | Foreign market size index | World Economic Forum | Value of exports of goods and services, normalized on a 1–7 (best) scale. | 2007-2017 |
| C76 | GDP (PPP$ billions) | World Economic Forum | Gross domestic product valued at purchasing power parity in billions of international dollars. | 2007-2017 |
| C77 | General government debt % GDP | World Economic Forum | Gross debt consists of all liabilities that require payment or payments of interest and/or principal by the debtor to the creditor at a date or dates in the future, expressed as % GDP. | 2007-2017 |
| C78 | Imports as a percentage of GDP | World Economic Forum | Total imports is the sum of total imports of merchandise and commercial services, expressed as a percentage of GDP. | 2007-2017 |
| C79 | Inflation (annual % change) | World Economic Forum | Annual percent change in consumer price index (year average). | 2007-2017 |
| C80 | Intensity of local competition | World Economic Forum | Perception about the intensity of competition in the local markets? Higher values indicate higher intensity of competition perceived. | 2007-2017 |

| Code | Label | Source | Definition | Data availability |
|---|---|---|---|---|
| C81 | Local supplier quantity | World Economic Forum | Perception about the availability of local suppliers, where higher scores represent more numerous local suppliers. | 2007-2017 |
| C82 | Wages-to-productivity | World Economic Forum | Perception about wages being well-related to employee productivity? Higher values indicate better correspondence between the wages and productivity. | 2007-2017 |
| C83 | Prevalence of foreign ownership | World Economic Forum | Perception about the prevalence is foreign ownership of companies, where high values indicate higher prevalence perceived. | 2007-2017 |
| C84 | Prevalence of trade barriers | World Economic Forum | Perception about the extent in which non-tariff barriers (e.g., health and product standards, technical and labeling requirements, etc.) limit the ability of imported goods to compete in the domestic market. High values indicate that that non-tariff barriers are not very limiting for the competition. | 2007-2017 |
| C85 | Primary education enrolment | World Economic Forum | The reported value corresponds to the ratio of children of official primary school age (as defined by the national education system) who are enrolled in primary school. | 2007-2017 |

** Indicators based on European Commission (2017).*

## Annex 3: JRC studies on specific resilience characteristics

This annex presents results from two complementary JRC studies that help enriching the set of candidate characteristics. We first discuss some findings stemming from a study on income inequality and employment dynamics in the years of the crisis. The study points to the role of different occupation types in resilient behaviour, which motivates one of our resilience characteristics (see Section 4.3). The second section presents some results derived from an analysis on automatic stabilizers using the EUROMOD model,[33] also included in the set of candidate characteristics.

### Employment dynamics and the resilience of different groups of workers

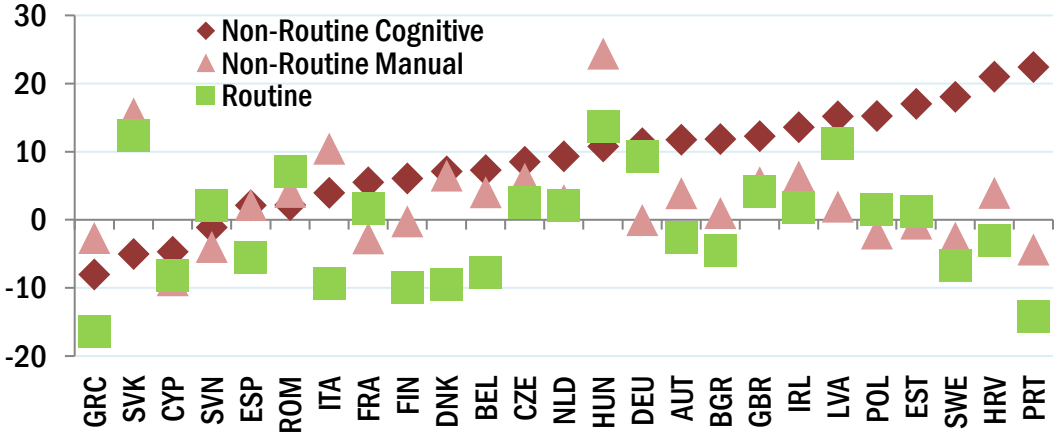
Martinez Turegano and Marschinski (2017) studies the drivers of income inequality and employment dynamics in the EU before and after the financial crises. The study provides evidence of a heterogeneous impact of shocks across different population groups (see Figure 12).

As one specific finding, the study underlines how the crisis took a heavy toll on unemployment in manufacturing and construction sectors, whereas certain service sectors remained resilient – health on top of them.

In addition, 'task-biased technological change' increased the educational level observed in jobholders of non-routine cognitive occupations across all sectors. This is compatible with a growing demand for non-routine cognitive jobs due to a demand shift to a higher share of services ('job polarization').

Figure 12 illustrates the percentage change in employment, by type of occupation and country, from 2011 to 2016. The graph shows that employment in non-routine cognitive occupations presents the highest growth rate for the majority of EU countries. Greece, Slovakia, Cyprus and Slovenia are the only MS where the figure is negative.

Figure 12: Change of employment, by type of occupation and country - 2011-2016. Square = Routine work, Triangle = Non Routine Manual Work, Diamond = Non Routine Cognitive Work.




At the same time, and in line with the conclusions of OECD (2017) for the manufacturing sector, some of the countries experiencing the largest increases in this occupational group

[33] The model was originally developed and maintained by the Institute for Social and Economic Research (ISER) at the University of Essex. More recent developments are done in a close collaboration with the JRC.

also exhibit high increases in ICT capitalization, including Portugal, Sweden, Estonia, Latvia and the United Kingdom.

Non-routine manual occupation comes second in average employment creation across EU countries. Jobs in the category of routine tasks fall for around half of the MS in the sample, and show a limited increase in most of the rest.

In conclusion, routine workers prove to be the group that exhibits the highest vulnerability and has shown the least resilience during the period of analysis. This calls for some reflection on the need for more targeted socioeconomic policies.

Prompted by the different experience of the different job categories during the crisis, we have also included the share of routine, non-routine manual and non-routine cognitive workers in our analysis of resilience characteristics in Section 4.3. In line with the preliminary results of Martinez Turegano and Marschinski (2017), a high share of non-routine manual tasks turns out to be an amplifier of the negative consequences of the crisis in the short run.

**Increasing resilience to economic shocks: the role of automatic stabilisers**

The interest in automatic stabilisers has been growing since the Great Recession both in academic and policy circles. By cushioning the effect of market income shocks on disposable income (i.e. income after tax and benefits), fiscal policy instruments act as a smoothing factor of the effect of the business cycle on household demand, protecting individual and societal well-being, and reinforcing economic growth through improved macroeconomic stability. In other words, automatic stabilisers can be seen as an instrument to increase resilience, particularly the absorptive capacity (impact). At the same time, their ability to facilitate absorption beyond income levels might be less strong.

Joint Research Centre (2017b) uses the microsimulation model EUROMOD to assess how changes in market income affect household disposable income in EU Member States.

Income stabilization coefficients (ISC) have been computed in the spirit of Dolls *et al.* (2012), measuring the share of a shock to market income that is absorbed by a country's tax and benefit system. A larger coefficient indicates a higher level of stability of household resources with respect to changes in its market income.

Three income stabilisation indicators are computed:

1) Country Level ISC. It is computed as the difference between the aggregated country-level variations in household resources in the presence and in the absence of a tax and benefit system, as a share of the aggregated change in market income. It provides a single coefficient per country.

2) Household Level ISC. For each household, it measures the cushioning effect of the tax and benefit system if all the household members were to experience at once the same income shock. The coefficient takes household specific values.

3) Individual Level ISC. Employing an iterative procedure, it computes the cushioning effect of the tax and benefit system on household disposable income if household members would experience the shock one at the time. The coefficient takes individual specific values.

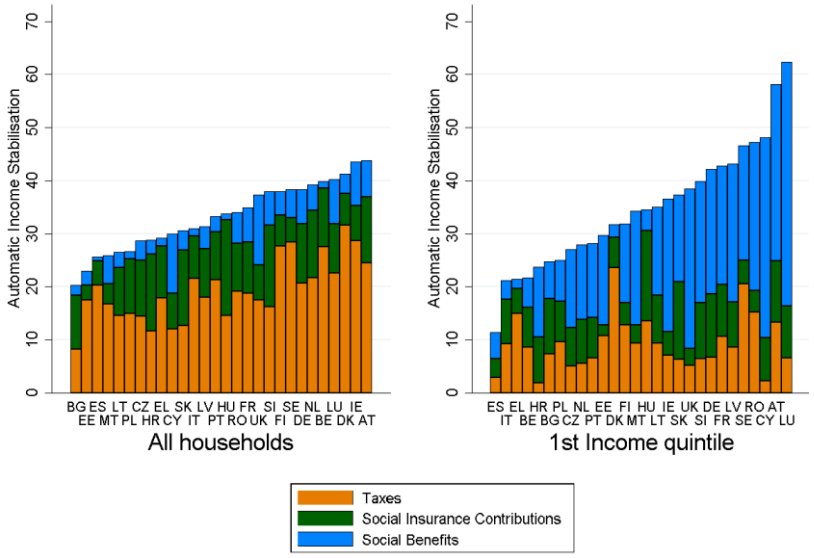
The values of the ISCs show a high degree of heterogeneity in the stabilisation properties of the tax and benefit systems of the Member States. For example, results for 2014 (see Figure 13 below) show that the country average of the household level stabilisation coefficients varies from around 20% in Bulgaria to around 44% in Austria.

Based on the decomposition of the ISCs by the source of stabilisation, a major role for taxes emerges, followed by social insurance contributions and benefits. The latter suggests that fiscal reforms could represent the best channel for promoting greater automatic stabilisation of income shocks in the EU.

The relative importance of taxes changes substantially, however, when focusing on households from the poorest quintile of the income distribution (right hand side of Figure 13). For them, a major share of stabilisation comes from benefits in most Member States.

Though one would expect that the level of automatic income stabilisation positively influenced resilience, none of its variants proved to be a significant explanatory variable in our regressions. Further investigations are left for future research.

Figure 13: Level of automatic income stabilisation for households in EU countries (2014)




Source: JRC simulations based on the EUROMOD model.

## Annex 4: Heat-maps and correlation table for the individual system variables – resilience metrics

For the impact, the predominant colour is yellow, which shows that the economic–financial crisis hit all countries in some dimensions. There are no countries for which the heat-map is entirely green, i.e. each country, at least in a few dimensions, was less resilient than some other countries. At the same time, the most resilient countries show high resilience in the majority of the system variables, i.e. their high ranking is not due to an exceptional performance in a restricted number of dimensions. Concerning the recovery, the heat-map is red for more countries than those for which it is green, and there are less shades of yellow, partly due to the fact that countries with a low impact had very little to recover. The heat-map for the medium-run indicator confirms a consistency across the response of the three parts of the system, i.e. assets, engine and outcomes.

### IMPACT

| | ASSET | | | | | | ENGINE | | | | | | | | | | | | | | | | OUTCOME | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Country | DWELLINGS | EXP. EDUCATION | EXP. HEALTH | FAIRNESS | TRUST PEOPLE | INVESTMENT | SOCIAL ACTIVITY | GOV. DEFICIT | GOV. DEBT | HH LOANS | HOUSE PRICES | TRUST EP | TRUST LEGAL | INFLATION | ACTIVE LM | PASSIVE LM | LABOUR PROD. | CORP. LOANS | PRIVATE DEBT | EXP. R&D | STOCK PRICES | TEMPORARY WORK | WAGES | EMPLOYMENT | GDP | HAPPINESS | HEALTH | HH CONSUMPTION | INEQUALITY | NEET | SOCIAL EXCLUSION | HH INCOME | SATISFACTION | UNEMPLOYMENT | Avg. score |
| PL | 0.2 | 0.8 | 0.3 | 0.0 | 0.0 | 1.4 | 0.0 | 0.4 | 0.9 | 0.5 | 0.0 | 0.0 | 0.3 | 0.2 | 1.0 | -2.1 | 1.1 | 1.4 | -0.1 | 1.0 | 0.4 | 0.4 | 0.8 | 1.4 | 1.4 | 0.8 | 0.1 | 1.4 | 1.7 | 0.7 | 1.5 | 1.0 | 0.8 | 0.9 | 0.61 |
| DE | 0.7 | 0.5 | 0.1 | 0.7 | -0.2 | 0.9 | 1.0 | 0.5 | 0.7 | 1.6 | 1.2 | 0.6 | 0.0 | 0.5 | -1.0 | -1.4 | 0.1 | 0.7 | 0.9 | 0.7 | 0.7 | 0.6 | 0.5 | 1.2 | 0.3 | 1.1 | 1.5 | 0.7 | 0.7 | 1.4 | 0.5 | 0.8 | 0.8 | 1.2 | 0.61 |
| BE | 1.0 | 0.6 | 0.3 | -0.4 | 0.1 | 1.0 | 0.2 | 0.3 | 0.6 | 1.0 | 1.3 | 0.5 | 0.2 | 0.0 | 0.8 | 0.5 | 0.5 | -0.1 | -1.1 | 0.6 | 0.3 | 0.5 | 0.5 | 0.8 | 0.7 | -0.1 | 0.0 | 0.8 | 0.6 | 0.8 | 0.5 | 0.7 | 0.1 | 0.9 | 0.45 |
| AT | 0.7 | 0.6 | 0.3 | 0.3 | 0.1 | 0.9 | -2.0 | 0.6 | 0.5 | 1.2 | 1.2 | 0.6 | -0.1 | 0.7 | 0.6 | 0.2 | 0.6 | 0.8 | 0.6 | 0.6 | 0.1 | 0.3 | 0.4 | 1.1 | 0.6 | 1.1 | -0.7 | 0.7 | -0.3 | 1.0 | -0.5 | 0.2 | 0.8 | 0.9 | 0.44 |
| BG | | 0.8 | 0.8 | -0.2 | -0.2 | 0.3 | -0.6 | 0.2 | 0.9 | 0.1 | -0.3 | 0.3 | 0.4 | -1.5 | -2.2 | 0.1 | 1.2 | 1.0 | 0.5 | 1.0 | -0.9 | 0.5 | 1.3 | -0.3 | 1.2 | 1.1 | 0.4 | 0.5 | 1.0 | 0.4 | 3.4 | 1.3 | 0.8 | -0.1 | 0.41 |
| LU | 0.9 | 0.8 | 0.1 | | | 1.1 | | 0.5 | 0.7 | -0.5 | 1.2 | | | 0.7 | 0.6 | 0.6 | -1.7 | 0.5 | 2.7 | -1.5 | 0.2 | -0.5 | 0.0 | 0.8 | 0.2 | 0.9 | -0.8 | 0.7 | -0.5 | 1.1 | -0.3 | | 0.6 | 0.6 | 0.35 |
| SK | 1.1 | 0.3 | 0.3 | -0.1 | 0.3 | 0.5 | 0.7 | 0.3 | 0.4 | 0.8 | 0.4 | -1.7 | -1.0 | 0.0 | 0.4 | 1.5 | 0.7 | 0.1 | 0.1 | 0.6 | 0.2 | -1.4 | 1.2 | 0.4 | 0.9 | -1.4 | 2.0 | 1.1 | -0.1 | 0.7 | 0.7 | 1.3 | -1.4 | 0.5 | 0.30 |
| FR | 0.7 | 0.2 | 0.0 | 0.4 | 0.2 | 0.9 | 0.4 | 0.5 | 0.0 | 0.8 | 0.9 | 0.1 | 0.2 | 0.6 | 0.5 | 0.2 | 0.4 | 0.7 | -0.1 | 0.4 | 0.6 | 0.3 | 0.1 | 0.8 | 0.5 | -0.6 | -0.8 | 0.7 | -0.9 | 0.6 | 0.4 | 0.6 | -0.9 | 0.6 | 0.30 |
| SE | 0.3 | 0.3 | 0.2 | -0.1 | -1.3 | 0.7 | 1.3 | 0.5 | 1.2 | 1.1 | 1.1 | 1.5 | 1.3 | 0.6 | -0.2 | -1.8 | -0.4 | 0.6 | -0.4 | 0.1 | 0.7 | 0.8 | -0.7 | 0.5 | 0.1 | 0.3 | 0.5 | 0.7 | -0.9 | 0.6 | -0.3 | 0.4 | 0.2 | 0.6 | 0.29 |
| FI | 0.4 | 0.6 | 0.1 | 0.9 | 1.1 | 0.5 | 0.0 | -0.1 | 0.1 | 0.9 | 1.1 | 0.0 | -0.6 | 0.4 | 0.6 | 0.0 | -1.0 | -0.1 | -0.2 | -1.6 | 0.3 | 0.9 | 0.3 | 0.5 | -0.1 | 0.7 | -0.7 | 0.5 | 0.9 | 0.0 | 0.4 | 0.7 | 0.5 | 0.6 | 0.25 |
| NL | 0.0 | 0.6 | 0.2 | 1.0 | 0.6 | 0.5 | 1.0 | 0.3 | 0.3 | 0.0 | 0.1 | -0.1 | 0.1 | 0.6 | 0.1 | -0.5 | 0.1 | 0.0 | 0.4 | 0.0 | 0.4 | -0.2 | -0.3 | 0.4 | 0.6 | 0.0 | 0.0 | 0.3 | 1.2 | 0.6 | 0.3 | -0.3 | -0.5 | 0.5 | 0.25 |
| HU | -0.3 | -2.8 | -1.2 | 0.2 | 1.1 | 0.4 | -0.6 | 1.2 | 0.8 | -0.2 | -0.5 | 0.9 | 1.6 | 3.1 | 0.8 | -0.5 | 0.7 | 0.0 | 0.1 | 0.5 | 0.4 | -1.0 | 0.7 | 0.4 | 0.1 | 0.9 | 2.5 | -0.7 | -0.7 | -0.1 | -0.9 | -0.2 | 0.8 | 0.4 | 0.23 |
| MT | 0.6 | 0.2 | -0.8 | | | 0.4 | | 1.0 | 1.1 | 1.0 | 1.0 | | | 0.7 | -0.9 | 0.0 | 0.1 | -0.8 | 0.1 | -0.2 | 0.7 | -0.2 | -0.3 | 1.1 | 1.0 | -0.6 | -1.5 | 0.6 | 0.0 | 1.6 | -0.6 | | -0.3 | 1.0 | 0.21 |
| CZ | 0.3 | 0.6 | 0.4 | -1.7 | -1.6 | 0.8 | -1.1 | 0.5 | 0.7 | 0.5 | 1.0 | 1.2 | 0.7 | -0.8 | 0.6 | 0.4 | 0.1 | -0.8 | 0.3 | 0.0 | 0.4 | 0.0 | 0.2 | 0.6 | 0.6 | -1.5 | -0.2 | 0.9 | 1.2 | 0.5 | 0.6 | 0.7 | -0.2 | 0.7 | 0.19 |
| UK | -0.8 | 0.1 | 0.2 | -0.2 | 0.2 | 0.3 | -0.4 | 0.0 | -0.6 | 0.0 | 0.3 | 0.6 | 0.5 | 0.1 | 0.8 | 0.2 | 0.1 | -0.9 | 0.4 | 0.1 | 0.9 | 0.6 | -1.4 | 0.6 | 0.2 | 0.7 | -1.8 | 0.2 | 0.5 | 0.5 | 0.0 | -0.6 | 0.8 | 0.6 | 0.09 |
| IT | 0.8 | -1.8 | -0.2 | | | -0.1 | | 0.6 | 0.0 | 0.7 | 0.1 | | | 0.2 | -0.2 | 0.4 | 0.0 | 0.1 | 0.3 | 0.3 | 0.1 | 0.2 | 0.2 | 0.3 | -0.3 | 0.2 | 0.3 | -0.2 | 0.3 | -0.9 | -0.5 | -0.7 | 0.8 | -0.1 | 0.03 |
| PT | -0.9 | -1.4 | -1.1 | -0.4 | 0.5 | -0.5 | 2.2 | -0.1 | -1.3 | -0.6 | 0.5 | -0.6 | -0.4 | -0.1 | 0.3 | 0.0 | 1.0 | 0.8 | 0.0 | 0.6 | 0.0 | 0.1 | -1.0 | -0.7 | -0.1 | 1.1 | 0.3 | -0.4 | 1.8 | 0.3 | -0.1 | -0.2 | 0.8 | -0.3 | 0.00 |
| RO | | -2.6 | 2.6 | | | -0.1 | | 0.1 | 0.3 | -0.4 | -2.1 | | | -0.5 | -2.4 | -1.8 | 1.8 | 0.6 | 0.3 | -1.7 | -0.3 | 0.8 | 1.0 | 0.8 | 0.9 | -1.2 | 0.4 | 0.2 | 0.9 | -0.4 | 1.2 | 0.0 | 0.2 | 0.9 | -0.01 |
| DK | -0.3 | -0.1 | 0.4 | 0.5 | 0.1 | 0.4 | 0.1 | -0.2 | 0.6 | -0.6 | -0.1 | 0.6 | 0.8 | 0.5 | 0.2 | -1.1 | 0.1 | -4.1 | 0.0 | 0.9 | 0.5 | -1.1 | 0.8 | 0.1 | 0.2 | 0.3 | -0.9 | 0.3 | -1.5 | 0.5 | 0.1 | 0.7 | 0.0 | 0.4 | -0.03 |
| SI | 0.6 | 0.2 | 0.0 | -0.7 | -0.6 | -0.6 | 0.7 | -1.3 | -1.2 | 0.4 | -0.2 | -1.1 | -1.1 | 0.5 | -0.6 | -0.5 | -1.3 | 0.3 | 0.2 | 1.5 | -0.6 | 0.9 | -0.4 | -0.2 | 0.0 | -0.3 | 0.5 | 0.4 | -0.2 | 0.3 | -0.3 | -0.3 | -0.9 | 0.1 | -0.16 |
| HR | | -0.5 | 0.2 | 2.6 | 1.5 | 0.0 | -1.5 | 0.4 | -0.7 | 0.2 | -0.3 | 0.6 | 0.5 | -0.5 | -1.4 | 0.7 | -1.3 | 0.0 | 0.0 | -1.0 | -0.1 | -3.2 | -0.6 | -0.6 | -0.6 | 0.5 | | -0.9 | -0.2 | -1.1 | | 0.6 | 0.9 | -0.3 | -0.20 |
| ES | | 0.2 | 0.4 | -0.4 | 0.6 | -0.6 | -0.1 | -0.9 | -1.4 | -0.9 | -1.0 | -0.1 | -0.2 | 0.4 | -0.3 | 0.9 | 1.0 | 0.1 | 0.6 | -0.3 | 0.5 | 1.7 | 0.1 | -1.6 | -0.2 | -0.2 | 1.1 | -0.8 | -1.6 | -1.0 | -1.0 | -0.6 | -1.2 | -2.2 | -0.28 |
| EE | -0.2 | 0.1 | 0.7 | 0.1 | 0.4 | -1.2 | -1.0 | 0.4 | 1.1 | -0.2 | -1.5 | 0.7 | 0.6 | -1.1 | -0.9 | 2.0 | -0.3 | -1.0 | -0.2 | 0.6 | 0.0 | -0.2 | 1.6 | -1.4 | -1.9 | -0.5 | -0.2 | -2.0 | -0.9 | -0.7 | -0.5 | 0.1 | -1.1 | -1.2 | -0.29 |
| LT | -0.4 | 1.4 | 0.6 | | | -0.8 | | -0.1 | 0.3 | -0.6 | -0.9 | | | -2.1 | 0.7 | 0.8 | 0.2 | 0.0 | 0.6 | -0.9 | 0.0 | 1.2 | -0.3 | -1.0 | -0.8 | 0.1 | -1.3 | -1.4 | -1.8 | -0.9 | -0.8 | -0.3 | 0.8 | -1.4 | -0.32 |
| IE | -2.2 | 0.7 | 0.7 | -1.1 | -0.7 | -0.6 | -1.2 | -4.3 | -2.7 | -1.9 | -1.7 | -0.6 | 0.5 | -0.3 | 0.9 | 1.3 | 0.2 | -0.1 | -2.9 | 0.8 | -0.1 | -0.1 | 0.8 | -1.4 | -0.2 | 0.5 | -0.3 | 0.0 | 0.9 | -1.7 | -1.3 | 0.4 | 0.2 | -0.8 | -0.54 |
| LV | -3.1 | -0.2 | -1.4 | | | -1.6 | | -0.2 | -0.3 | -1.8 | -1.5 | | | -2.1 | -1.2 | 0.5 | -2.0 | -0.1 | -0.3 | -2.9 | 0.3 | -0.5 | -0.6 | -1.6 | -2.1 | -0.1 | 0.6 | -2.2 | -0.6 | -0.8 | -0.8 | -1.1 | 0.8 | -1.4 | -0.97 |
| CY | 0.5 | 0.1 | -0.7 | -2.3 | -3.0 | -1.8 | 0.8 | -0.8 | -0.9 | -2.7 | 0.0 | -2.5 | -3.2 | -0.7 | 1.8 | -1.0 | 0.3 | 0.7 | -2.6 | 0.2 | -4.4 | -1.7 | -2.7 | -1.3 | 0.0 | -0.8 | -0.4 | 0.2 | -1.3 | -2.2 | -0.4 | -2.2 | -1.4 | -1.2 | -1.10 |
| EL | -0.7 | -0.4 | -3.4 | 1.0 | 0.7 | -2.9 | 0.1 | -0.2 | -1.9 | -0.5 | -1.2 | -1.5 | -1.2 | 0.0 | 0.6 | 0.3 | -2.4 | -0.2 | -0.2 | -0.4 | -1.5 | 0.3 | -2.2 | -2.0 | -3.1 | -3.2 | -0.5 | -2.4 | 0.0 | -1.9 | -1.5 | -3.0 | -3.2 | -2.4 | -1.21 |

Notes: The heat-map reports standardized scores (i.e. z-scores) for the impact indicator. The colour scheme applied is defined in relation to each column separately. The colour scale ranges from red (low resilience) to green (high resilience). Average scores represent the country-specific mean of the indicators constructed on all variables available.

## RECOVERY

| Country | ASSET | | | | | | ENGINE | | | | | | | | | | | | | | | | OUTCOME | | | | | | | | | | | Avg. score |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | DWELLINGS | EXP. EDUCATION | EXP. HEALTH | FAIRNESS | TRUST PEOPLE | INVESTMENT | SOCIAL ACTIVITY | GOV. DEFICIT | GOV. DEBT | HH LOANS | HOUSE PRICES | TRUST EP | TRUST LEGAL | INFLATION | ACTIVE LM | PASSIVE LM | LABOUR PROD. | CORP. LOANS | PRIVATE DEBT | EXP. R&D | STOCK PRICES | TEMPORARY WORK | WAGES | EMPLOYMENT | GDP | HAPPINESS | HEALTH | HH CONSUMPTION | INEQUALITY | NEET | SOCIAL EXCLUSION | HH INCOME | SATISFACTION | UNEMPLOYMENT | |
| LV | 3.6 | 0.0 | -0.9 | | | -0.2 | | 0.4 | 0.3 | 1.4 | 0.5 | | | 3.3 | 0.4 | -0.2 | 1.0 | -0.2 | 1.7 | -0.6 | 1.1 | 3.2 | 2.2 | 1.3 | 0.6 | 0.2 | 0.2 | 1.6 | 2.2 | 2.3 | 2.5 | 1.2 | -0.7 | 2.1 | 1.05 |
| IE | -0.1 | 0.2 | 0.0 | 0.7 | 0.1 | 4.1 | 0.5 | 4.2 | 4.6 | 1.0 | 1.5 | 1.3 | 0.0 | -0.2 | -0.1 | 1.1 | 3.6 | -0.9 | -1.1 | -0.2 | 1.1 | 1.4 | -0.1 | 0.6 | 3.0 | -0.5 | -0.7 | -0.2 | 1.0 | 2.1 | 0.7 | -0.5 | 0.2 | 1.1 | 0.87 |
| EE | -0.1 | -0.9 | 0.2 | -0.2 | -0.2 | 0.3 | -0.1 | -0.7 | -0.4 | 1.5 | 2.1 | -0.6 | -0.3 | 1.9 | 2.4 | 2.7 | 0.3 | 1.3 | 1.2 | -0.6 | 2.0 | 0.3 | 0.7 | 1.6 | 0.8 | 0.6 | -0.8 | 1.8 | 0.0 | 1.6 | -0.3 | 0.5 | 0.5 | 2.1 | 0.62 |
| BG | | 1.5 | 2.5 | -0.8 | -0.8 | -0.7 | -0.8 | -0.2 | -0.5 | -0.6 | -0.3 | -0.6 | -1.0 | 1.6 | 0.8 | 2.2 | 1.0 | -0.7 | 0.3 | 2.1 | 0.1 | 1.0 | 3.2 | 0.1 | -0.1 | 3.4 | 0.4 | 0.3 | -1.2 | 0.5 | 2.1 | 1.3 | 2.2 | 0.6 | 0.57 |
| MT | -0.8 | 2.0 | 1.7 | | | 1.8 | | -0.3 | 0.9 | -1.1 | -0.1 | | | -0.2 | 2.2 | -0.6 | 0.3 | 3.9 | 1.1 | 1.2 | -0.4 | -0.6 | -0.3 | 1.9 | 1.9 | 1.3 | 0.4 | 1.0 | -0.6 | -0.4 | -0.3 | | 0.3 | -0.5 | 0.55 |
| LT | 0.2 | -0.4 | -0.3 | -0.7 | 0.1 | 0.8 | -0.8 | 0.4 | -0.3 | 0.6 | 0.1 | 2.7 | 2.7 | 2.0 | -0.9 | 0.5 | 0.6 | 0.1 | 0.6 | -0.5 | 1.4 | 0.2 | 1.1 | 2.0 | 0.9 | -0.5 | -0.8 | 2.2 | -1.2 | 0.6 | 0.8 | 1.7 | 0.1 | 2.1 | 0.54 |
| HU | -0.8 | 0.5 | -0.9 | -0.8 | -0.8 | -0.7 | -0.8 | -0.5 | 0.2 | 0.7 | 1.3 | 2.5 | -0.2 | 0.1 | 1.6 | -1.1 | 0.1 | -0.9 | 1.4 | 0.1 | 1.0 | 1.0 | -0.1 | 2.2 | -0.2 | -0.5 | -0.4 | 0.0 | -1.2 | 1.1 | 1.5 | -0.4 | 1.8 | 0.8 | 0.22 |
| SK | -0.7 | 2.1 | 1.3 | -0.6 | -0.2 | -0.1 | 2.8 | -0.1 | -0.2 | -0.4 | 0.0 | -0.6 | -1.0 | -0.7 | 0.1 | -0.8 | 0.5 | 1.5 | -1.1 | 2.4 | -0.2 | -0.2 | 0.7 | 0.2 | 0.7 | -0.5 | 1.6 | -0.6 | 1.6 | -0.5 | -0.1 | 0.7 | -0.7 | 0.4 | 0.21 |
| SE | 1.8 | 0.1 | 0.1 | 1.8 | 1.4 | 0.5 | 1.0 | -0.8 | -0.1 | 0.0 | 2.3 | -0.6 | -0.4 | -0.4 | 0.3 | -0.6 | -0.3 | -0.4 | -0.1 | -0.5 | 0.6 | -0.4 | -0.5 | -0.5 | 0.6 | -0.1 | -0.4 | 0.8 | -0.5 | 0.2 | -0.6 | -0.3 | -0.3 | -0.7 | 0.09 |
| UK | 0.7 | -0.8 | 0.6 | 1.5 | 0.1 | 0.2 | -0.8 | 0.0 | -0.5 | 0.7 | 0.3 | 0.0 | 1.8 | -0.3 | 0.5 | 0.5 | -0.9 | 0.1 | 0.4 | -0.5 | -0.3 | -0.5 | -0.6 | -0.2 | 0.0 | 0.0 | -0.8 | 0.0 | 0.7 | 0.3 | -0.5 | -0.6 | 0.3 | -0.1 | 0.05 |
| PL | 0.2 | 0.5 | 1.0 | -0.8 | -0.8 | -0.3 | 0.7 | -0.3 | -0.4 | -1.2 | -0.6 | -0.6 | -0.7 | -0.5 | -0.5 | -0.8 | 1.1 | -0.4 | -1.1 | 2.5 | 0.2 | -0.2 | 0.8 | 0.1 | 1.1 | -0.5 | -0.2 | 1.3 | -0.2 | -0.6 | 1.7 | 1.1 | -0.3 | 0.1 | 0.04 |
| RO | | 0.0 | 0.2 | | | -0.5 | | -0.1 | -0.3 | -0.4 | -0.5 | | | 0.3 | -1.2 | -1.1 | 1.6 | -0.6 | 0.0 | 0.5 | 0.8 | -0.8 | 1.4 | -0.5 | 0.3 | -0.5 | -0.6 | 1.7 | -1.2 | -1.2 | 1.6 | 3.1 | -0.7 | -0.8 | 0.02 |
| DE | 0.0 | 0.3 | 0.5 | 0.5 | 2.2 | -0.1 | -0.8 | -0.3 | 0.9 | -0.1 | 0.3 | 0.4 | 0.2 | -0.6 | -1.2 | -1.1 | -0.4 | 0.4 | -0.2 | -0.1 | 0.8 | 0.3 | -0.2 | 0.0 | 0.0 | -0.4 | -0.8 | -0.4 | 0.4 | -0.3 | -0.7 | 0.1 | 0.1 | -0.1 | -0.01 |
| LU | 0.7 | 1.8 | 0.7 | | | 0.3 | | -0.8 | -0.1 | -0.9 | 1.0 | | | -0.7 | 0.0 | 0.1 | -0.8 | -0.5 | -0.1 | -0.6 | -0.1 | 0.6 | -0.5 | -0.8 | 1.1 | -0.1 | -0.8 | 0.6 | 0.6 | -1.1 | -0.8 | | -0.4 | -1.2 | -0.10 |
| PT | -0.5 | -1.1 | -1.4 | 2.1 | 0.0 | -0.6 | -0.8 | 0.4 | -0.5 | 0.1 | -0.2 | 1.2 | 0.6 | -0.2 | -0.4 | -0.4 | -0.6 | -0.8 | 1.3 | -1.1 | -1.5 | -0.9 | -0.8 | 0.2 | -1.0 | 1.7 | -0.7 | -0.6 | -0.3 | 0.5 | -0.6 | -0.5 | 2.4 | 0.5 | -0.13 |
| CZ | -0.8 | 0.1 | 0.3 | -0.8 | -0.7 | -0.4 | -0.8 | -0.1 | 0.4 | -0.3 | -0.1 | 0.1 | 1.5 | 0.3 | 0.9 | -0.5 | -0.2 | 1.0 | -0.8 | 0.7 | -1.3 | -0.6 | -0.1 | 0.5 | -0.1 | -0.5 | -0.2 | -0.2 | -1.2 | -0.4 | -0.4 | 0.3 | -0.7 | -0.1 | -0.15 |
| DK | 0.3 | 1.0 | -0.2 | 0.6 | 1.1 | 0.0 | -0.5 | -0.7 | 0.4 | -0.7 | 0.2 | -0.2 | -0.8 | -0.7 | -0.1 | -0.6 | -0.3 | -0.9 | 0.2 | -0.9 | 1.8 | -0.9 | -0.2 | -0.8 | -0.5 | -0.5 | -0.6 | -0.6 | 1.8 | -1.1 | -0.7 | -0.2 | -0.7 | -0.8 | -0.20 |
| ES | | -1.0 | -1.4 | 1.2 | -0.8 | -0.3 | -0.8 | -0.1 | -0.4 | 0.5 | -0.5 | -0.5 | 0.1 | -0.6 | -1.0 | 0.2 | -0.2 | -0.4 | 2.3 | -1.1 | -1.1 | 1.5 | -0.8 | 0.2 | -0.6 | -0.5 | -0.1 | -0.5 | -1.2 | 0.8 | -0.7 | -0.3 | -0.7 | 1.0 | -0.24 |
| SI | -0.8 | -1.1 | -0.6 | -0.6 | -0.8 | -0.8 | 0.2 | 1.1 | -0.1 | -0.2 | -0.8 | -0.6 | 0.0 | -0.3 | 1.4 | 1.1 | -0.3 | -0.6 | 1.1 | -0.3 | -1.0 | -0.4 | -0.5 | -0.5 | -0.6 | -0.5 | 1.4 | -0.8 | -0.5 | -0.7 | -0.5 | -0.3 | -0.7 | -0.5 | -0.26 |
| CY | -0.8 | -1.1 | -1.4 | -0.8 | -0.8 | 0.8 | 0.8 | 0.4 | -0.5 | 3.4 | -1.0 | -0.6 | -1.0 | -0.6 | 0.0 | 1.1 | -0.6 | 0.1 | -1.1 | -0.2 | -1.5 | 1.3 | -0.8 | -0.9 | -1.0 | -0.5 | 1.4 | -0.8 | -0.2 | 0.1 | -1.0 | -0.7 | -0.7 | -0.2 | -0.28 |
| AT | 0.3 | 0.0 | -0.3 | -0.8 | -0.8 | -0.3 | -0.8 | -0.5 | -0.4 | -0.7 | 1.5 | -0.6 | -1.0 | -0.5 | -0.5 | -0.4 | -0.6 | -0.2 | -0.7 | 0.1 | -0.4 | -0.9 | 0.1 | -1.0 | -0.5 | 2.4 | -0.4 | -1.0 | 0.7 | -1.3 | -0.1 | -1.2 | 2.4 | -1.2 | -0.28 |
| BE | 0.0 | 0.9 | 1.0 | -0.8 | -0.8 | -0.3 | 1.4 | -0.7 | -0.5 | -0.7 | -0.8 | -0.6 | 0.2 | 0.1 | -0.8 | -1.0 | -0.8 | 0.7 | -1.0 | 0.4 | 0.2 | -0.9 | -0.7 | -1.2 | -0.5 | -0.5 | -0.2 | -0.5 | 0.8 | 0.1 | -0.8 | -0.7 | -0.7 | -1.0 | -0.32 |
| FR | -0.1 | -0.4 | -0.1 | 1.1 | 1.8 | -0.6 | 1.4 | -0.5 | -0.5 | -0.5 | -1.1 | -0.6 | 0.6 | -0.7 | -0.6 | -0.3 | -0.6 | -0.3 | -1.1 | -0.7 | -0.4 | -0.9 | 0.0 | -1.0 | -0.6 | -0.5 | -0.6 | -0.6 | 0.6 | -1.1 | -0.3 | -0.2 | -0.7 | -1.1 | -0.33 |
| HR | | -1.1 | -0.9 | | | -0.5 | | 0.0 | -0.3 | -0.7 | -1.0 | | | -0.3 | -1.0 | -0.8 | 0.3 | -0.3 | -0.4 | -0.5 | -1.0 | -0.9 | -0.6 | -0.1 | -0.9 | -0.5 | 3.6 | -1.0 | 0.7 | 0.0 | 0.4 | -1.1 | -0.7 | 0.1 | -0.33 |
| NL | -0.8 | -0.4 | 0.7 | -0.8 | -0.8 | 0.0 | -0.8 | -0.2 | 0.1 | 0.6 | -0.5 | -0.6 | 0.3 | -0.7 | -1.2 | 0.7 | -0.7 | -0.4 | -0.7 | 0.1 | 0.3 | 0.2 | -0.7 | -0.9 | -0.6 | -0.3 | -0.6 | -1.0 | 0.1 | -1.0 | -0.9 | -0.8 | 0.0 | -0.8 | -0.39 |
| FI | 0.2 | -0.6 | 0.4 | 0.0 | 1.9 | -0.6 | 0.4 | -0.9 | -0.5 | -0.8 | -1.1 | -0.6 | -1.0 | -0.5 | -0.4 | -0.3 | -0.7 | -0.3 | -0.9 | -1.3 | 0.2 | -0.9 | -0.8 | -1.3 | -1.0 | -0.5 | 1.1 | -0.1 | 0.2 | -1.2 | -0.5 | -0.8 | -0.7 | -1.0 | -0.44 |
| EL | -0.8 | -1.1 | -1.4 | -0.8 | -0.8 | -0.9 | -0.8 | 1.5 | -0.5 | -0.8 | -1.2 | -0.6 | -1.0 | -0.2 | 0.1 | -0.7 | -1.3 | -0.2 | -0.6 | 0.3 | -1.4 | 0.0 | -1.0 | -0.4 | -1.4 | -0.5 | -0.5 | -1.3 | -0.8 | 1.1 | -0.8 | -0.7 | -0.7 | 0.1 | -0.58 |
| IT | -0.4 | -1.1 | -1.3 | | | -0.7 | | -0.7 | -0.5 | -0.6 | -1.2 | | | -0.7 | -1.2 | 1.3 | -1.0 | -0.3 | -0.6 | -1.0 | -0.8 | -0.9 | -0.9 | -0.8 | -1.2 | -0.5 | 0.0 | -1.1 | -1.2 | -0.2 | -0.5 | -0.7 | -0.2 | -0.9 | -0.70 |

Notes: The heat-map reports standardized scores (i.e. z-scores) for the recovery indicator. The colour scheme applied is defined in relation to each column separately. The colour scale ranges from red (low resilience) to green (high resilience). Average scores represent the country-specific mean of the indicators constructed on all variables available.

## MEDIUM-RUN

| Country | ASSET | | | | | | ENGINE | | | | | | | | | | | | | | | | | OUTCOME | | | | | | | | | | | Avg. score |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | DWELLINGS | EXP. EDUCATION | EXP. HEALTH | FAIRNESS | TRUST PEOPLE | INVESTMENT | SOCIAL ACTIVITY | GOV. DEFICIT | GOV. DEBT | HH LOANS | HOUSE PRICES | TRUST EP | TRUST LEGAL | INFLATION | ACTIVE LM | PASSIVE LM | LABOUR PROD. | CORP. LOANS | PRIVATE DEBT | EXP. R&D | STOCK PRICES | TEMPORARY WORK | WAGES | EMPLOYMENT | GDP | HAPPINESS | HEALTH | HH CONSUMPTION | INEQUALITY | NEET | SOCIAL EXCLUSION | HH INCOME | SATISFACTION | UNEMPLOYMENT | |
| MT | 0.2 | 1.4 | 0.3 | | | 1.4 | | 1.3 | 1.5 | 0.8 | 0.9 | | | 0.2 | 0.8 | -0.4 | 0.3 | 3.3 | 0.6 | 0.8 | 0.4 | -0.4 | -0.3 | 2.3 | 1.9 | 0.2 | -0.9 | 1.2 | -0.3 | 1.7 | -0.6 | | 0.0 | 0.9 | 0.70 |
| BG | | 1.5 | 1.8 | -0.7 | -0.5 | -0.2 | -0.8 | -0.1 | 0.7 | -0.1 | -0.4 | 0.1 | 0.0 | 1.2 | -1.1 | 1.6 | 1.2 | -0.2 | 0.6 | 2.0 | -0.7 | 0.8 | 2.9 | -0.2 | 0.6 | 2.4 | 0.6 | 0.6 | 0.4 | 0.8 | 3.5 | 1.7 | 1.9 | 0.3 | 0.68 |
| PL | 0.4 | 0.8 | 0.7 | -0.5 | -0.3 | 1.0 | 0.0 | 0.1 | 0.8 | 0.2 | -0.3 | -0.2 | 0.0 | -0.6 | 0.4 | -1.6 | 1.3 | 0.4 | -0.6 | 2.3 | 0.4 | 0.3 | 1.0 | 1.4 | 1.6 | 0.3 | 0.0 | 2.1 | 1.5 | 0.5 | 1.9 | 1.4 | 0.2 | 1.3 | 0.54 |
| DE | 0.7 | 0.5 | 0.3 | 1.0 | 1.0 | 0.7 | 0.7 | 0.4 | 1.1 | 1.9 | 1.2 | 0.8 | 0.2 | -0.5 | -1.6 | -1.4 | -0.3 | 0.8 | 0.6 | 0.2 | 0.8 | 0.7 | 0.0 | 1.2 | 0.2 | 0.6 | 0.8 | 0.4 | 0.8 | 1.4 | 0.0 | 0.6 | 0.5 | 1.5 | 0.53 |
| SK | 0.8 | 1.6 | 0.8 | -0.4 | 0.3 | 0.3 | 1.2 | 0.3 | 0.3 | 0.8 | 0.4 | -1.6 | -1.2 | -1.0 | 0.4 | 0.1 | 0.7 | 1.5 | -0.4 | 2.1 | 0.1 | -1.4 | 1.0 | 0.5 | 1.0 | -1.3 | 2.6 | 0.5 | 0.6 | 0.5 | 0.5 | 1.3 | -1.2 | 0.9 | 0.36 |
| SE | 1.5 | 0.2 | 0.2 | 1.2 | -0.4 | 0.9 | 1.4 | -0.6 | 1.2 | 1.4 | 2.1 | 1.1 | 0.9 | -0.1 | 0.1 | -1.3 | -0.4 | -0.1 | -0.3 | -0.3 | 0.8 | 0.6 | -0.6 | 0.2 | 0.5 | 0.2 | 0.3 | 1.1 | -1.1 | 0.9 | -0.5 | 0.1 | -0.1 | 0.3 | 0.33 |
| HU | -0.9 | -1.4 | -1.3 | -0.3 | 0.7 | -0.2 | -0.8 | 1.3 | 0.9 | 0.1 | 0.1 | 2.1 | 1.3 | 2.2 | 1.7 | -1.0 | 0.3 | -0.8 | 0.7 | 0.3 | 0.7 | -0.6 | 0.2 | 1.9 | -0.1 | 0.4 | 1.9 | -0.6 | -1.2 | 0.6 | 0.1 | -0.4 | 1.7 | 1.0 | 0.31 |
| LU | 1.5 | 1.7 | 0.4 | | | 1.1 | | -0.7 | 0.7 | -0.9 | 1.5 | | | -0.5 | 0.5 | 0.4 | -1.2 | -0.2 | 2.0 | -1.1 | 0.1 | -0.3 | -0.4 | 0.2 | 0.9 | 0.6 | -1.0 | 1.0 | -0.3 | 0.6 | -0.6 | | 0.1 | 0.0 | 0.22 |
| BE | 1.1 | 1.0 | 0.7 | -0.8 | -0.2 | 0.6 | 0.4 | -0.7 | 0.4 | 1.0 | 0.8 | 0.3 | 0.4 | 0.1 | 0.1 | -0.5 | -0.6 | 0.6 | -1.3 | 0.6 | 0.3 | 0.2 | -0.3 | -0.1 | 0.0 | -0.3 | -0.1 | 0.4 | 0.9 | 1.0 | 0.0 | 0.1 | -0.4 | 0.4 | 0.18 |
| AT | 1.0 | 0.4 | 0.0 | -0.3 | -0.2 | 0.6 | -2.1 | 0.2 | 0.4 | 1.2 | 1.7 | 0.3 | -0.4 | -0.2 | 0.1 | -0.2 | -0.4 | 0.3 | 0.1 | 0.4 | -0.1 | 0.0 | 0.2 | 0.4 | 0.0 | 2.0 | -0.7 | 0.0 | 0.0 | 0.3 | -0.4 | -0.5 | 2.0 | 0.2 | 0.18 |
| CZ | -0.2 | 0.4 | 0.4 | -1.9 | -1.6 | 0.4 | -1.3 | 0.7 | 0.9 | 0.6 | 0.8 | 1.1 | 1.3 | -0.1 | 1.1 | -0.2 | -0.1 | 0.5 | -0.2 | 0.5 | -0.2 | -0.2 | 0.0 | 1.0 | 0.3 | -1.4 | -0.2 | 0.7 | 0.6 | 0.4 | 0.2 | 0.7 | -0.6 | 0.8 | 0.16 |
| EE | -0.3 | -0.5 | 0.6 | 0.0 | 0.3 | -0.8 | -1.1 | -0.6 | 1.0 | 0.3 | -0.4 | 0.4 | 0.4 | 1.8 | 1.0 | 2.8 | 0.1 | 0.6 | 0.4 | -0.1 | 0.9 | -0.1 | 1.2 | -0.1 | -0.6 | -0.1 | -0.6 | -0.5 | -0.8 | 0.3 | -0.5 | 0.4 | -0.2 | 0.0 | 0.15 |
| UK | -0.4 | -0.5 | 0.4 | 1.0 | 0.3 | 0.4 | -0.6 | 0.1 | -0.9 | 0.3 | 0.4 | 0.6 | 1.3 | -0.3 | 1.0 | 0.5 | -0.8 | -0.4 | 0.5 | -0.3 | 0.6 | 0.4 | -1.1 | 0.4 | 0.1 | 0.5 | -1.8 | 0.2 | 0.8 | 0.9 | -0.3 | -0.8 | 0.6 | 0.6 | 0.12 |
| LT | -0.3 | 0.6 | 0.2 | | | -0.2 | | 0.6 | 0.2 | -0.5 | -0.8 | | | 1.3 | -0.1 | 0.7 | 0.6 | 0.0 | 0.8 | -0.8 | 0.6 | 1.2 | 0.7 | 0.5 | 0.1 | -0.1 | -1.5 | 0.2 | -2.2 | -0.6 | -0.2 | 0.8 | 0.5 | -0.3 | 0.07 |
| FR | 0.8 | -0.1 | 0.0 | 1.1 | 1.1 | 0.4 | 0.6 | -0.1 | -0.2 | 0.8 | 0.3 | -0.1 | 0.5 | -0.5 | -0.1 | -0.1 | -0.4 | 0.1 | -0.6 | -0.3 | 0.3 | 0.0 | 0.0 | 0.0 | -0.1 | -0.7 | -0.9 | 0.2 | -0.6 | -0.1 | 0.1 | 0.3 | -0.9 | 0.0 | 0.03 |
| RO | | -1.6 | 1.9 | | | -0.4 | | 0.2 | 0.1 | -0.7 | -2.2 | | | 0.1 | -2.7 | -1.7 | 2.0 | -0.3 | 0.3 | -0.5 | 0.1 | 0.5 | 1.4 | 0.3 | 0.8 | -1.1 | 0.0 | 1.3 | 0.3 | -1.4 | 1.7 | 1.9 | -0.4 | 0.6 | 0.03 |
| NL | -0.6 | 0.1 | 0.5 | 0.3 | 0.3 | 0.4 | 0.7 | 0.3 | 0.4 | 0.2 | -0.2 | -0.3 | 0.3 | -0.6 | -0.7 | 0.3 | -0.6 | -0.4 | 0.0 | 0.1 | 0.4 | -0.1 | -0.7 | -0.2 | -0.1 | -0.2 | -0.2 | -0.4 | 1.2 | -0.1 | -0.2 | -0.7 | -0.2 | 0.1 | -0.03 |
| IE | -2.6 | 0.6 | 0.5 | -0.3 | -0.5 | 2.1 | -1.1 | -0.1 | -1.1 | -2.0 | -0.9 | 0.2 | 0.5 | -0.5 | 0.6 | 1.4 | 3.2 | -0.9 | -2.7 | 0.3 | 0.4 | 0.3 | 0.3 | -0.8 | 2.0 | 0.1 | -0.5 | -0.2 | 1.3 | -0.5 | -0.6 | 0.0 | 0.3 | -0.3 | -0.05 |
| FI | 0.6 | 0.0 | 0.3 | 0.8 | 2.0 | 0.1 | 0.0 | -2.1 | -0.1 | 0.8 | 0.5 | -0.2 | -0.8 | -0.4 | 0.1 | -0.3 | -0.9 | -0.4 | -0.6 | -1.7 | 0.3 | 0.5 | -0.4 | -0.4 | -0.8 | 0.3 | 0.1 | 0.4 | 0.9 | -0.8 | 0.0 | 0.0 | -0.2 | 0.1 | -0.07 |
| PT | -1.3 | -1.6 | -1.4 | 1.2 | 0.4 | -0.8 | 1.9 | 0.6 | -1.6 | -0.7 | 0.4 | 0.2 | 0.0 | -0.3 | 0.0 | -0.3 | -0.3 | -0.3 | 0.6 | -0.5 | -0.6 | -0.2 | -1.0 | -0.5 | -0.8 | 1.6 | -0.1 | -0.7 | 1.5 | 0.7 | -0.4 | -0.4 | 2.1 | 0.0 | -0.08 |
| LV | -1.3 | -0.2 | -1.4 | | | -1.4 | | 0.4 | -0.2 | -1.7 | -1.1 | | | 3.0 | -0.6 | 0.1 | 0.3 | -0.2 | 0.6 | -1.8 | 0.7 | 0.6 | 1.4 | -0.5 | -0.8 | 0.1 | 0.6 | -0.9 | 0.4 | 0.7 | 0.7 | 0.0 | -0.1 | -0.3 | -0.10 |
| DK | -0.1 | 0.6 | 0.2 | 0.9 | 0.6 | 0.3 | -0.1 | -1.8 | 0.8 | -1.0 | 0.0 | 0.5 | 0.4 | -0.7 | 0.1 | -0.9 | -0.3 | -3.1 | 0.1 | -0.2 | 1.1 | -1.4 | 0.2 | -0.4 | -0.2 | 0.0 | -1.0 | -0.1 | -0.6 | -0.2 | -0.3 | 0.3 | -0.5 | -0.1 | -0.20 |
| SI | 0.2 | -0.6 | -0.3 | -0.9 | -0.8 | -1.0 | 0.7 | -0.4 | -1.3 | 0.4 | -0.5 | -1.1 | -0.8 | 0.0 | 0.6 | 0.6 | -0.7 | -0.4 | 0.7 | 0.5 | -0.8 | 0.7 | -0.5 | -0.6 | -0.4 | -0.5 | 1.3 | -0.2 | -0.4 | -0.1 | -0.5 | -0.4 | -0.9 | -0.2 | -0.26 |
| IT | 0.6 | -1.8 | -0.8 | | | -0.6 | | -0.1 | -0.2 | 0.6 | -0.4 | | | -0.8 | -1.0 | 1.1 | -0.9 | -0.2 | 0.0 | -0.6 | -0.3 | -0.1 | -0.6 | -0.3 | -1.1 | -0.1 | 0.3 | -1.0 | -0.2 | -1.2 | -0.6 | -0.9 | 0.3 | -0.8 | -0.40 |
| ES | | -0.5 | -0.4 | 0.6 | 0.2 | -0.7 | -0.3 | -1.9 | -1.7 | -0.9 | -1.2 | -0.3 | 0.0 | -0.6 | -0.9 | 0.6 | 0.2 | -0.3 | 1.5 | -1.0 | 0.0 | 2.2 | -0.6 | -1.4 | -0.6 | -0.4 | 0.9 | -1.0 | -2.1 | -0.7 | -1.1 | -0.6 | -1.1 | -2.2 | -0.49 |
| HR | | -1.0 | -0.3 | | | -0.3 | | 0.8 | -0.9 | 0.0 | -0.7 | | | -0.7 | -1.7 | -0.2 | -0.1 | -0.3 | -0.2 | -0.8 | -0.5 | -3.4 | -0.7 | -0.6 | -1.0 | 0.1 | | -1.5 | 0.1 | -1.3 | | -0.3 | 0.0 | -0.3 | -0.61 |
| CY | 0.0 | -0.6 | -1.1 | -2.4 | -2.9 | -1.0 | 0.9 | -0.7 | -1.2 | -2.0 | -0.5 | -2.3 | -2.9 | -1.3 | 1.4 | 0.3 | -0.4 | 0.5 | -2.4 | 0.0 | -4.0 | -1.2 | -1.7 | -1.8 | -0.7 | -0.9 | 0.6 | -0.3 | -1.4 | -2.6 | -0.8 | -2.0 | -1.2 | -1.7 | -1.12 |
| EL | -1.3 | -1.0 | -3.0 | 0.3 | 0.3 | -3.0 | -0.1 | 2.7 | -2.2 | -1.0 | -1.6 | -1.5 | -1.4 | -0.3 | 0.6 | -0.3 | -1.8 | -0.3 | -0.5 | 0.0 | -1.7 | 0.3 | -1.6 | -2.2 | -2.8 | -2.6 | -0.6 | -3.0 | -0.3 | -1.5 | -1.5 | -2.5 | -2.1 | -3.1 | -1.19 |

Notes: The heat-map reports standardized scores (i.e. z-scores) for the medium-run indicator. The colour scheme applied is defined in relation to each column separately. The colour scale ranges from red (low resilience) to green (high resilience). Average scores represent the country-specific mean of the indicators constructed on all variables available.

## CORRELATION BETWEEN INDIVIDUAL METRICS AND THE CORRESPONDING INDICATORS

Overall, there is a relatively high correlation between individual metrics and the corresponding aggregate indicators. However, some variables (mostly in the social domain, often coming from surveys) exhibit only a modest correlation for all metrics (both at the system and at the core level). The case of corporate loans is particular: the impact of the crisis on its dynamic behaviour is particularly strong, but apparently, it differs from the general crisis impact on most other variables. This finding is interesting even in itself, as it suggests that Member States differed in the degree they managed to insulate their economies (and society at large) from adverse credit market developments. It also reinforces the case for the system view, as different parts of the system may be strongly hit by the crisis yet behave differently, thus adding extra information to the overall picture.
It is worth highlighting that investment (for the impact), employment, GDP, and unemployment exhibit a consistently high correlation across the board. At the same time, bivariate scatterplots would reveal that there is still a substantial difference between the aggregate measures and any of these individual metrics.

| | | ASSET | | | | | | ENGINE | | | | | | | | | | | | | | | | OUTCOME | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | DWELLINGS | EXP. EDUCATION | EXP. HEALTH | FAIRNESS | TRUST PEOPLE | INVESTMENT | SOCIAL ACTIVITY | GOV. DEFICIT | GOV. DEBT | HH LOANS | HOUSE PRICES | TRUST EP | TRUST LEGAL | INFLATION | ACTIVE LM | PASSIVE LM | LABOUR PROD. | CORP. LOANS | PRIVATE DEBT | EXP. R&D | STOCK PRICES | TEMPORARY WORK | WAGES | EMPLOYMENT | GDP | HAPPINESS | HEALTH | HH CONSUMPTION | INEQUALITY | NEET | SOCIAL EXCLUSION | HH INCOME | SATISFACTION | UNEMPLOYMENT |
| IMPACT | Core | 0.66 | 0.01 | 0.34 | 0.21 | 0.19 | 0.91 | 0.07 | 0.64 | 0.72 | 0.81 | 0.71 | 0.57 | 0.46 | 0.51 | -0.06 | -0.36 | 0.40 | 0.19 | 0.53 | 0.21 | 0.55 | 0.16 | 0.42 | **0.94** | 0.76 | 0.40 | 0.12 | 0.73 | 0.29 | 0.88 | 0.49 | 0.67 | 0.43 | 0.88 |
| | System | 0.60 | 0.12 | 0.46 | 0.21 | 0.25 | **0.94** | 0.02 | 0.47 | 0.66 | 0.79 | 0.65 | 0.61 | 0.55 | 0.44 | -0.08 | -0.26 | 0.46 | 0.16 | 0.47 | 0.33 | 0.61 | 0.20 | 0.57 | 0.88 | 0.77 | 0.52 | 0.14 | 0.74 | 0.37 | 0.86 | 0.57 | 0.81 | 0.49 | 0.85 |
| RECOVERY | Core | 0.26 | 0.19 | 0.10 | 0.06 | -0.09 | 0.71 | -0.09 | 0.51 | 0.66 | 0.45 | 0.61 | 0.57 | 0.25 | 0.59 | 0.44 | 0.27 | 0.74 | 0.22 | 0.39 | 0.07 | 0.58 | 0.59 | 0.42 | 0.79 | **0.79** | 0.09 | -0.22 | 0.59 | 0.11 | 0.70 | 0.44 | 0.37 | 0.16 | 0.75 |
| | System | 0.45 | 0.38 | 0.33 | 0.04 | -0.04 | 0.54 | 0.01 | 0.32 | 0.48 | 0.32 | 0.57 | 0.48 | 0.19 | 0.71 | 0.47 | 0.24 | 0.72 | 0.23 | 0.39 | 0.25 | 0.59 | 0.59 | 0.68 | 0.75 | **0.78** | 0.29 | -0.17 | 0.70 | 0.19 | 0.61 | 0.63 | 0.54 | 0.24 | 0.71 |
| MEDIUM RUN | Core | 0.32 | 0.49 | 0.55 | 0.11 | 0.25 | 0.67 | -0.17 | 0.16 | 0.83 | 0.59 | 0.54 | 0.67 | 0.66 | 0.30 | 0.04 | -0.22 | 0.30 | 0.46 | 0.29 | 0.36 | 0.67 | 0.04 | 0.48 | **0.93** | 0.72 | 0.38 | 0.00 | 0.69 | 0.21 | 0.80 | 0.36 | 0.71 | 0.45 | 0.88 |
| | System | 0.34 | 0.57 | 0.66 | 0.16 | 0.29 | 0.67 | -0.13 | -0.02 | 0.79 | 0.54 | 0.52 | 0.61 | 0.61 | 0.30 | 0.00 | -0.13 | 0.36 | 0.35 | 0.29 | 0.44 | 0.66 | 0.18 | 0.60 | 0.83 | 0.75 | 0.52 | 0.04 | 0.75 | 0.30 | 0.84 | 0.55 | 0.78 | 0.52 | **0.87** |
| BOUNCE FORWARD | Core | 0.27 | 0.50 | 0.44 | 0.11 | 0.13 | 0.58 | -0.14 | 0.24 | 0.76 | 0.50 | 0.50 | 0.66 | 0.63 | 0.31 | 0.09 | -0.35 | 0.27 | 0.46 | 0.23 | 0.37 | 0.58 | 0.12 | 0.39 | **0.86** | 0.66 | 0.23 | -0.03 | 0.62 | 0.07 | 0.79 | 0.28 | 0.58 | 0.31 | 0.76 |
| | System | 0.30 | 0.63 | 0.55 | 0.13 | 0.21 | 0.61 | -0.10 | 0.05 | 0.73 | 0.46 | 0.52 | 0.56 | 0.51 | 0.30 | 0.07 | -0.24 | 0.34 | 0.39 | 0.17 | 0.38 | 0.56 | 0.25 | 0.53 | 0.76 | 0.70 | 0.34 | 0.01 | 0.72 | 0.18 | 0.78 | 0.44 | 0.69 | 0.36 | **0.78** |

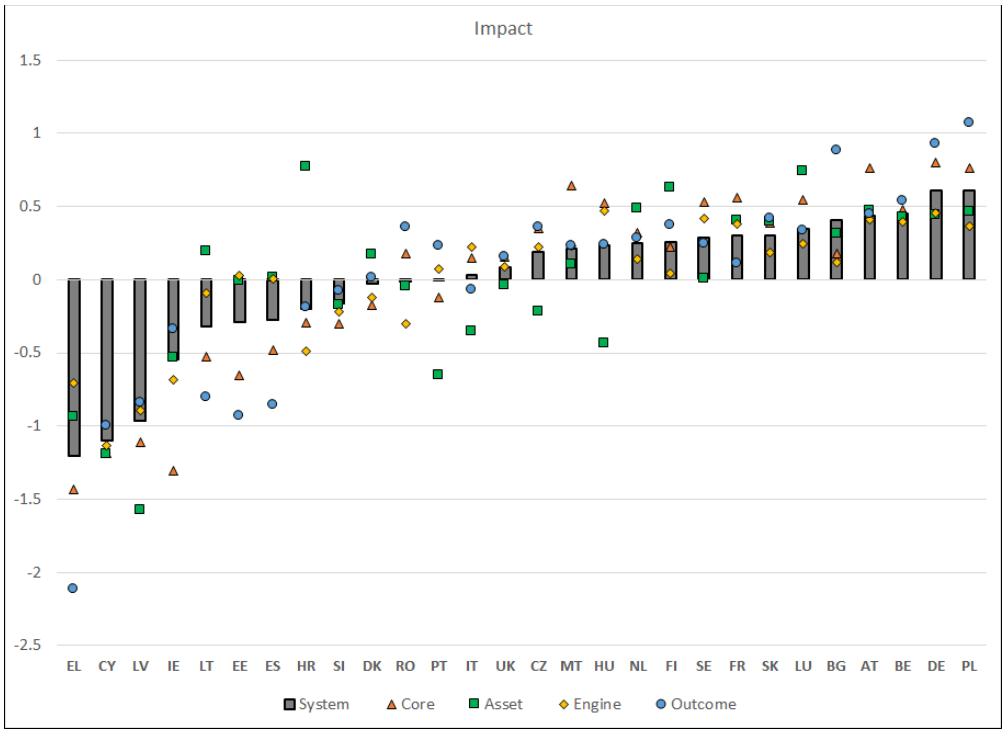
Notes. The "System" row of the table reports the correlation between the different metrics of each individual system variable and the corresponding resilience indicator. The "Core" row reports the correlation with a narrow resilience indicator, where the individual metrics are averaged only for the core economic and financial variables. Green indicates a correlation exceeding 0.5. Bold indicates the highest correlation value per row.

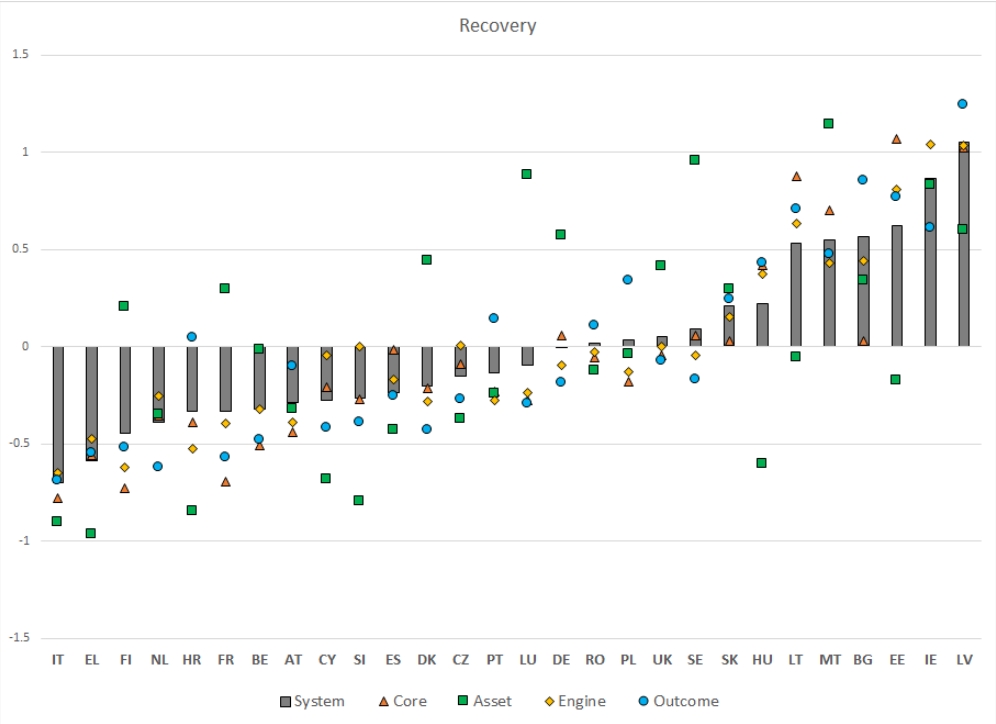
## Annex 5: Graphs on the resilience indicators

Figure 14 presents bar charts of the impact, recovery and medium-run indicators, respectively. Countries are ranked from the least resilient (left) to the most resilient (right). The main purpose of this graph is to compare the resilience indicators computed on the complete set of variables (bars), with the resilience of its sub-components: *core-economic* (triangles), assets (squares), engine (diamonds) and outcomes (circles). In general, these graphs confirm that countries that are the most (least) resilient in one dimension tend to be the most (least) resilient in all dimensions, though some differences emerge. For example, as far as the impact is concerned, HU ranks above average in terms of all dimension but assets, while the opposite is true for HR. Moreover, resilience indicators built on the assets show a higher dispersion.

Countries on the right hand side were impacted less compared to the others. The recovery metrics for these Member States is more difficult to be interpreted, since one could have a low recovery as a consequence of having experienced a weak impact. For this reason, looking at the medium-term impact (bottom chart) is more informative. The most resilient countries over the medium-run turn are Malta, Bulgaria, Poland and Germany.

Figure 14: Resilience indicators for the full system and its main ingredients. Top panel: Impact; medium panel: recovery; bottom panel: medium run.




Recovery
1.5
1
0.5
0
-0.5
-1
-1.5
IT EL FI NL HR FR BE AT CY SI ES DK CZ PT LU DE RO PL UK SE SK HU LT MT BG EE IE LV
System
Core
Asset
Engine
Outcome

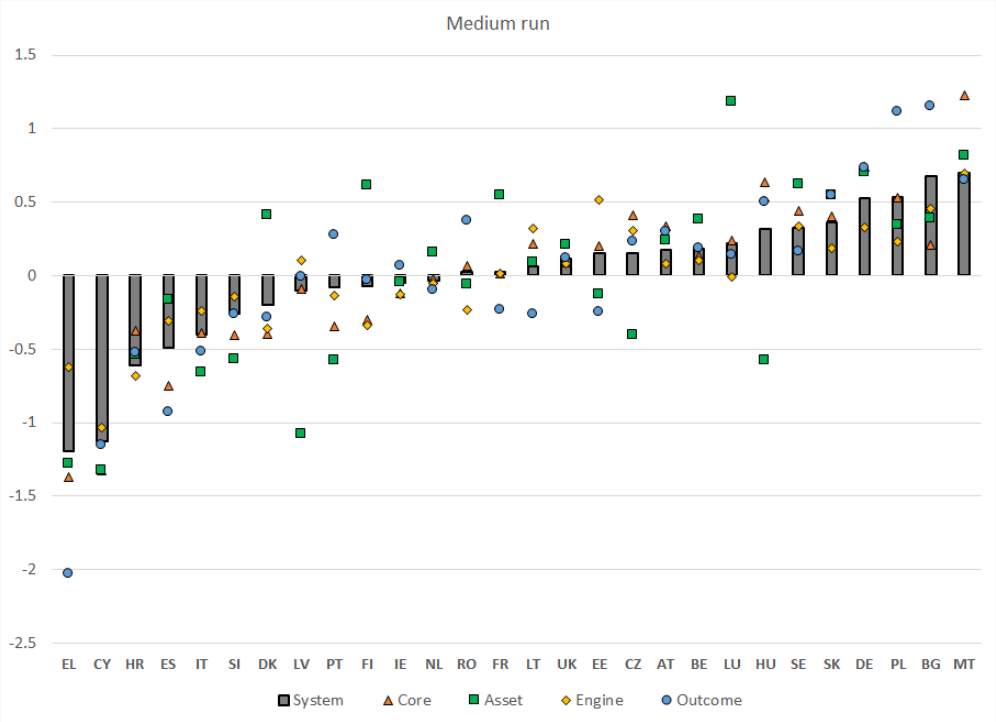

Medium run
1.5
1
0.5
0
-0.5
-1
-1.5
-2
-2.5
EL CY HR ES IT SI DK LV PT FI IE NL RO FR LT UK EE CZ AT BE LU HU SE SK DE PL BG MT
System
Core
Asset
Engine
Outcome

Figure 15 compares the impact, recovery and medium-run performance indicators calculated only for the *core–economic* variables (x-axis) vs those computed by taking a full *system view* (y-axis).

Figure 15: Comparison between the system view and the core-economic view.

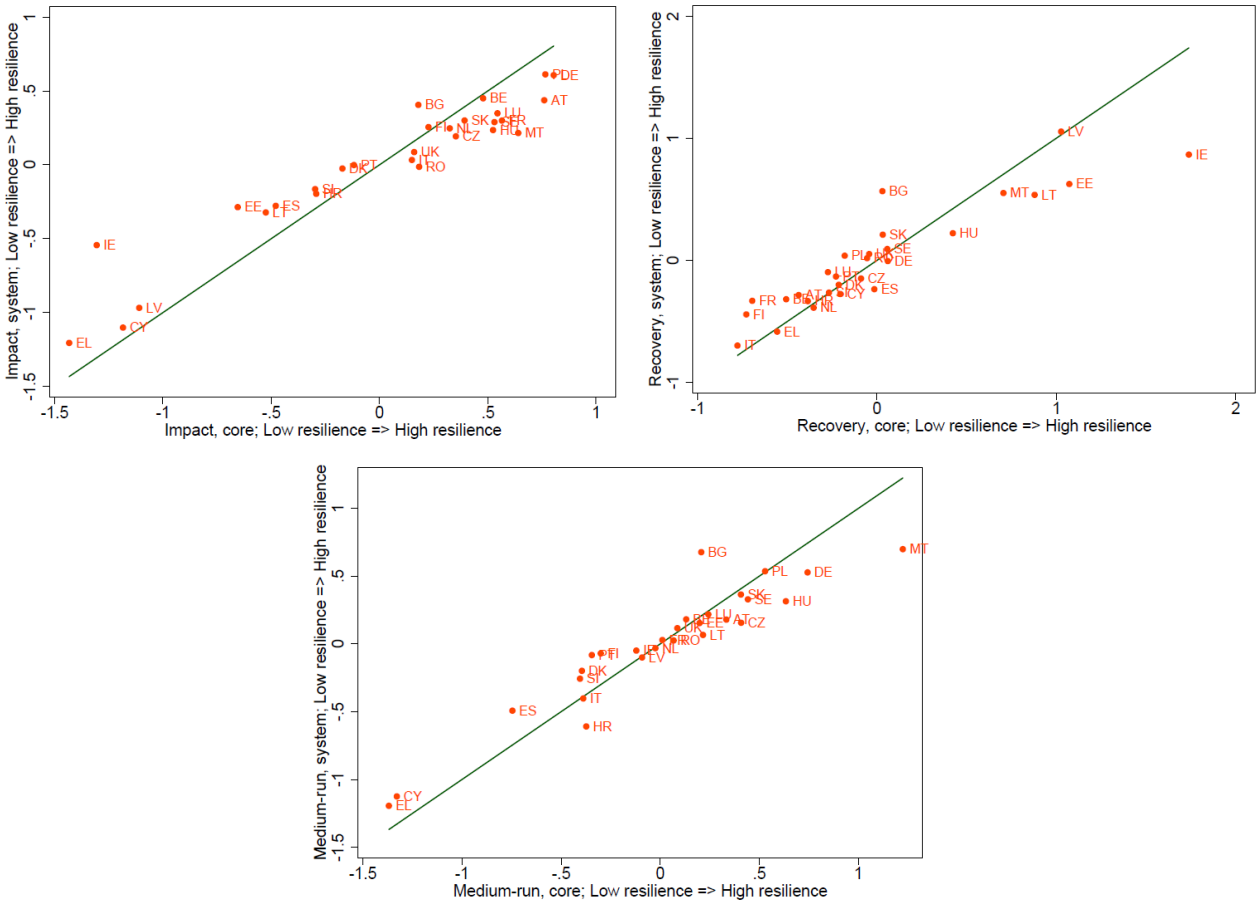
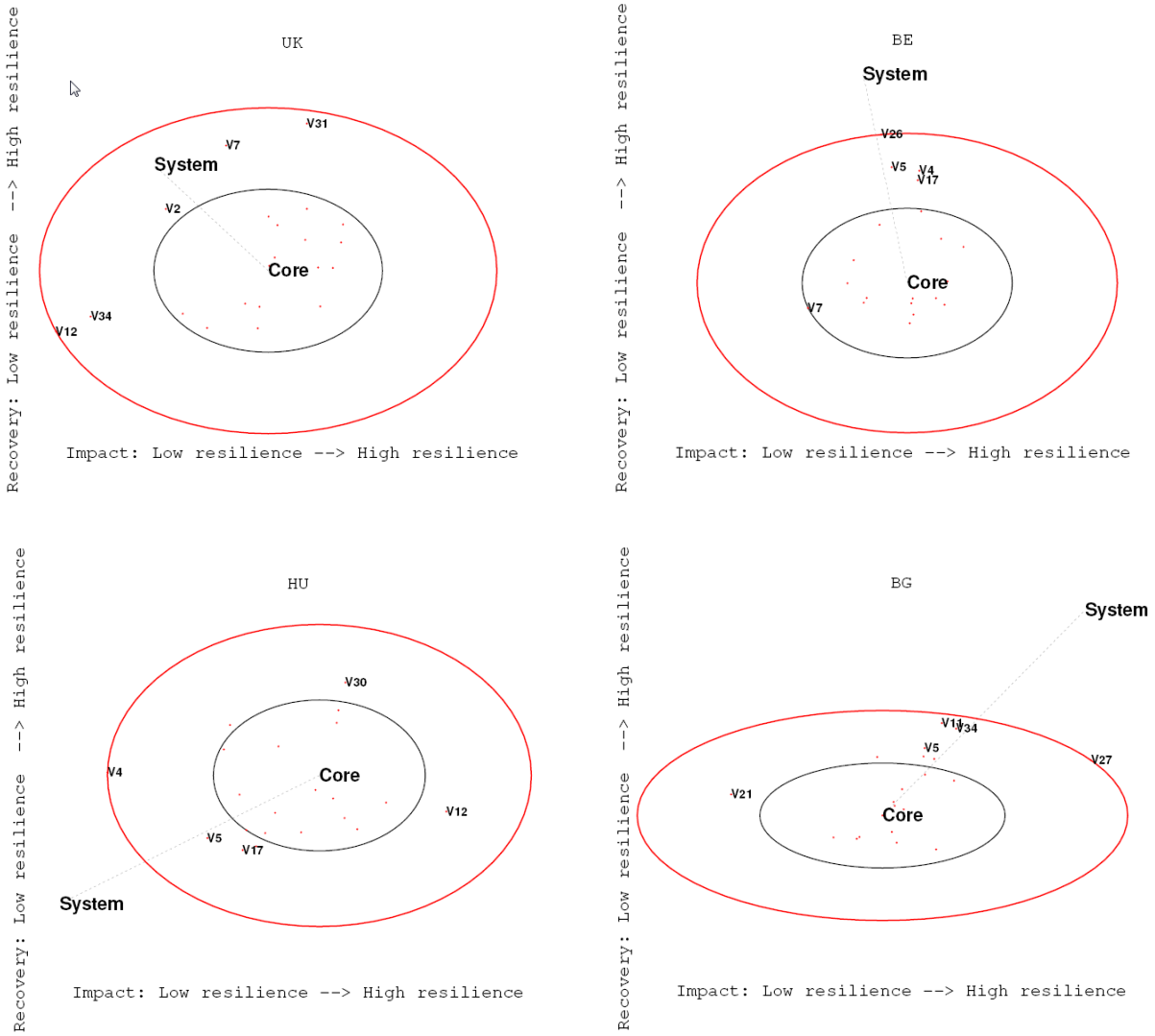


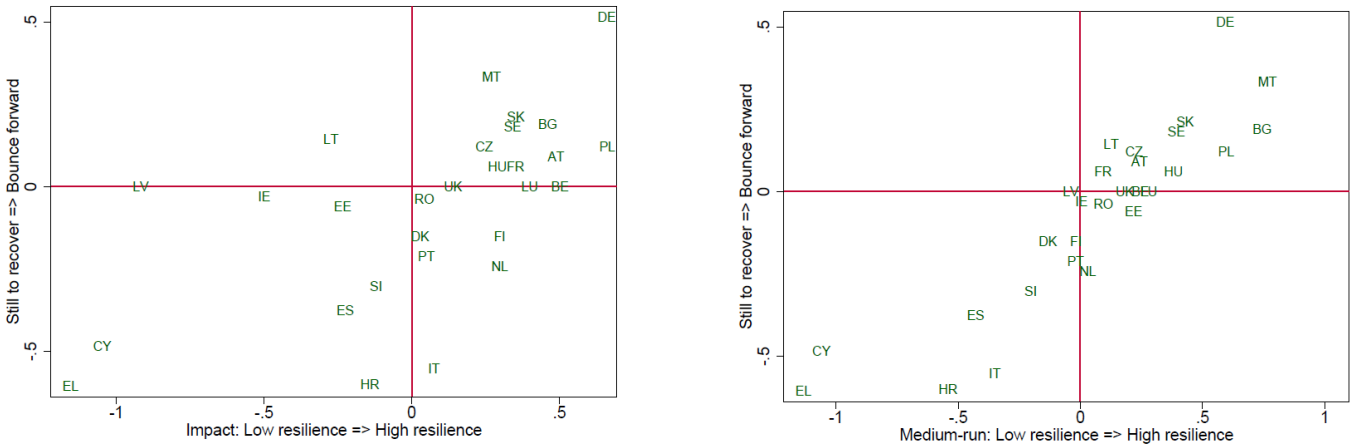

Figure 16 shows which variables are responsible for the different resilience performance once the analysis is broadened from a *core-economic* focus to a full *system view*. The analysis keeps the core-economic variables fixed while adding the more social variables one at a time. The points in the chart correspond to the value of the aggregate resilience indicator, computed on the set of core-economic variables plus the one extra variable of interest. The outer circle indicates the largest distance from the indicator based on the core set while the inner circle is its half. The five variables that are able to change the final resilience score most significantly are highlighted.

Figure 16: Comparison between the resilience indicators (impact and recovery) in the core-economic setting and the system view, for selected countries. The indicated variables are those responsible for the largest changes in the value of the aggregate indicators between the two settings.

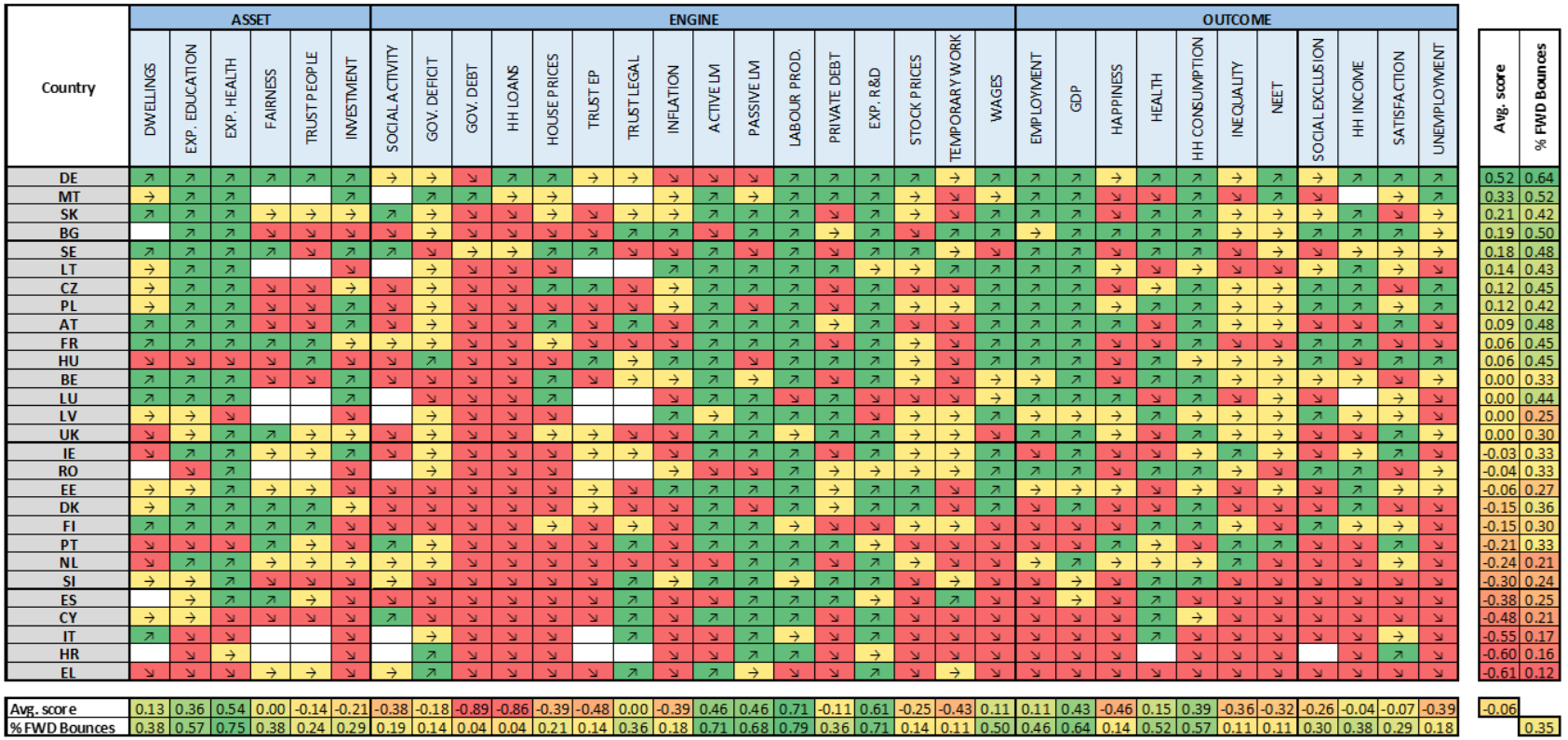



The variables indicated on the figure are the following.
UK: v2 – Dwellings, v7 – Fairness, v12 – Health, v31 – Trust in legal system, v34 – Wages.
BE: v4 – Expenditures on education, v5 – Expenditures on health, v7 – Fairness, v17 – Inequality, v26 – Social activity.
HU: v4 – Expenditures on education, v5 – Expenditures on health, v12 – Health, v17 – Inequality, v30 – Trust in the European Parliament.
BG: v5 – Expenditures on health, v11 – Happiness, v21 – Active labour market policies, v27 – Social exclusion, v34 – Wages.

Figure 17: Comparison between the bouncing forward and the impact and medium run indicators.



## Annex 6: Heat-map based on the bouncing forward indicator




Notes: The bouncing forward analysis captures the medium-run impact of the crisis relative to the pre-crisis situation, taking into account the observed pre-crisis volatility for each dimension. The pre-crisis volatility of a variable is defined as the standard (root-mean-square) deviation of its observed values around an HP-filtered trend during the 2000-2007 period. The heat-map is to be read as follows: 1) if the medium-run impact on the relevant variable is positive and larger than its pre-crisis volatility (i.e. "bouncing forward"), the cell is denoted by ↗ and coloured in green, 2) if the medium-run impact on the relevant variable is smaller (in absolute terms) than its pre-crisis volatility (i.e. "just recovering"), the cell is denoted by → and coloured in yellow, 3) if the medium-run impact on the relevant variable is negative and larger in magnitude than its pre-crisis volatility (i.e. "still to recover"), the cell is denoted by ↘ and coloured in red.

Average scores by country and variable are calculated as the simple mean of the relevant cross-section, whereby cases of "bouncing forward", "just recovering", and "still to recover" are assigned the values of +1,0, and -1, respectively. The share of forward bounces per variable is calculated as the number of forward bounces divided by the number of countries for which data is available for that specific variable. Similarly, the share of forward bounces per country is calculated as the number of forward bounces divided by the number of variables for which data is available for that specific country. Total averages for both summary indicators (bottom right corner) correspond to the mean of the respective country scores.

Bouncing forward information is missing for corporate loans, as loan dynamics could not be defined consistently for the pre-, during and post-crisis period.

## Annex 7: Detailed results for the analysis of resilience characteristics

| Impact of the crisis: univariate regressions | | | | |
|---|---|---|---|---|
| Var code | Variables | Adjusted $R^2$ | Coefficient | Significance level |
| C14 | Expenditures on social protection (00-07) | 0.30 | 0.07*** | 0.00 |
| C48 | Unit labour cost growth (05-07) | 0.29 | -0.03*** | 0.00 |
| C43 | Net int'l. investment position (05-07) | 0.26 | 0.007*** | 0.00 |
| C42 | Current account balance (05-07) | 0.25 | 0.04*** | 0.00 |
| C74 | Foreign market size (2007) | 0.24 | 0.29*** | 0.00 |
| C69 | Innovation capacity (2007) | 0.22 | 0.24*** | 0.01 |
| C81 | Quantity of local suppliers (2007) | 0.19 | 0.44** | 0.01 |
| C17 | Investment per GDP (05-07) | 0.19 | -0.05** | 0.01 |
| C19 | Non routine manual tasks (00-07) | 0.19 | -6.37** | 0.01 |
| C4 | Gender Equality Index (2005) | 0.12 | 0.02** | 0.04 |
| | | | | |
| **Impact of the crisis: bivariate regressions** | | | | |
| Var code | Variables | Adjusted $R^2$ | Coefficient | Significance level |
| C42 | Current account balance (05-07) | 0.52 | 0.09*** | 0.00 |
| C16 | GDP per capita (05-07) | | -0.99*** | 0.00 |
| | | | | |
| C15 | Expenditures on social protection (00-07) | 0.46 | 0.10*** | 0.00 |
| C51 | Real effective exchange rate (00-07) | | 0.05*** | 0.01 |
| | | | | |
| C48 | Unit labour cost growth (05-07) | 0.44 | -0.04*** | 0.00 |
| C44 | Export market share - 5 year % change (05-07) | | 0.008*** | 0.01 |
| | | | | |
| C14 | Expenditures on social protection (00-07) | 0.37 | 0.05** | 0.03 |
| C43 | Net int'l. investment position (05-07) | | 0.005* | 0.06 |
| | | | | |
| C14 | Expenditures on social protection (00-07) | 0.35 | 0.04* | 0.07 |
| C48 | Unit labour cost growth (05-07) | | -0.02* | 0.10 |
| | | | | |
| C14 | Expenditures on social protection (00-07) | 0.30 | 0.05* | 0.10 |
| C42 | Current account balance (05-07) | | 0.02 | 0.35 |
| | | | | |
| C19 | Non routine manual tasks (00-07) | 0.35 | -3.97 | 0.10 |
| C14 | Expenditures on social protection (00-07) | | 0.05** | 0.01 |

*** means the variable is significant at 1%, ** significant at 5% and * significant at 10%

The univariate specifications are the best eight of the meaningful ones, followed by selected interesting findings (marked by gray). The bivariate specifications are the best three of the meaningful pairs, followed by some selected interesting findings (marked by gray).

| Recovery from the crisis: univariate regressions | | | | |
|---|---|---|---|---|
| Var code | Variables | Adjusted $R^2$ | Coefficient | Significance level |
| C10 | GDP growth (00-07) | 0.46 | 0.15*** | 0.00 |
| C44 | Export market share - 5 year % change (00-07) | 0.40 | 0.098*** | 0.00 |
| C52 | Financial sector liabilities (06-07) | 0.39 | 0.03*** | 0.00 |
| C79 | Inflation (08-10) | 0.35 | 0.13*** | 0.00 |
| C76 | Government debt (05-07) | 0.31 | 0.31** | 0.00 |
| | | | | |
| **Recovery from the crisis: bivariate regressions** | | | | |
| Var code | Variables | Adjusted $R^2$ | Coefficient | Significance level |
| C10 | GDP growth (00-07) | 0.72 | 0.18*** | 0.00 |
| C61 | Ease of doing business index (2010) | | 0.02*** | 0.00 |
| | | | | |
| C79 | Inflation (08-10) | 0.67 | 0.17*** | 0.00 |
| C72 | FDI generating technology transfer (08-10) | | 0.47*** | 0.00 |
| | | | | |
| C44 | Export market share - 5 year % change (00-07) | 0.65 | 0.012*** | 0.00 |
| C61 | Ease of doing business index (2010) | | 0.03*** | 0.00 |

*** means the variable is significant at 1%, ** significant at 5% and * significant at 10%

The univariate specifications are the best five of the meaningful ones. The bivariate specifications are selected from the best five of the meaningful pairs, showing some interesting findings.

| Medium-run: univariate regressions | | | | |
|---|---|---|---|---|
| Var code | Variables | Adjusted $R^2$ | Coefficient | Significance level |
| C65 | Political stability (08-10) | 0.18 | 0.50** | 0.01 |
| C82 | Wages related to productivity (08-10) | 0.17 | 0.42** | 0.02 |
| C52 | Financial sector liabilities (08-10) | 0.14 | -0.02** | 0.03 |
| C43 | Net int'l. investment position (05-07) | 0.14 | 0.005** | 0.03 |
| C78 | Imports per GDP (2007) | 0.13 | 0.007** | 0.04 |
| C72 | FDI generating technology transfer (08-10) | 0.13 | 0.33** | 0.04 |
| C70 | Efficacy of corporate boards (08-10) | 0.12 | 0.35** | 0.04 |
| C62 | Trade openness (08-10) | 0.12 | 0.003** | 0.04 |
| | | | | |
| **Medium-run: bivariate regressions** | | | | |
| Var code | Variables | Adjusted $R^2$ | Coefficient | Significance level |
| C43 | Net int'l investment position (05-07) | 0.38 | 0.008*** | 0.00 |
| C44 | Export market share - 5 year % change (05-07) | | 0.009*** | 0.00 |
| | | | | |
| C52 | Financial sector liabilities (08-10) | 0.37 | -0.03*** | 0.00 |
| C10 | GDP growth (08-10) | | 0.11*** | 0.00 |
| | | | | |
| C43 | Net int'l investment position (05-07) | 0.37 | 0.008*** | 0.00 |
| C51 | Real effective exchange rate (00-07) | | 0.05*** | 0.00 |
| | | | | |
| C65 | Political stability (08-10) | 0.34 | 0.50*** | 0.01 |
| C52 | Financial sector liabilities (08-10) | | -0.02** | 0.01 |
| | | | | |
| C52 | Financial sector liabilities (08-10) | 0.33 | -0.03*** | 0.00 |
| C77 | Trust in the financial system (08-10) | | 0.47*** | 0.01 |
| | | | | |
| C65 | Political stability(08-10) | 0.30 | 0.68*** | 0.00 |
| C16 | GDP per capita (05-07) | | -0.43** | 0.03 |

*** significant at 1%, ** significant at 5% and * significant at 10%

The univariate specifications are the best eight of the meaningful ones. The bivariate specifications are the best three of the meaningful pairs, followed by some selected interesting findings (marked by gray).

| Bouncing forward: univariate regressions | | | | |
|---|---|---|---|---|
| Var code | Variables | Adjusted $R^2$ | Coefficient | Significance level |
| C81 | Wages related to productivity (08-10) | 0.28 | 0.32*** | 0.00 |
| C69 | Efficacy of corporate boards (08-10) | 0.22 | 0.27*** | 0.01 |
| C79 | Intensity of local competition (08-10) | 0.18 | 0.28** | 0.01 |
| C71 | FDI generating technology transfer (08-10) | 0.17 | 0.23** | 0.02 |
| C82 | Prevalence of foreign ownership (08-10) | 0.16 | 0.19** | 0.02 |
| C76 | Trust in the financial system (08-10) | 0.15 | 0.26** | 0.02 |
| C64 | Political stability (2008-2010) | 0.14 | 0.28** | 0.03 |
| C42 | Net int'l investment position (05-07) | 0.14 | 0.003** | 0.03 |
| C60 | Ease of doing business index (2010) | 0.10 | 0.01* | 0.06 |
| | | | | |
| **Bouncing forward: bivariate regressions** | | | | |
| Var code | Variables | Adjusted $R^2$ | Coefficient | Significance level |
| C79 | Intensity of local competition (08-10) | 0.49 | 0.40*** | 0.00 |
| C43 | Export market share - 5 year % change (08-10) | | 0.007*** | 0.00 |
| | | | | |
| C69 | Efficacy of corporate boards (08-10) | 0.46 | 0.33*** | 0.00 |
| C43 | Export market share - 5 year % change (08-10) | | 0.006*** | 0.00 |
| | | | | |
| C81 | Wages related to productivity (08-10) | 0.46 | 0.34*** | 0.00 |
| C42 | Net int'l investment position (05-07) | | 0.004*** | 0.00 |
| | | | | |
| C64 | Political stability (2008-2010) | 0.34 | 0.20* | 0.08 |
| C81 | Wages related to productivity (08-10) | | 0.28*** | 0.01 |

*** significant at 1%, ** significant at 5% and * significant at 10%

The univariate specifications are the best eight of the meaningful ones, followed by a selected interesting finding (marked by gray). The bivariate specifications are the best three of the meaningful pairs, followed by some selected interesting findings.

## Annex 8: The importance of expenditures on social protection

That government expenditures on social protection are a source of socio-economic resilience of a country or community is an intriguing finding on several counts. First, it squares with the growing post-crisis consensus that raising social standards and institutionalizing social protection may be indispensable for social stability and sustainable development. This was one of the key arguments for the recently introduced European Pillar of Social Rights. Similar ideas are advocated by the OECD's "Inclusive Growth" or "Growth-Fragility" frameworks in relation to a wide range of socio-economic indicators. Given the mounting empirical evidence that income inequality, especially inequality at the bottom, hampers economic performance (Cingano, 2014; Ostry, Berg and Tsangarides, 2014), the case for making expenditures on social protection a more efficient and endemic policy tool is much warranted.

Secondly, and more importantly, our finding suggest that exploring the role of a strong welfare state (high level of expenditures on social protection) in coping with economic turbulences is of prime importance. Unfortunately, this is an area of research that has not garnered enough attention in the past, either within or outside the European Union. To our best knowledge, the only paper that studied the empirical link between social protection and economic performance from a decidedly resilience perspective is by Roca and Ferrer (2016), who find that higher levels of expenditures on social protection by the government were positively associated with growth performance during the recent crisis episode in 16 developing countries. Replicating their result in a methodologically sound fashion in the context of the EU would therefore be an important contribution.

The third rationale for studying the link between expenditures on social protection and economic resilience stems from the complexity and multitude of potential configurations and transmission channels. For example, various studies have shown that not only the level, but also the composition of expenditures on social protection may matter for economic performance: Arjona *et al.* (2002) find that only "active" spending is associated with higher growth, Alesina *et al.* (2017) establish that transfer payments may have a different effect on output than non-transfer expenditures, while Johansson (2016) shows that transfers need to be combined with an adequate tax structure to be effective. Our understanding is also very limited regarding the main functions of expenditures on social protection: as Fan & Rao (2003) shows for a set of developing countries, certain types of expenditures (e.g. health, education) are likely to contribute more to economic growth than others, and that this may change from country to country. Identifying the most effective channels of social protection during the European crisis episode is therefore a commendable policy objective.

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KJ-NA-29221-EN-N

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doi:10.2760/840532

ISBN 978-92-79-85746-1