

Determinants of macroeconomic resilience in the euro area: An empirical assessment of policy levers

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Abstract

This paper investigates which structural characteristics matter most for a country's economic resilience. This is done econometrically by comparing the capacity to absorb and recover from common shocks across the euro area Member States. The paper aims at identifying a set of factors as diverse and specific as possible in order to guide future policy actions. The results suggest that factors related to the well-functioning of markets matter most. For instance, creating environments that foster entrepreneurship increases the ability to adapt and recover from exogenous shocks. Price controls both amplify shocks and slow down the recovery. A higher stock of non-performing loans and a weaker competition in the banking sector affect negatively an economy's absorption as well as recovery capacity. Some structural factors such as economic openness appear to have different impact on the shock absorption capacity and the recovery capacity in the face of a common shock. Such findings reiterate the need to identify and pursue vigorously policies and structural reforms. Finally, the macro-econometric results also imply that more analysis is needed to understand better specific micro-economic transmission mechanisms such as active labour market policies.

JEL Codes: E32;L50;J21

Keywords: macroeconomic resilience, common shocks, economic structures, structural reforms

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1. Introduction

Resilience is mostly defined as a capacity of an entity or a system to recover quickly from difficulties (typically an adverse external shock). The concept of resilience has been used in different fields. For example, in environment science and ecology it mostly refers to ecosystems' ability to deal with natural disasters such as earthquakes, hurricanes, floods or droughts. In economics, the resilience has been commonly viewed from the regional perspective (Martin and Sunley, 2015). In such a context, the adverse shock can be represented for example by closure of major regional employer or reallocation of whole industry and the system's resilience can be evaluated in terms of impact on employment and income levels. Given that external shocks are unavoidable, an economy's resilience has been deemed as a crucial ability in a fast changing world and an increase in resilience became a key policy objective.

Macroeconomic resilience refers to the ability of countries to withstand shocks and recover quickly towards potential growth (e.g. Briguglio et al., 2009), i.e. it is defined in term of dynamics of output. ⁽¹⁾ Increasing the resilience of the economy will reduce the risk that a country deviates significantly from its real convergence path. However, macroeconomic resilience is a very broad concept and attempts to narrow it down were done only recently as an initiative of policy institutions. ⁽²⁾ Likewise, the empirical evidence about the determinants of resilience at country level is still rather scarce and mostly aimed at narrow set of broad structural characteristics such as functioning of labour and product market (Brůha and Kucharčuková, 2017, Duval and Vogel, 2008, Sondermann, 2018). However, in order to guide the structural reforms it seems necessary to identify more detailed structural features of countries that contribute to their ability to weather impact of adverse shocks. Likewise, in order to prioritize between different structural reforms it is necessary to evaluate the impact of a broad set of structural characteristics and institutions. Finally, it is also important to acknowledge that potential for relatively quick and successful structural reforms is not the same in all areas as some structural characteristics are linked to the degree of economic development and evolve only in the long term.

Convergence towards resilient economic structures seems to be also a necessary condition for the well-functioning of the Economic and Monetary Union (EMU). ⁽³⁾ Namely, with irreversible fixed nominal exchange rates and a common monetary policy, convergence to resilient economic structures across EMU is especially crucial as Member states' economies need to absorb economic shocks via internal adjustment and a common monetary policy loses its effectiveness if business cycles are not synchronised. Therefore, in the ongoing policy debate about the well-functioning of EMU, resilience refers mostly to cyclical downturns, which if persistent may affect adversely also the potential growth via hysteresis effects. Graph 1 summarizes the variety in cyclical behaviour among euro area Member States in terms of amplitude and persistence of the output gap. ⁽⁴⁾ While the output gap widened significantly at the onset of the Global Financial Crisis in all euro area Member States, it persisted at a much stronger pace in the Member States hardest hit by the crisis. To the extent that this was triggered by a common shock with the same intensity, this pattern may reflect differences in resilience.

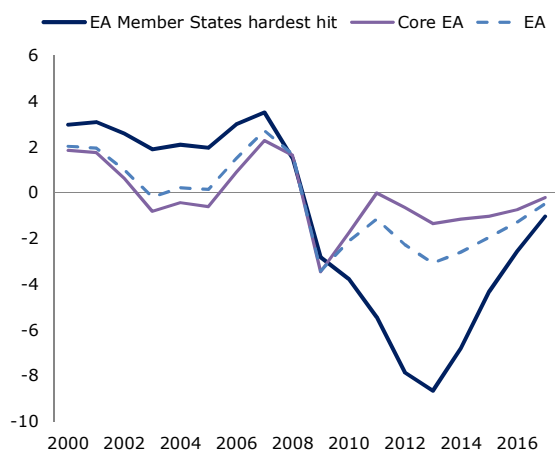
⁽¹⁾ The common measure of macroeconomic output is the GDP. However, it is important to note that adverse shocks may affect also non-market production and, most importantly, have also significant distributional effects.

⁽²⁾ See Alessi et al., 2018, Canton et al., 2016, ECB, 2016, Giudice et al., 2018, G20, 2017, IMF, 2016.

⁽³⁾ The notion of convergence was highlighted also in high-level EU policy documents, namely The Five Presidents' Report (Juncker, J-C, in close cooperation with Tusk, D, Dijsselbloem, J., Draghi, M. and M. Schultz (2015), Completing Europe's Economic and Monetary Union).

⁽⁴⁾ Other measures could be used. For instance, Caldera Sánchez et al. (2016) identify economic resilience as a lower occurrence of severe recession. Elbourne et al. (2008) use the level of expected discounted utility as a measure of resilience.

Graph 1: Output gap dynamics across the euro area



Note: Core EA includes DE, AT, NL and FR. EA Member States hardest hit includes IE, ES, EL, CY and PT. The output gap measures the gap between actual GDP and potential GDP as percentage of potential GDP and is measured in this section as AMECO variable AVGDGP.

Source: Authors' estimates based on AMECO data.

The aim of this paper is to investigate empirically the factors that may have contributed to these disparities. The *significance* and *relative importance* of these factors is evaluated by comparing *the impact of and recovery from* common shocks across the euro area Member States (for which sufficient data are available as well as a selected group of non-euro EU Member States) over the period from 1998 to 2015.⁽⁵⁾

Strengthening resilience entails acting on three elements: i) reducing the economies' vulnerability to shocks; ii) increasing their shock-absorption capacity; and iii) increasing their ability to reallocate resources and recover from the shocks.⁽⁶⁾ This paper focusses on the latter two elements, namely it aims at identifying the structural features of economies that make them able to weather the impact of adverse shocks both in the short- and medium-term. The factors affecting the first element have already been examined elsewhere (e.g. Röhn, et al., 2015, Hermanssem and Röhn, 2015) by identifying the short-term vulnerabilities and imbalances⁽⁷⁾ that affect the likelihood that an economy gets hit by a shock.

This paper first provides a general discussion on a broad range of factors that may affect economic resilience and subsequently it assesses empirically how these different factors affect economic resilience at the level of the euro area Member States in order to identify policy levers that can be used to strengthen it. It is important to note that the subsequent analysis provides empirical results within the limits set by data availability and by the use of a reduced form econometric analysis. As such the analysis is less suited to provide a full understanding of the micro-economic transmission mechanisms that affect an economy's resilience such as active labour market policies that are specifically targeted to specific groups like the young, the low skilled and the long-term unemployed. Further analysis and development of this framework would be useful.

⁽⁵⁾ I.e., BE, DE, IE, ES, FR, IT, LU, NL, AT, PT, FI, CZ, DK, HU, PL, SE and UK. The sample size is set by data availability.

⁽⁶⁾ See for example IMF (2016) and Giudice et al. (2018) for an extensive but non-exhaustive taxonomy of factors that could have an impact on the three building blocks of economic resilience. While the authors offer a broad framework, they do not empirically compare the relative importance of the different factors.

⁽⁷⁾ Contrary to shocks which are exogenous, imbalances tend to be policy-driven and build up over time until they become unsustainable. A rich literature has aimed at identifying the progressive accumulation of imbalances.

This paper is structured as follows. Sub-section 2 briefly describes the analytical framework used to estimate the impact of various factors affecting an economy's capacity to absorb and recover from common shocks. Sub-section 3 identifies the factors that may potentially affect an economy's shock absorption and recovery capacity, including i) structural factors such as the diversity and openness of the economy, ii) factors affecting the functioning of labour, product and financial markets, iii) macro-economic conditions, and iv) factors affecting the quality of non-economic institutions such as governance. Sub-section 4 provides estimates of the significance of these factors. The last section draws some policy conclusions.

2. Factors affecting the shock absorption capacity and persistence of shocks

Previous research tested the significance of a range of broad factors (e.g. product market, labour market, taxation) that are most relevant for macroeconomic resilience without exploring the detailed factors that can be linked to concrete structural reforms. For instance, some authors report that a high level of product market regulation weakens industries' resilience to adverse shocks (Canova et al., 2012). For the euro area Member States, it was reported that well-functioning labour and product markets and political institutions improve an economy's shock absorption capacity (Sondermann, 2018). The analysis examining possible trade-offs between growth and macroeconomic resilience, did not find trade-offs as far as product and labour market reforms are concerned, but indicated that trade-offs may appear in the areas of financial market and macro-prudential policies (Caldera Sánchez et al., 2016). Finally, some authors report that a low protection of temporary contracts, political stability, regulatory quality and pre-crisis fiscal space were found to be the most relevant for a swift recovery, whereas unemployment benefits and employment protection legislation do not seem to increase macroeconomic resilience (Brůha and Kucharčuková, 2017).

This paper provides an assessment of factors at a more disaggregated level. The factors affecting macroeconomic resilience are classified in several categories - ranging from very broad structural factors such as the economy's openness to international trade and institutional characteristics like the level of corruption, to very specific characteristics including the regulation of labour markets as well as short-term macroeconomic conditions such as interest rates. Here it should be noted that while there are many potential factors, they do not necessarily point in the same direction. In some cases the same factor can have positive impact on absorption while negative on recovery. Table A. 1 in Annex briefly describes the indicators which are used to measure these factors. As previously discussed, it can be reasonably assumed that these factors have an impact on resilience in broad terms, i.e. they contribute to a country's capacity to weather adverse shocks irrespectively of the shock origin (idiosyncratic, common) and type.

2.1 Product markets

Competitive product markets are important drivers of macroeconomic resilience as well-functioning product markets generate more rapid adjustments also shifting the adjustment burden from quantities (i.e. output) to prices which has an impact on competitiveness.

Several factors affect the degree of competition in product markets⁽⁸⁾ including *barriers to entrepreneurship* such as licenses and permit systems and administrative burdens, barriers to trade and investment such as differential treatment of foreign suppliers and barriers to FDI as well as state control such as price controls and government involvement in network industries. More specifically, entrepreneurship framework conditions have a direct impact on the entry and exit of firms which is especially important during the recovery as it helps to reallocate resources (Andrews and Saia, 2017).

⁽⁸⁾ Following the classification of the OECD Product Market Regulation Indicator (Koske et al., 2015).

State control, especially price controls and strict regulation of network industries and professional services may limit especially an economy's recovery capacity. The impact of product market regulation on the economy's absorption and recovery capacity is not unambiguous. For example, on the one hand, more stringent product market regulation may lead to higher price mark-ups that allow firms to cushion the employment impact of price fluctuations initially (e.g. OECD, 2006). On the other hand, however, more stringent product market regulation slows-down the recovery as it hinders the reallocation of resources by hindering, for instance, the entry of new firms (Duval and Vogel, 2008, Canova et al., 2012).

In the EU and euro area context, *deepening the Single Market* including the transposition and application of directives, impacts Member States' resilience as it strengthens opportunities to increase product diversification and price flexibility, while cross-border convergence towards best practices in terms of market openness, insolvency frameworks and business regulations may speed up the recovery (Jolles and Meyermans, 2018).

Finally, product markets affect resilience also in an indirect way because well-functioning product markets allow for a better transmission of monetary and fiscal policy impulses (Pelkmans et al., 2008).

2.2 Labour markets

The composition of the labour force represents a key structural feature of labour market as a high share in total employment of experienced high-skilled workers and self-employment creates a stronger capacity to absorb and adapt to shocks.⁽⁹⁾ Self-employment may also be a mechanism to escape unemployment when the economy gets hit by an adverse shock.⁽¹⁰⁾⁽¹¹⁾

Another important feature is flexibility of wages and prices. When wages and prices are rigid most of the adjustment falls on quantities, including output and employment – especially in the case of persistent shocks. Labour markets institutions have a direct impact on macro-economic adjustment.⁽¹²⁾ However, their impact on absorption and recovery does not necessarily point in the same direction. For example, out-of-work income support could help to stabilise aggregate demand if the shock would induce lay-offs - thereby tempering the impact of the shock on consumption and limiting hysteresis effects linked to persistent unemployment spells that would aggravate the long-run growth potential (e.g. Meyermans and Nikolov, 2017). However, a too generous or protracted out-of-work income support may increase workers' reservation wage which in turn may hinder labour reallocation.⁽¹³⁾ In addition, the effective use of such schemes during a downturn is conditioned by the available fiscal space (e.g. Hijzen et al., 2017).

⁽⁹⁾ For instance, Liang and Goetz (2016) analysing data at the US regional level, report that the marginal impacts of Chinese import penetration on job losses are dampened in localities with higher self-employment rates, reflecting their stronger propensity to be flexible and absorb new knowledge when a shock hits the economy.

⁽¹⁰⁾ Such endogeneity implies then that in the empirical analysis instrumental variables are used if the share of self-employment in total employment is included as explanatory variable.

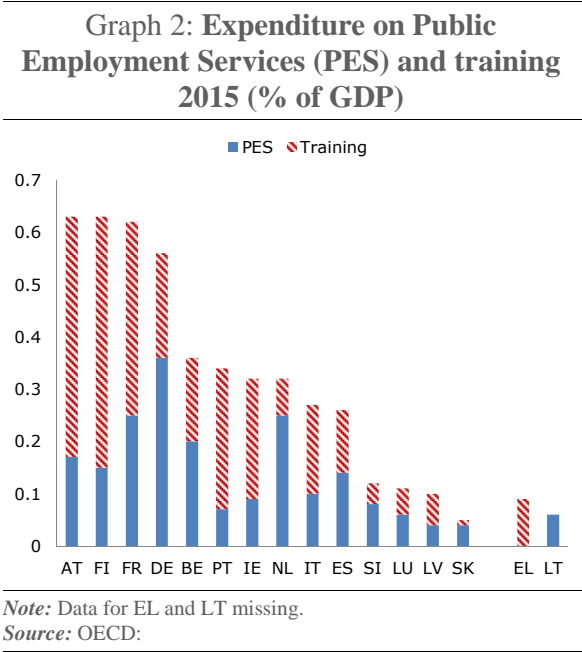
⁽¹¹⁾ The Global Entrepreneurship Monitor (2018), for instance, distinguishes between necessity and opportunity entrepreneurship and finds that necessity entrepreneurship tends to decrease as the level of economic development increases.

⁽¹²⁾ For instance, Blanchard and Wolfers (2000) provide empirical evidence on the interactions between shocks and labour market institutions - albeit in their analysis the dependent variable is the unemployment rate.

⁽¹³⁾ Apart from raising workers' reservation wage, out-of-work income support may also increase workers time for job search thereby improving job matching – which in turn may improve potential productivity. For instance, Bassanini and Duval (2006) who report a positive effect of unemployment benefits on the persistence of unemployment. But Brůha and Kucharčuková (2017) do not find evidence that generous unemployment benefits make a difference.

Strict *Employment Protection Legislation (EPL)* ⁽¹⁴⁾ may temper the firing of labour in the face of an adverse shock which in turn may temporarily support employment and aggregate demand. However, it could also delay any necessary labour reallocation during the recovery phase. ⁽¹⁵⁾ A less restrictive EPL could on the other hand increase job turn-over as well as income insecurity, so that, in the absence of adequate unemployment benefits, aggregate consumption would be adversely affected by precautionary savings – slowing down the recovery. ⁽¹⁶⁾

Active labour market policies (ALMP) also impact macroeconomic resilience especially during the recovery as they cover a whole range of policies that facilitate labour reallocation such as training of workers as well as guidance and counselling provided by public employment services (PESs). ⁽¹⁷⁾ Graph 2 shows that there are notable differences across Member States in terms of expenditure on public employment services and training.



Collective bargaining is a key determinant of wage flexibility whereby both highly centralised and highly decentralised regimes strengthen the alignment of wages and productivity, while a high degree of coordination of bargaining can moderate wage increases. ⁽¹⁸⁾ At the same time, bargaining could increase

⁽¹⁴⁾ The OECD EPL indicator captures the strictness of the Employment Protection Legislation through 18 indicators that cover three broad areas: 1. Employment protection of regular workers against individual dismissal; 2. Specific requirements for collective dismissals; and 3. Regulation of temporary forms of employment.

⁽¹⁵⁾ Duval and Vogel (2008) show that strict labour and product market regulation initially may dampen the impact of a common shock but make it more long-lasting. Biroli et al. (2010) show that the EPL indeed dampens the adjustment and increases the persistence of the shock. EPL tends to lead to more nominal wage rigidity as shown in Holden and Wulfsberg (2005). At a more granular level, Brůha and Kucharčuková (2017) report that low protection of contracts positively impact macroeconomic resilience.

⁽¹⁶⁾ Hence, the need to explore the empirical significance of other drivers such as income support for the unemployed and access to credit markets (e.g. Koeniger and Prat, 2007).

⁽¹⁷⁾ Bassanini and Duval (2006) examine unemployment patterns, so not strictly at overall macroeconomic resilience, and found specific interactions across policies and institutions to be very robust, namely between unemployment benefits and public spending on active labour market programmes

⁽¹⁸⁾ For instance, Speckesser et al. (2015) report that a higher degree of coordination and centralisation tempers nominal unit labour cost growth but has no significant impact real unit labour cost.

rigidities in adjustment to localised developments in case of excessive centralisation or being unable to smoothen wage adjustment over time and sectors in case of excessive decentralisation.

Finally, *labour market duality* may hinder an economy's capacity to absorb and recover from a shock because of increased employment volatility. An excessive adjustment burden falls on workers at the margin of the labour market through the deregulation of temporary contracts, development of agency work and other contracts of limited duration. Indeed, the prevalence of fixed-term contracts (as opposed to highly protected permanent ones) is found to increase the response of unemployment to output shocks while decreasing its persistence (e.g. Kosio et al., 2016). ⁽¹⁹⁾

2.3 Financial markets

Well-functioning financial markets help economic agents to smoothen their consumption and investment in the face of shocks. By channelling savings and borrowing across regions and over time - provided intertemporal budget constraints are respected. However, several factors may limit this capacity whereby it is important to distinguish between financial system *long-term characteristics from vulnerabilities*. For example, Caldera Sánchez et al. (2016) report a trade-off between efficiency and crisis-risk with regards to financial market policies.

For instance, a high *stock of non-performing loans* may hinder the absorption of shocks as it limits the banking sector to provide new loans. At the same time, a severe shock may adversely affect borrowers' ability to repay their debts. In turn, this increase in non-performing loans weakens banks' lending capacity and thus also the economy's capacity to absorb shocks. ⁽²⁰⁾ Graph 3 shows strong differences in terms of non-performing loans (as percentage of total gross loans) across Member States as well as over time in some Member States. ⁽²¹⁾

While the financial sector has the potential to help absorb shocks, it may itself be a source of shocks or intensify the amplitude of credit cycles. For example, excessive credit expansion followed by a housing bubble and burst and sudden reversal may lead banks to curtail lending and increase lending spreads (e.g. Kanngiesser et al., 2017). In case of the long-term characteristics of financial intermediation, it was found that a higher stringency of capital adequacy requirements for banks, greater reliance of a domestic banking system on deposits, and openness to non-domestic banks decrease the vulnerability to financial contagion. Access to multiple sources of funding may in turn reduce the persistence of the effects of shocks (e.g. Ahrend and Goujard, 2012a).

Banking sector competition is a crucial structural variable that may improve the allocative efficiency of capital as well as investment, which in turn may speed up the recovery. ⁽²²⁾ However, beyond a threshold level of financial development the financial sector may ignite a reallocation of highly skilled from the

⁽¹⁹⁾ While the degree of labour market duality cannot be directly measured, it can be traced via other aforementioned features such as EPL or collective bargaining.

⁽²⁰⁾ In the consecutive econometric analysis this interaction has been taken into account using instrumental variables. In general, in this section variables are instrumented using lagged variables with lags up to 3 years. More specifically, for non-performing loans the instrumental variables include lagged output gap and other lagged financial variables such as public debt and household debt.

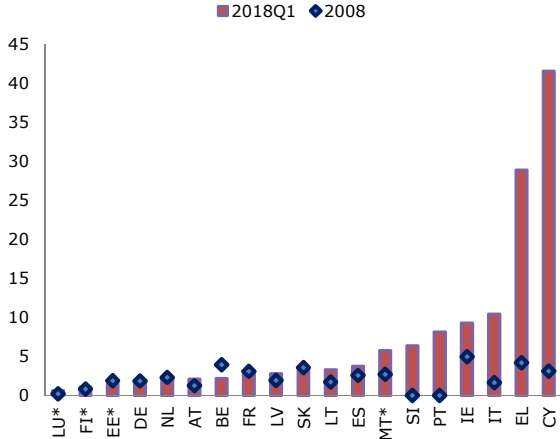
⁽²¹⁾ Due to differences in national accounting, taxation, and supervisory regimes, these data are not strictly comparable across countries. Data retrieved from the Federal Reserve Bank of St. Louis covering for most Member States the full 1998-2015 period. ECB data on non-performing loans only start as of 2007.

⁽²²⁾ In the consecutive econometric analysis, market power will be measured by the Lerner index which measures the difference between output prices and marginal costs. An increase in the Lerner index indicates a deterioration of the competitive conduct of financial intermediaries. Source, World Bank.

real to the financial sector and give rise to excessive increases in mortgage credit which both are less conducive to macroeconomic resilience (e.g. Popov, 2017).

Finally, some types of international financial integration, such as international bank lending, tend to amplify contagion shocks and increase crisis risk.⁽²³⁾ In other words, an optimal balance between banking sector and capital market integration is required to withstand sudden reversals in financial flows (e.g. bank credit) by adjustments in other parts of the financial system (e.g. equity funding).

Graph 3: Gross non-performing debt instrument
(as % of total gross debt instruments)



Note: Ratio of non-performing debt instruments (payments of interest and principal past due by 90 days or more) to total gross debt (total value of loan portfolio). Debt instruments include both loans and other securities (namely bonds). The data on NPL ratios are available only from 2014. The difference between these two ratios is mostly around 1 p.p.

Source: ECB (Consolidated Banking Data)

2.4 Structural factors

Diversification of economic activity ⁽²⁴⁾ allows the economy to be more flexible in adapting to changing economic conditions thereby strengthening the capacity to absorb and recover from shocks. However, strong inter-linkages between economic activities or diversification in activities showing strong cyclicity such as manufacturing and construction may limit the gains from diversification (e.g. Martin, 2012). Moreover, the impact of diversification on growth potential is not unambiguous. On the one hand, diversification reduces specialisation in those activities in which Member States have a comparative advantage thereby lowering overall productivity growth. On the other hand, stronger resilience through diversity may create stronger incentives to innovate and invest which may improve potential growth.

The economy's openness to international trade allows sharing some of the adjustment burden with the rest of the world as it strengthens economies' capacity to absorb and recover from shocks, especially, in the case of an idiosyncratic shock. However, when a common shock hits not only the domestic market but also export markets the absorption capacity may be tempered. In addition, trade openness may affect the

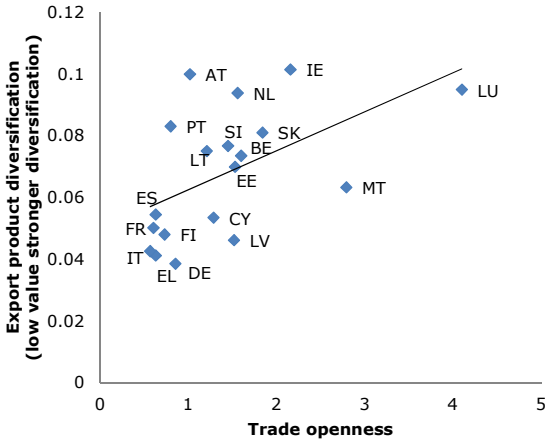
⁽²³⁾ See, for instance the identification of structural policies that increase or decrease financial crisis risks in Ahrend and Goujard (2012b).

⁽²⁴⁾ Several indicators have been proposed to measure diversification. See Wundt, B. (1992). Here an indicator based on sectoral employment shares is used.

effectiveness of other adjustment channels as it is, for instance, more difficult in a more open economy to stimulate domestic demand expansion as it spills out through the import channel (e.g. Spilimbergo et al., 2008).

Closely related to a Member State's trade openness is its type of exports. For instance, Graph 4 shows a positive correlation between trade openness and the degree of specialization, suggesting that Member States with strong market openness have a strong specialisation in their exports, i.e. less diversified export portfolio (As measured by the Hirschman Herfindahl Index). More specifically, research suggests that inter-industry trade (as opposed to intra-industry) specialisation may make economies more vulnerable to country specific shocks (e.g. Krugman, 1981).

Graph 4: Trade openness and export diversification (2015)



Note: Trade openness = (exports + imports)/ GDP in current prices. Export diversification as measured by Hirschman Herfindahl Index which is equal to sum of squared shares of each product in total export. A country with a perfectly diversified export portfolio will have an index close to zero, whereas a country which exports only one export good will have a value of 1 (least diversified).

Source: Authors' estimates based on AMECO and WB.

With stronger *income inequality* ⁽²⁵⁾ leading to more income concentration at the top, the fall in aggregate demand may be smaller when hit by an adverse shock because high income earners have a lower propensity to cut their expenditures when their income decreases compared to income earners at the lower end. ⁽²⁶⁾ At the same time, however, the adverse impact may get aggravated if lower income groups do not have savings or access to credit to absorb a negative shock. In addition, if higher income inequality would lead to fewer opportunities for training for the workers at the lower end of the income distribution, the recovery may also be adversely affected.

⁽²⁵⁾ Chen et al. (2018) report that overall income inequality has remained broadly stable in the EU over the past decade but disparities in poverty and income inequality across generations have increased markedly.

⁽²⁶⁾ For instance, Carroll et al. (2014) using data for 15 European countries from the Household Finance and Consumption Survey report that spending of unemployed individuals and households earning low income and holding little wealth is more sensitive to shocks. This may be triggered by the fact that people at the lower end of the income distribution are often liquidity and credit constrained.

2.5 Macro-economic conditions

Macro-economic conditions also affect the economy's absorption capacity. First, the fiscal stance affects an economy's capacity to respond to adverse shocks in aggregate demand. A strong structural fiscal balance ⁽²⁷⁾ (in combination with a sustainable public debt level) creates room for counter-cyclical public measures and automatic stabilisers in the case of a temporary shock. ⁽²⁸⁾ Second, the private sector debt level may also affect an economy's capacity to withstand shocks as a high private debt may not only limit the capacity to borrow to smoothen consumption over time, but it may also be so high that it pushes the private sector into pro-cyclical deleveraging, i.e. the so-called balance sheet recession (e.g. Koo, 2014). Third, the way changes in the interest rate are transmitted will also affect the absorption capacity. In case of an adverse common shock, interest rates would likely be cut (provided monetary authorities' room for manoeuvre is not constrained by the zero lower bound) but such cuts may have a different impact on domestic interest rates if financial markets are fragmented and the monetary transmission channel is impeded. Finally, nominal and real (effective) exchange rate depreciations may create room to increase net exports. However, in a currency union the nominal exchange rate of the common currency will primarily respond to developments at the level of the currency union as a whole. By contrast, real effective exchange rates may respond to domestic conditions such as nominal unit labour costs – which often show a strong rigidity. Its impact on macroeconomic resilience will then also depend on the economy's structural features such as the size of its tradable and non-tradable sectors.

2.6 Institutional quality

Several empirical studies report that institutional quality ⁽²⁹⁾ has an important impact on both macro-economic stability and potential growth (e.g. Acemoglu, 2005). However, determining causality in this context is not always clear-cut. For example, Glaeser et al. (2005) report findings for a reverse causality suggesting that growth and human capital accumulation lead to institutional improvement and not the other way around. OECD (2013) argues that while a strong correlation can be found between perceived corruption and output level, this relationship is difficult to assess because corruption may compensate for the shortcomings of regulatory systems that dampen economic growth.

3. Empirical framework

An output gap autoregressive econometric equation is estimated in panel setting whereby each country's *absorption capacity* (measured by the response coefficient to the common shock in the equation) and *the speed of recovery* (measured by the response coefficient of the lagged output gap) depend on country specific structural characteristics (see sub-section 3.2 for more details on the specification). In reality, each economy is subject to both *idiosyncratic* and *common shocks*. Moreover, the shocks can be of different nature such as productivity shock, confidence shock or change in preferences. Importantly, shocks are not directly observable and have to be estimated. In this empirical framework, the resilience of

⁽²⁷⁾ Measured by AMECO (European Commission macroeconomic database) indicator UBLGBP: Net lending (+) or net borrowing (-) excluding interest of general government adjusted for the cyclical component: Adjustment based on potential GDP

⁽²⁸⁾ However, for instance, Guerini et al (2017) argue that increases in public debt may crowd-in private investment. Hijzen et al. (2017) show that automatic fiscal stabilisers contributed to labour market resilience during the Great Recession.

⁽²⁹⁾ Institutional quality is often measured by the World Bank Governance Indicators which covers six dimensions of governance including regulatory quality, rule of law, and control of corruption (which are also part of the subsequent analysis).

Member States is tested in case of common shocks. Namely, an economy is more resilient than another if after being hit by a common shock it performs better. Given that the purpose of the analysis is to identify structural characteristics that make countries better weather adverse developments, it is necessary to draw on the *cross-country experience*. This can be most easily done in case of *general common shocks*, i.e. shocks of the same size without identifying the exact nature of the shock. However, it can be assumed that most of the results hold also for idiosyncratic shocks. Sub-section 3.1 estimates such general common shocks hitting the Member States.

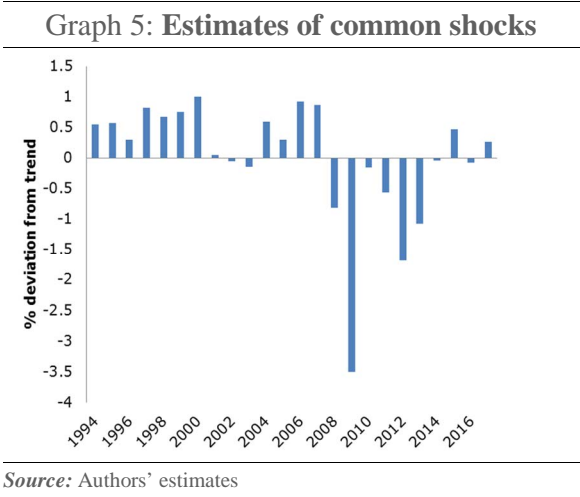
3.1 Estimation of common shocks

The first step in the analysis of resilience is identification of adverse episodes, which were common to all countries in the sample (common shocks) in order to link cross-country divergences to their resilience rather than to different size of shocks hitting them. However, shocks cannot be observed and must be estimated. Specifically, the common shocks are estimated in a panel model describing real GDP growth (e.g. Sondermann, 2018) as

$$dln(GDP_{i,t}) = \delta_t DUM_t + \rho_i DUM_i + v_{i,t}$$

for a sample from 1998 until 2015 and covering 17 countries⁽³⁰⁾, with GDP being real GDP, DUM_t a time dummy, DUM_i , a country dummy, and with v the stochastic term.

The common shock is captured by the standardised estimates of δ_t , while the idiosyncratic shock is captured by $\rho_i + v_{i,t}$.⁽³¹⁾ The Graph 5 shows estimates as by how much the common shock induced observed GDP growth to deviate from its trend growth.



⁽³⁰⁾ I.e., BE, DE, IE, ES, FR, IT, LU, NL, AT, PT, FI, CZ, DK, HU, PL, SE and UK.

⁽³¹⁾ Implicit assumptions estimating these common shocks are that common and idiosyncratic shocks are not correlated with each other and that shocks are exogenous. On endogenous shocks that emerge from within the system, see for instance Minsky (1986) and Wolf (2015).

3.2 Specification of output gap dynamics in panel

The following econometric equation is used to estimate the Member States' absorption and recovery capacity in response to a common shock

$$\begin{aligned}
 Y_{i,t} = & \beta SHOCK_C_t + \sum_{l=1}^k \beta_l Z_{i,l,t} SHOCK_C_t \\
 & \text{impact of common shock} + \text{structural factors affecting its absorption} \\
 & + \alpha Y_{i,t-1} + \sum_{j=1}^k \alpha_j Z_{i,j,t} Y_{i,t-1} \\
 & \text{recovery from past output gaps} + \text{structural factors affecting recovery} \\
 & + \sum_{m=1}^n \gamma_{i,m} (Q_{i,m,t} - \bar{Q}_{i,m}) + u_{i,t} \\
 & \text{impact macro-economic policy variables} + \text{stochastic component}
 \end{aligned}$$

with Y the output gap; Z the structural factors affecting absorption and recovery such as product market regulation; SHOCK_C a common shock; Q the macro-economic variables affecting output gap such as interest rates; \bar{Q} equilibrium value of macro-economic variable³²; and with i a country index, t time index, k number of structural factors and m number of macro-economic variables.

The contribution of each factor $Z_{i,j,t}$ to the absorption and recovery is measured by, respectively, $\beta_j Z_{i,j,t}$ and $\alpha_j Z_{i,j,t}$ having a positive or negative value and indicating whether they amplify/dampen the impact of a shock, or speed-up/delay the recovery. The total absorption and recovery capacity is measured by collecting all terms, i.e. $\beta + \sum_{l=1}^k \beta_l Z_{i,l,t}$ for the absorption capacity and $\alpha + \sum_{l=1}^k \alpha_l Z_{i,l,t}$ for the recovery capacity. The latter is expected to have a value between 0 and 1, a lower value indicates a faster recovery.

Several issues have to be taken into account when estimating the above equation. First, the explanatory variables may be strongly correlated with each other as they are often changed as part of a reform package (i.e. multicollinearity). Second, the explanatory variables may be correlated with the random component as for instance reforms are introduced or delayed in response to the state of the business cycle (i.e. simultaneity).⁽³³⁾ Third, the error terms of the equations do not have the same distribution as their variance may differ across Member States. In addition, they may also be cross-sectionally correlated as well as serially correlated.⁽³⁴⁾ Fourth, as common and idiosyncratic shocks are assumed to be orthogonal, the omission of the latter type of shocks in the regression does not induce a missing-variables bias. Fifth, to save on the degrees of freedom no country fixed effects have been included but the dependent and explanatory variables were demeaned.

Moreover, by construction the lagged output gap and shock should be uncorrelated. In period t the shock is by definition "news" (i.e. uncorrelated with any variable from the past including the lagged output gap

⁽³²⁾ In the regression analysis these equilibrium values are assumed to be constant over the sample size.

⁽³³⁾ Problems of simultaneity have been addressed by taking 3-year average moving averages of the interaction variables, except for the instrumentalised variables that include short-interest rate, public debt, private debt and the real effective exchange. Note also, that the lagged dependent variable appear always in an interaction term rather than separately. Therefore, the regression is not a standard dynamic panel that would require use of GMM-type of estimators such as Arellano-Bond.

⁽³⁴⁾ These problems have been addressed by applying an appropriate generalised least squares estimator. However, as in this exercise the number of time periods is low compared to number of cross sections it will have to be assumed that covariance matrices of random components are constant over time. The latter assumption will affect the efficiency, but not consistency of the estimates.

as well as past "news"). Furthermore, time varying interactions between explanatory variables may call for the inclusion of both base variables separately to avoid a missing variables bias (e.g. Aitken and West, 1991). However, here it should be remembered that the dependent variable (i.e. the output gap) is on average equal to zero (over the business cycle). The explanatory variables, i.e. the shock and lagged output gap interacting with a broad set of factors, are also on average equal to zero. Including a factor on its own not interacting with the shock or lagged output gap (which is on its own different from zero) would then imply that "in equilibrium" the output gap would not be closed. As such, the regression analysis does not include base variables separately. Finally, a low significance level for a point estimate for a factor does not necessarily mean that the factor is irrelevant as a low level of significance may arise because of multi-collinearity or because the considered indicators vary only in very limited ranges over time and across countries (and regression analysis is based on variation of indicators).

3.3 Variable selection by Bayesian Model Averaging

Another issue related to estimation of aforementioned equation is model uncertainty. Namely, there are many potential explanatory variables. First, putting all of the potential variables into one regression might inflate the standard errors if irrelevant variables are included. Second, using sequential testing to exclude unimportant variables might deliver misleading results since there is a chance of excluding the relevant variable each time the test is performed. Bayesian model averaging (BMA) takes into account model uncertainty by considering the model combinations and weighting them according to their model fit.⁽³⁵⁾ The robustness of a variable in explaining the dependent variable can be expressed by the probability that a given variable is included in the regression. It is referred to as the posterior inclusion probability (PIP).

BMA gives each model γ a weight, which captures the model's fit (similar to an adjusted R2) and reports weighted averages of the models' regression parameters and standard deviations, using posterior model probabilities from Bayes' theorem:

$$p(M^\gamma | Y_{i,t}, Z_{i,l,t}) \propto p(Y_{i,t} | M^\gamma, Z_{i,l,t}) p(M^\gamma)$$

where $p(M^\gamma | Y_{i,t}, Z_{i,l,t})$ is the posterior model probability, \propto a sign of proportionality, $p(y | M^\gamma, Z_{i,l,t})$ the marginal likelihood of the model and $p(M^\gamma)$ the prior probability of the model. The posterior model distribution of any statistic θ is then obtained from model weighting as follows:

$$p(\theta | M^\gamma, Y_{i,t}, Z_{i,l,t}) = \sum_{\gamma=1}^{2^K} p(\theta | M^\gamma, Y_{i,t}, Z_{i,l,t}) \frac{p(M^\gamma | Y_{i,t}, Z_{i,l,t}) p(M^\gamma)}{\sum_{j=1}^{2^K} p(y | M_j, Z_{i,l,t}) p(M_j)}$$

To express the lack of prior knowledge about the parameters and models, uniform priors are used. For the vector of coefficients β^γ Zellner's g prior is used as Eicher et al. (2011) have shown that the application of the uniform model prior and the unit information prior to the parameters in the model performs well for forecasting. Moreover, a posterior inclusion probability (PIP) is reported for each variable to show the probability with which the variable is included in the true model:

⁽³⁵⁾ A vast literature uses model averaging to address these issues, in economics notably in the domain of determinants of economic growth (Fernandez et al., 2001, Feldkircher and Zeugner, 2009).

$$PIP = p(\beta^y \neq 0|y) = \sum_{\beta^y \neq 0} p(M^y|y)$$

The large number of potential variables entering into our BMA renders enumeration of all potential combinations of variables not only time consuming but even infeasible (Feldkircher and Zeugner, 2009). Therefore, we use the Markov Chain Monte Carlo (MCMC) sampler developed by Madigan and York (1995) to obtain results for the most important part of the posterior model distribution. The quality of the MCMC approximation of the actual posterior distribution is linked to the number of draws the sampler is set to go through during the estimation process (iterations). However, the MCMC sampler might start sampling from models that do not yield the best results and only after some time converges to models with high posterior model probabilities. Hence, we discard initial iterations of the sampler (burn-ins).

4. Determinants of the absorption and recovery capacity

The empirical analysis is based on an unbalanced data set that covers more than 20 explanatory variables as potential determinants of resilience for a period ranging from 1998 until 2015. These variables interact with the lagged dependent variable, i.e. the lagged output gap, (to identify determinants of recovery capacity) as well as the common shock variable (to identify determinants of shock absorption capacity) so that in principle more than 40 explanatory variables can be included in the regression equation underpinning the empirical analysis - as described in Table A. 1 in Annex. This poses then a problem of degrees of freedom and multicollinearity.

To deal with these problems the following strategy was implemented. First, several panel regressions were performed using a prior beliefs rooted in economic theory to select the relevant factors affecting shock absorption and recovery. However, this approach has its limitation as some indicators may show a strong degree of collinearity at their lowest level of disaggregation as is the case of the product market regulation indicator, which includes at its lowest level of disaggregation, for instance, indicators measuring administrative burdens on corporations, sole proprietor firms and in services sectors. Next, a Bayesian model averaging (BMA) technique was applied that allows identifying the most robust variables (in this case, determinants of resilience) from a very large pool of potential factors based on statistical selection criteria - as explained in sub-section 3.3. This method allows testing even large set of variables at a more disaggregated level (for example, one can test not only the main structural characteristics of the labour market but numerous fairly detailed features thereof) and provides the ranking of relative importance of such variables.

4.1 Empirical results

This sub-section reports detailed results of panel regression both at aggregated (Table 1) and more detailed level of disaggregation for product market regulation and active employment policies (Table 2), and results of BMA with ranking the most relevant factors selected from the entire pool of potential determinants (Table 3). Below, the individual factors are presented according to the classification followed in sub-section 2, while Table A.1 in Annex describes how these factors have been measured.

Starting from the specification discussed in sub-section 3.2, the reference regression (labelled V1 in Table 1) is specified in terms of aggregate factors including the indicator measuring total product market regulation, employment protection legislation and labour market policies, non-performing loans and competition in the banking sector, openness to international trade, export diversification and diversification of production. Several variants of this reference regression have been estimated. First, the

interaction between factors and the nature of the shock is further explored (Table 1), next the aggregate indicators are further disaggregated (Table 2 and 3). This stepwise approach is dictated by concerns of multicollinearity and lack of degrees of freedom when too many explanatory variables would be included in an equation. As such, due regard should be given to possible omitted variables biases interpreting the estimation results of each of the variants.

Table 1 below shows a selected set of estimation results for an unbalanced sample covering the 1998-2015 period for euro area Member States for which sufficient data are available as well as a selected group of non-euro EU Member States.⁽³⁶⁾ Focussing on variant V1 of Table 1, most of the point estimates have the expected sign. While this variant assumes a symmetric impact of the factors for a negative as well as positive common shock, variant V2 in Table 1 allows for an asymmetric impact – making use of slope dummies.⁽³⁷⁾ Comparing these regression results, suggests, for instance, that stricter product market regulation and stronger openness to international trade improves the absorption capacity when the economy is hit by a negative common shock.⁽³⁸⁾ Variant V3 shows regression results assuming asymmetry in the recovery which suggests, for instance, that stricter product market regulation delays the recovery.⁽³⁹⁾ Variant V4 shows point estimates for time-invariant interactions whereby the reference regression (V1) is re-estimated setting the structural factors equal to their sample average. Except for the diversification of the employment composition the qualitative nature of the estimates does not change.

Table 2 provides some evidence on further disaggregation of the aggregates in variant V1 of Table 1. A further disaggregation of the product market regulation indicator shows that some of its components show some significance (see Variant V5 in Table 2). This is especially the case for state control (which includes price regulation and regulation of network industries) which shows a positive point estimate for its interaction with the lagged output gap indicating that stronger state control slows down the recovery. Nevertheless, the indicator related to barriers to trade which includes barriers to FDI and different treatment of foreign suppliers, shows a significant negative sign suggesting that stricter regulation in this field would speed up recovery.

At an even stronger level of disaggregation, Variant V6 in Table 1 shows that looking at the detail of barriers to entrepreneurship the complexity of regulatory procedures has a significant negative impact of absorption capacity, while the administrative burdens on start-ups significantly slows down the recovery. Nevertheless, a high administrative burden also tempers the absorption capacity. The latter may indicate that as it takes more time to get non-profitable firms out of business, this may temporarily support employment and thus also aggregate demand. A further disaggregation of the barriers to trade and investment (variant V7), confirm also that a differential treatment of foreign suppliers strengthen the shock absorption potential. Finally, further disaggregating of the state control dimension (variant V8) suggests significant adverse impact of price control on absorption and recovery capacity, while stricter regulation of network industries shows a negative adverse impact on the absorption capacity.

⁽³⁶⁾ I.e. BE, DE, IE, ES, FR, IT, LU, NL, AT, PT, FI, CZ, DK, HU, PL, SE and UK. For the other euro area Member States the data on product market regulation did not cover a sufficient long period; some EL data on labour market policies not available.

⁽³⁷⁾ The slope dummy = 1 if negative shock and =0 if positive shock.

⁽³⁸⁾ In order to save on the degrees of freedom, two variants with a slope dummy were estimated separately, i.e. V2 with slope dummy interacting with factors affecting the absorption, and V3 with slope dummy interacting with factors affecting the recovery.

⁽³⁹⁾ A similar asymmetric result for PMR is for instance also reported in Duval and Vogel (2008).

Table 1: Panel regression results

Dependent variable : Output gap									
	V1 Base	V2 Shock asymmetry	V3 Recovery asymmetry	V4 Factors sample average	V1 Base	V2 Shock asymmetry	V3 Recovery asymmetry	V4 Factors sample average	
Factors	ABSORPTION (interaction with shock)				RECOVERY (interaction with lagged output gap)				
Shock (absorption) lagged output gap (recovery)	0.01 (0.36)	0.05 (1.58)	0.02 (0.76)	0.05 *** (2.91)	0.63 *** (4.04)	0.74 *** (3.89)	1.17 *** (4.80)	1.12 *** (7.09)	
I. Product markets									
- Product Market Regulation (PMR)	0.11 ** (2.30)	0.24 *** (2.63)	0.11 ** (2.04)	0.07 (0.99)	0.04 (0.68)	0.05 (0.75)	-0.14 * (-1.75)	0.05 (0.71)	
II. Labour markets									
- Employment policies	0.00 (1.62)	-0.00 * (-1.73)	0.00 *** (2.63)	0.00 *** (2.70)	-0.00 *** (-4.51)	-0.00 ** (-2.26)	-0.00 *** (-4.78)	-0.00 *** (-6.77)	
- Employment protection legislation (EPL)	0.05 ** (2.02)	0.04 (0.87)	0.06 ** (2.13)	0.03 (0.81)	-0.03 (-1.04)	-0.05 (-1.62)	-0.04 (-0.84)	-0.11 *** (-3.21)	
III. Financial markets									
- Non-performing loans	0.01 *** (3.31)	0.01 (1.35)	0.01 (1.56)	0.02 *** (3.38)	0.01 ** (2.57)	0.00 (0.92)	0.01 ** (2.07)	-0.01 (-1.06)	
- Bank competition (Lerner) (high value for low competition)	0.56 *** (4.32)	0.32 (1.56)	0.60 *** (4.37)	0.90 *** (3.26)	0.34 *** (3.04)	0.30 ** (2.26)	-0.13 (-0.66)	-0.23 (-0.98)	
IV. Structural Factors									
A. Trade openness	0.24 *** (13.31)	0.49 *** (5.04)	0.25 *** (10.04)	0.22 *** (6.20)	-0.19 *** (-6.93)	-0.21 *** (-6.34)	0.04 (0.41)	-0.35 *** (-8.81)	
B. Export diversification (Hirschman Herfindahl Index, 0 to 1, with 1 least diversified)	-3.21 *** (-7.48)	-3.14 *** (-3.93)	-3.44 *** (-7.38)	-3.47 *** (-4.98)	2.19 *** (4.38)	2.44 *** (3.70)	1.56 * (1.81)	4.85 *** (6.87)	
C. Employment diversification	0.89 (1.01)	-3.33 (-1.34)	0.68 (0.75)	0.90 (0.81)	0.22 (0.20)	-0.38 (-0.29)	-3.18 * (-1.72)	-2.43 ** (-2.34)	
Correction for negative shock (use of slope dummy)									
Shock (absorption) lagged output gap (recovery)		-0.04 (-0.66)					-1.00 *** (-2.78)		
- Product Market Regulation (PMR)		-0.24 ** (-2.10)					0.45 *** (3.80)		
- Employment policies		0.00 *** (2.83)					0.00 ** (2.06)		
- Employment protection legislation (EPL)		0.06 (1.07)					0.01 (0.16)		
- Non-performing loans		0.00 (0.30)					-0.01 (-1.01)		
- Bank competition (Lerner) (high value for low competition)		0.56 (1.65)					0.66 ** (2.53)		
- Trade openness		-0.27 *** (-2.63)					-0.19 * (-1.88)		
- Export diversification (Hirschman Herfindahl Index, 0 to 1, with 1 least diversified)		-1.00 (-0.89)					-0.11 (-0.09)		
- Employment diversification		4.81 * (1.75)					4.76 * (1.73)		
V. Macro-economic conditions									
A. Short-term interest rate	-0.31 *** (-6.47)	-0.36 *** (-6.47)	-0.38 *** (-7.11)	-0.35 *** (-9.24)					
B. Nominal effective exchange rate	0.16 (0.17)	-0.11 (-0.10)	0.64 (0.63)	-1.46 (-1.54)					
Diagnostic statistics									
Number of observations	232	232	232	232					
Number of explanatory variables	20	29	29	20					
Adjusted R-squared	0.848859	0.853605	0.856770	0.855470					
Durbin-Watson	1.63	1.72	1.69	1.75					

Note: slope dummy = 1 if negative shock, =0 if positive shock. Mutiplying the slope dummy with the explanatory variable provides an asymmetric response . Shock asymmetry: only asymmetric resposne for absorption; recovery assymmetry: only asymmetric resposne for recovery.

Table 2: Panel regression – Disaggregation variants

Dependent variable: output gap										
	V5	V6	V7	V8	V9	V5	V6	V7	V8	V9
	PMR disaggregated	Entrepreneurs hip barriers disaggregated	Trade and investment barriers disaggregated	State control barriers disaggregated	Labour market policies disaggregated	PMR disaggregated	Entrepreneurs hip barriers disaggregated	Trade and investment barriers disaggregated	State control barriers disaggregated	Labour market policies disaggregated
	ABSORPTION (interaction with shock)					RECOVERY (interaction with lagged output gap)				
Shock (absorption) lagged output gap (recovery)	-0.02 (-1.01)	-0.03 (-1.35)	-0.02 (-0.67)	-0.03 (-1.28)	0.02 (0.85)	0.42 ** (2.14)	0.25 (1.26)	0.47 ** (2.26)	0.37 ** (1.98)	0.68 *** (4.20)
I. PRODUCT MARKETS										
Product Market Regulation (PMR) - aggregate (Index scale of 0-6 from least to most restrictive)					0.11 ** (2.04)					0.03 (0.57)
A. Barriers to entrepreneurship (aggregate)	0.07 (1.45)		0.03 (0.55)	0.03 (0.55)		0.07 (1.40)		0.07 (1.24)	0.06 (1.29)	
- Administrative burdens on startups		-0.11 *** (-2.93)					0.23 *** (6.81)			
- Complexity of regulatory procedures		0.09 *** (4.55)					-0.01 (-0.57)			
- Regulatory protection of incumbents		-0.11 * (-1.70)					-0.04 (-0.63)			
B. Barriers to trade and investment (aggregate) (Index scale of 0-6 from least to most restrictive)	-0.07 (-1.43)	-0.11 ** (-2.10)		-0.08 (-1.37)		-0.53 *** (-7.20)	-0.40 *** (-5.37)		-0.46 *** (-6.10)	
- Differential treatment of foreign suppliers			-0.46 *** (-3.86)					-0.25 * (-1.79)		
-barriers to FDI and other barriers			0.06 (1.50)					-0.24 *** (-5.49)		
C. State control (aggregate) (Index scale of 0-6 from least to most restrictive)	0.08 * (1.70)	0.20 *** (3.12)	0.16 *** (3.12)			0.12 ** (2.36)	-0.01 (-0.24)	0.10 * (1.79)		
- price control				0.04 * (1.91)					0.08 *** (3.19)	
- network industries				0.05 *** (2.86)					0.02 (0.71)	
II. LABOUR MARKETS										
A. Employment policies - aggregate	0.00 *** (2.89)	0.00 *** (4.70)	0.00 *** (3.20)	0.00 *** (3.20)		-0.00 *** (-3.03)	-0.00 *** (-4.78)	-0.00 ** (-2.23)	-0.00 ** (-1.97)	
- public employment services (PES)					0.00 (1.10)					-0.00 *** (-3.45)
- employee training					0.00 (0.56)					0.00 (1.34)
- start-up incentives for unemployed					-0.00 (-0.06)					0.01 ** (2.00)
- out-of-work support					-0.00					-0.00 (-0.16)
B. Employment protection legislation (EPL)	0.03 (1.06)	0.06 * (1.74)	-0.05 (-1.17)	0.06 ** (2.22)	0.05 * (1.95)	-0.02 (-0.54)	-0.02 (-0.58)	-0.02 (-0.64)	0.01 (0.41)	-0.03 (-1.29)
III. FINANCIAL MARKETS										
A. Non-performing loans	0.01 ** (2.44)	0.01 *** (3.31)	0.01 (1.17)	0.01 ** (2.33)	0.01 *** (3.10)	0.01 * (1.94)	0.01 ** (2.08)	0.01 ** (2.34)	0.01 * (1.93)	0.00 (1.43)
B. bank competition (Lerner) (high value for low competition)	0.64 *** (4.90)	0.20 (1.35)	0.49 *** (3.71)	0.73 *** (5.26)	0.55 *** (3.61)	0.34 *** (2.69)	0.10 (0.82)	0.28 ** (2.22)	0.41 *** (2.86)	0.35 *** (2.89)
IV. STRUCTURAL FACTORS										
A. Trade openness	0.23 *** (8.64)	0.19 *** (6.31)	0.19 *** (6.36)	0.24 *** (9.70)	0.24 *** (13.55)	-0.21 *** (-6.32)	-0.17 *** (-4.98)	-0.22 *** (-5.72)	-0.18 *** (-5.37)	-0.20 *** (-7.41)
B. Export diversification (Hirschman Herfindahl Index, 0 to 1, with 1 least div)	-2.80 *** (-5.35)	-1.47 *** (-2.81)	-1.46 ** (-2.21)	-3.41 *** (-6.46)	-3.28 *** (-7.00)	2.96 *** (5.35)	2.00 *** (3.31)	3.24 *** (4.84)	1.99 *** (3.01)	2.55 *** (4.72)
C. Employment diversification	-0.12	0.12	1.17	0.51	0.55	0.73	3.48 **	0.81	2.03	-0.14
V. MACRO-ECONOMIC CONDITIONS										
A. Nominal interest rate	-0.38 *** (-8.59)	-0.35 *** (-8.99)	-0.36 *** (-8.22)	-0.40 *** (-7.85)	-0.37 *** (-6.79)					
B. Real effective exchange rate	-0.31 (-0.32)	-0.78 (-0.87)	0.15 (0.14)	0.17 (0.17)	-0.10 (-0.10)					
Adjusted R-squared	0.857984	0.869837	0.860613	0.861976	0.852311					
Durbin-Watson	1.66	1.76	1.67	1.64	1.66					
Number of observations	232	232	232	232	232					
Number of explanatory variables	24	28	26	26	26					

The impact of non-performing loans and lack of competition in the banking sector⁽⁴⁰⁾ is significant for both the absorption and recovery capacity: a deterioration in these variables significantly amplifies the impact of the shock and significantly delays recovery.⁽⁴¹⁾

Employment protection legislation (EPL) has a significant impact on the absorption capacity in most variants, but does not show any significant interaction with the recovery capacity. Moreover, while variants 6 to 8 suggest that labour market policies as a whole have a significant impact on the absorption and recovery capacity, Variant V9 suggests that a further disaggregation of labour market policies does not show significance except for public employment services that speed up the recovery but such result may be due to multi-collinearity between the factors.

The positive sign of the point estimate of the openness to international trade interacting with the common shock suggests that stronger openness amplifies the impact of the common shock, as a common shock not only adversely affects the domestic market but also export markets. The negative sign of the point estimate of the interaction between openness to international trade and the lagged output gap shows that a stronger openness to international trade speeds up recovery, as it allows the economy to gain more from a recovery in its export markets.⁽⁴²⁾ The negative value of the point estimate of the interaction between the diversity of exports and the common shock suggests that less diversification lowers the impact of a common shock. However, a more diversified export market increases the recovery speed. Finally, the point estimates suggest that nominal interest rates tempered the size of output gap significantly, but no significant impact of changes in the real effective exchange rate was found.⁽⁴³⁾

Table 3 below shows results of the variable selection by means of the Bayesian model averaging (BMA). As the BMA routine⁽⁴⁴⁾ requires balanced sample, the sample in Table 1 was balanced using linear interpolation.

The BMA allows for variable ranking by means of their posterior inclusion probability (PIP). PIP captures the extent to which one can assess how robustly a potential explanatory variable is associated with the dependent variable (output gap). Variables with a high PIP can be considered robust determinants of the dependent variable. Hence, BMA is employed to detect the robust determinants of resilience from the list of 40 potential ones. The variables are all those included in the panel regression in Table 2 plus several additional, typically more disaggregated, variables. In order to include the largest possible set of variables, the BMA selection is performed separately for absorption and for recovery phase. Out of these 40 variables for each phase, Table 3 shows only those where PIP was higher than 0.1 and considered as robust those with PIP higher than 0.2 (these are discussed below). The post mean (SD) is the mean (standard deviation) of the estimated coefficients averaged over all models (this includes models where the variables was not included, the coefficient is zero in this case).

⁽⁴⁰⁾ As measured by the Lerner indicator which is equal to the difference between output prices and marginal costs (relative to prices).

⁽⁴¹⁾ Here it should be remembered that there may be reverse causality, in the sense that a deep downturn may generate an increase in non-performing loans, while in turn this increase may adversely affect the recovery. Reverse causality may also arise for the measure of bank competition as a deep downturn in combination with a financial crisis may affect bank competition. Such potential reverse causality has been addressed using instrumental variables.

⁽⁴²⁾ Estimating how trade openness would affect the absorption of a country-specific shock would be beyond the scope of this section.

⁽⁴⁰⁾ Additional estimates not shown in Table 2. suggest that increases in income inequality significantly weakens both absorption and recovery capacity. Good governance strengthens the economy's recovery capacity significantly, but it weakens the absorption capacity - the latter suggesting that with an ineffective administration zombie firms remain longer in business which lowers the impact of the shock, but slows down the recovery.

⁽⁴⁴⁾ The estimation was performed by BMS package described in Zeugner and Feldkircher (2015).

Table 3: Bayesian model averaging results

Absorption	PIP	POSTmean	PostSD	Recovery	PIP	POSTmean	PostSD
ST interest rate	0.94	-0.04	0.01	Regulatory Quality	0.34	-0.10	0.14
Export market penetration	0.75	-0.01	0.01	ST interest rate	0.24	-0.01	0.01
Specialisation of exports	0.70	-2.97	2.23	Employment diversification	0.23	0.05	0.80
Employment diversification	0.56	0.94	0.94	Public ownership	0.21	-0.04	0.08
Trade openness	0.21	0.04	0.09	State control	0.21	0.07	0.14
Public debt	0.20	0.00	0.00	Product market regulation (PMR)	0.19	0.08	0.19
Out-of-work support	0.12	-0.01	0.04	Start-up incentives for unemployed	0.19	0.25	0.55
Employee training	0.12	-0.05	0.16	Trade openness	0.18	-0.02	0.05
Gini - disposable income	0.10	0.00	0.01	Governance	0.13	-0.03	0.08
				Bank competition	0.12	0.07	0.22
				% change REER	0.11	0.06	0.21
				Corruption	0.10	-0.01	0.05

Note: PIP is post-inclusion probability indicating that the variable belongs to the true model.

Post-mean (SD) is the average estimated coefficient (standard deviation) across the models.

Lagged output gap and shock showed high PIP, both should be understood as technical variables covering variables not included in analysis.

The results feature several variables that were included in Table 2 but also a few additional ones (majority of the variables has the expected sign). The negative coefficient of *the short-term interest rate* suggests that accommodative monetary policy have decisive role when economy is hit by the shock and it needed to speed up the recovery. *Employment diversification* has at first sight counter-intuitive positive sign (i.e. the higher diversification, the higher impact of shock and the slower recovery). Whereas employment diversification could strengthen resilience in general, at the same time it limits the country's opportunities to specialize in those activities where it has a comparative advantage. This second effect seems to clearly dominate here. *The trade openness* has different impact in each phase. Whereas it slows down the shock absorption, it speeds up the recovery. This suggests that in case of common shock, the more open economies are more affected as their trading partners are affected as well. However, in the mid-term more open economy can rely on export as additional sources of recovery.

The absorption phase is further facilitated by specific features of exports, namely by high *export market penetration* ⁽⁴⁵⁾ and *specialization of exports*. On the contrary, it is hindered by high levels of *public debt*, which prevents more active used of fiscal policy. The recovery in turn facilitated by several variables representing state involvement in the economy. Namely, while *quality of regulation* speeds up the recovery, *the state control of economy* slows it down. Interestingly, *the public ownership* (which is a subcomponent of the state control variable) speeds-up the recovery. Finally, a notable difference with the panel regression is that the BMA ranks high out-of-work support and training during absorption.

4.2 Factors' impact on resilience: interpreting the point estimates

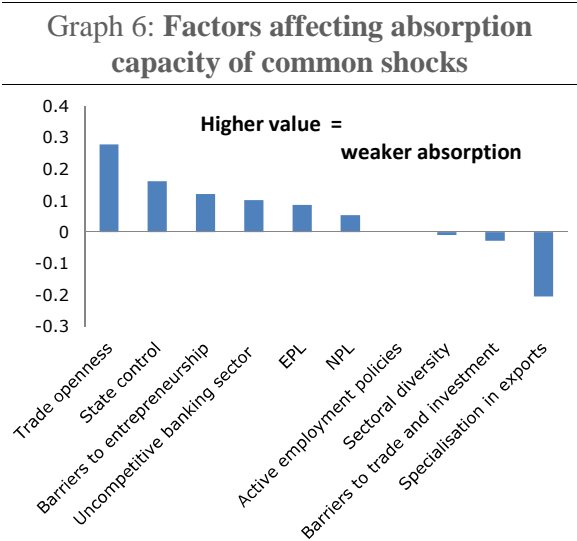
This sub-section aims at reporting on the factors that have been identified as the most significant in explaining macroeconomic resilience, in terms of contribution to an economy's shock absorption capacity (Graph 6) and to recovery capacity respectively (Graph 7) using the panel regressions ⁽⁴⁶⁾ and Bayesian Model Averaging (BMA).

⁽⁴⁵⁾ Export Market Penetration measures the share of the actual number of export relationships (at the country product level) in the maximum possible number of export relationships a country can form given the number of its exports. A low value indicates potential for expansion.

⁽⁴⁶⁾ For each of the factors shown in this and the following graphs, the impact on the absorption and recovery is estimated by multiplying the point estimate (of variant V5 in Table 2) with the 2008-2014 sample average. In this unbalanced dataset some years may be missing for some countries when estimating the average. For instance, the Lerner index measuring bank completion is not available for IE and FI as of 2011. In case of missing data, the average is calculated over the available data.

Product markets: The estimation results suggest that increased *state control* such as stronger regulation of network industries and price setting has an unambiguous negative impact on both the absorption and recovery capacity. Stricter barriers to *entrepreneurship* affect both dimensions of resilience adversely – albeit at a low level of significance. ⁽⁴⁷⁾ However, a further disaggregation of this indicator suggests a trade-off between absorption and recovery for its different components - as reported in Table 2. For example, the estimates suggest that stricter regulation of start-ups is particularly detrimental to the recovery but may strengthen the absorption capacity – indicating that making it easier to replace existing firms by new firms may lower output on impact but give a growth impetus during the recovery.

The estimates suggest against expectations that stricter *barriers to trade and investment* such as differential treatment of foreign suppliers and barriers to FDI ⁽⁴⁸⁾ may weaken the impact of a common shock and speed up the recovery. Although the former effect does not show a high level of significance, this finding is to be interpreted with care as the effects of trade barriers on macroeconomic resilience, like on growth ⁽⁴⁹⁾, are not straightforward. One interpretation could be that during shock absorption, low barriers to FDI may intensify competition and make FDI more responsive to local economic conditions, thereby amplifying the impact of a shock. For the recovery phase, the estimated dampening effect of lower barriers is more puzzling and may reflect econometric issues such as a lack of variability of these indicators over time and missing variables. Furthermore, while a differential treatment of foreign suppliers may speed up the recovery as it favours local suppliers it has also negative feedback on potential output growth as it adversely affects the efficient allocation of resources across the euro area and limits recovery via exports. In any case, this ambiguous finding on the impact of barriers in trade and investment on macroeconomic resilience calls for further research.



Note: Estimates based on variant V5 of Table 2, and evaluated for the period 2008-2014. The scale on the Y-axis measures the ppt. change in the output gap.
Source: Authors' estimates.

⁽⁴⁷⁾ Interpreting the point estimates in Table 3 it should be remembered that the OECD product market regulation indicators have a scale from 0 to 6, i.e. from least to most restrictive.

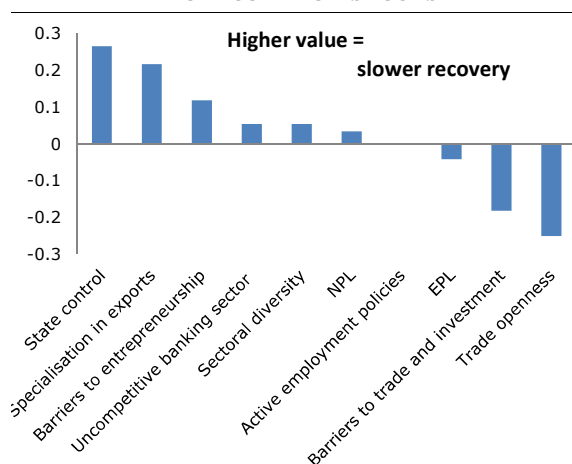
⁽⁴⁸⁾ More specifically, such regulation refers to less favourable tax treatment of foreign suppliers, discrimination in public procurement as well as special government rights in the case of acquisition of equity by foreign investors. For more details, see Koske et al. (2015)..

⁽⁴⁹⁾ For instance, Rodrik and Rodriguez (1999) warn against expecting an unambiguous relationship between trade openness and growth.

Labour markets: The estimation results show only a limited impact of employment policies on both shock absorption and on the recovery. The estimates suggest that *employment protection legislation* and *active labour market policies* have only a small impact on the economy's absorption and recovery capacity while research reported elsewhere suggests that spending on active labour market policies responding strongly to cyclical increases in unemployment may promote a quick return to work in the recovery. ⁽⁵⁰⁾ The analysis applied in this section, which focusses mainly on aggregated variables, seems to be less suited to capture the rich dynamics of active labour market policies targeted at specific groups of workers, such as long-term and youth unemployed. ⁽⁵¹⁾ However, the BMA analysis reveals that detailed features of the labour markets, namely out-of-work support and employee training rank high (in terms of posterior inclusion probability) in terms of reducing the impact of a shock. ⁽⁵²⁾

Financial markets: The estimates for the financial sector support the hypothesis that an increase in the share of *non-performing loans* in total gross loans (covering defaulting loans with payments of interest and principal past due by 90 days or more) and a weakening in the *banking sector competition* ⁽⁵³⁾ affect negatively an economy's absorption as well as recovery capacity.

Graph 7: Factors affecting recovery capacity from common shocks



Note: Estimates based on variant V5 of Table 2, and evaluated for the period 2008-2014. The scale on the Y-axis measures the ppt. contribution of a specific factor to the total recovery speed.

Source: Authors' estimates.

Structural factors: The estimation results show that *sectoral diversity in domestic production* had a rather small impact on resilience during the sample period considered in this paper. However, diversification in exports or its corollary – international trade specialisation - has an opposite significant

⁽⁵⁰⁾ For instance, OECD (2017) reports that after one year, an increase in active labour market spending of 1% of GDP would reduce the unemployment rate by almost 2 percentage points compared with less than half a percentage point for public spending overall.

⁽⁵¹⁾ For instance, the components of labour market policies such as training, public employment services and out-of-work support show a low significance. This low level of significance may be triggered by multicollinearity between the disaggregated components of labour market policies (that move in tandem) as well as by the use of instrumental variables. This calls then for analysis at more disaggregated level – which is beyond the scope of this section.

⁽⁵²⁾ However, such ranking does not give an indication of its total impact on absorption or recovery - which is equal to the point estimate multiplied with the value of the variable.

⁽⁵³⁾ As measured by the Lerner index measuring the difference between output prices and marginal costs. An increase in the Lerner index indicates a deterioration of the competitive conduct of financial intermediaries. See <https://fred.stlouisfed.org/tags/series?t=lerner+index%3Bworld+bank>.

effect on the capacity to absorb shocks and on the capacity to recover. The econometric results suggest that stronger specialisation (in terms of products) in exports strengthens the capacity to absorb a common shock, but weakens the capacity to recover. Indeed, specialisation allows for a better exploitation of comparative advantages and economies of scale, which in turn creates room to lower prices. As such, when export markets are hit by a common shock it would be easier to offset the decrease in external demand by price adjustments when exports are specialised. By contrast, during the recovery when all export markets are rebounding, opportunities for exports increase because overall demand increases. In other words, during the absorption period the estimation results suggest that it is price effects that affect exports (so that specialisation matters), while in the recovery period it is scale effects (so that specialisation is less important). Besides, in a context of disintegration of the value chain across countries, an export specialisation (in terms of products) could also confer an advantage in case of common shocks, based on the position in the value chain. The parts of the value chains that are less substitutable (for instance a part that is so technologically complex that few countries produce them) would therefore be less sensitive to common shocks (e.g. Timmer et al., 2013).

The economy's openness to international trade also seems to have an opposite impact on shock absorption and on the recovery capacity, which is also confirmed by the BMA analysis. In case of a common shock the openness of the economy will amplify the impact of the shock (i.e. weaken the absorption) because the shock does not only affect adversely the domestic market but also the export markets.⁽⁵⁴⁾ Such adverse outcomes may then be tempered by policies and reforms that strengthen the economy's absorption capacity, including through prudent fiscal policies and better functioning automatic fiscal stabilisers as well as through a well-functioning Banking Union and Capital Markets Union which increase risk-sharing. However, stronger openness as well as a more diversified export portfolio may speed-up the recovery.⁽⁵⁵⁾

Finally, in terms of *institutional quality*, the estimates from the panel regression, suggest that good governance strengthens the economy's recovery capacity significantly, but it weakens the absorption capacity – which may suggest that with an ineffective administration zombie firms remain longer in business which lowers the impact of the shock, but slows down the recovery. The BMA results confirm that good governance which includes quality of public and civil services, and independence from political pressures, as well as the quality of policy formulation and implementation ranks high among the factors that speed-up the recovery. This suggests that broad institutional characteristics of a country can determine its capacity to withstand adverse shocks alongside the structural characteristics of economic nature.

4.3 Relative performance of euro-area Member States

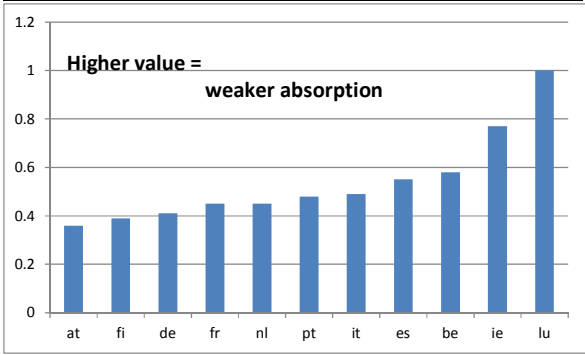
Graph 8 shows Member States' overall capacity to absorb a common shock – which combines the impact of all individual factors in a country. Member States recording a high value for this parameter will experience a stronger output loss when hit by a common shock than Member States recording a low value. The chart suggests that Luxembourg experienced the strongest impact when hit by a common shock. In the case of Luxembourg, this reflects to a large extent its strong openness to international trade and the fact that a common shock not only adversely affects its domestic market but also its export markets. Ireland also recorded a weak absorption capacity for a common shock but here it was primarily a combination of trade openness and relative high level of non-performing loans. Austria and Finland

⁽⁵⁴⁾ Important to note that the latter adverse mechanism would not occur in case of a country-specific shock.

⁽⁵⁵⁾ While diversification improves the absorption capacity it limits a country's potential to specialise in those goods and services it has a comparative advantage, suggesting a trade-off between stability and potential growth. In turn, stability may increase the incentives to invest and innovate, which increases potential growth.

showed a strong absorption capacity for common shocks reflecting partly their weaker trade openness and relative stronger exports specialisation.

Graph 8: Shock absorption capacity in case of common shock

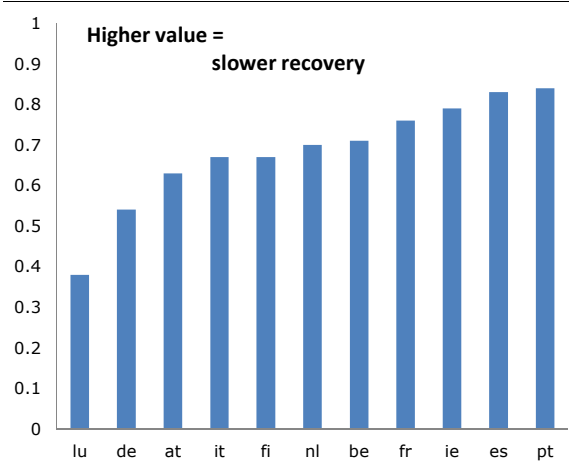


Note: Estimates based on variant V5 of Table 2, and evaluated for the period 2008-2014. The scale on the Y-axis measures the ppt. change in the output gap.

Source: Authors' estimates.

Graph 9 shows Member States' overall capacity to recover from a shock. While Luxembourg has the weakest capacity to absorb a common shock, it has the strongest capacity to recover – this is to a large extent due to its strong openness to trade. By contrast while Portugal does withstand common shocks better than several other Member States it requires more time to recover – as its lower openness to international trade limits the impact of the common shock but makes it more difficult to recover.

Graph 9: Recovery capacity in case of common shock



Note: Estimates based on variant V5 of Table 2, and evaluated for the period 2008-2014. The scale on the Y-axis measures total recovery speed.

Source: Authors' estimates.

5. Conclusions

This paper investigated the empirical significance of a selected set of structural factors that affect the euro area economies' capacity to absorb and recover from a common shock. To our knowledge, it is a first attempt to assess at a more disaggregated level the impact of individual factors on resilience. Nevertheless, some results suggest that further empirical research is needed. For instance, the reduced form macro-econometric approach is less suited to capture the rich dynamics between active labour market policies that support the most vulnerable workers and the economy's capacity to withstand shocks. Nor is it well suited to capture the impact of labour market dualism on resilience.

If Member States of the euro area display similar performances in terms of the absorption and recovery from common shocks then common policy tools such as the common monetary policy become more effective. Such convergence would not only provide stronger stability in terms of income and employment, but it would also strengthen the long term growth potential as it limits hysteresis effects linked to, for instance, long unemployment spells and the underutilisation and underinvestment of capital.

The empirical analysis highlighted that there are notable differences among the euro area Member States (for which sufficient data are available) in terms of both absorption and recovery capacity. It also showed that performances in terms of these two capacities are not necessarily fully in sync with each other. For example, the panel regression results suggest that in case of a common shock strong openness to international trade weakens the absorption capacity as export markets are also adversely affected by the common shock; but it may induce a faster recovery due to the same strong openness to international trade.

Such findings suggest then that the economies more open to international trade should pursue more vigorously policies and reforms that strengthen the economy's absorption capacity, including through prudent fiscal policies and better functioning automatic fiscal stabilisers as well as through a well-functioning Banking Union and Capital Markets Union which increase risk-sharing. While Member States may be hit by common shocks that are beyond their control, it is primarily within Member States that reforms to foster convergence to resilient economic structures should start.

At national level, a well-functioning business environment has a key role to play to promote macroeconomic resilience. More specifically, creating environments that foster entrepreneurship increases the ability to adapt and recover from exogenous shocks. The administrative burdens on startups are particularly detrimental to the recovery, which calls for streamlining administrative procedures for start-ups in countries that are still performing badly on this. Price controls both amplify shocks and slow down the recovery. Even so, increases in the share of non-performing loans in total gross loans and a weakening of competition in the banking sector affect negatively an economy's absorption as well as recovery capacity. But as the euro area economies are interconnected, there are some spillover effects that justify complementarities between the EU and national policies to increase economic resilience.

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Annex

Table A.1: Dataset

Factor	Indicator	Source	Factor	Indicator	Source
COMMON SHOCK	Stochastic disturbance arising outside the economic system	Own estimates	B. Competition in banking sector	Lerner index A measure of market power in the banking market. It compares output pricing and marginal costs (that is, markup). An increase in the Lerner index indicates a deterioration of the competitive conduct of financial intermediaries. (GFDD_OI_04)	World Bank retrieved via FRED
OUTPUT GAP	Gap between actual and potential gross domestic product at 2010 reference levels (AVGDGP)	AMECO	IV. STRUCTURAL FACTORS		
I. PRODUCT MARKETS			A. Trade openness	(exports + imports) / GDP in current prices	based on AMECO
Product Market Regulation (PMR)	See text below. Index scale of 0-6 from least to most restrictive.	OECD	B. Export diversification	Hirschman Herfindahl Index It is the sum of squared shares of each product in total export. A country with a perfectly diversified export portfolio will have an index close to zero, whereas a country which exports only one export will have a value of 1 (least diversified).	World Bank Trade Indicators
II. LABOUR MARKETS			C. Employment diversification	Sum of squared deviation of sectoral employment share from 1 divided by number of sectors	Own estimates
A. Employment policies	aggregate of items below		D. Inequality	Gini coefficient of equivalised disposable income - EU-SILC survey [ilc_di12]. Scale form 0 to 100, with 0 perfect equality and 100 perfect inequality.	Eurostat
- public employment services (PES)	PES and administration - Public expenditure as a percentage of GDP	OECD	V. MACRO-ECONOMIC CONDITIONS		
- employee training	Training - Public expenditure as a percentage of GDP	OECD	A. Nominal interest rate	Nominal short-term interest rates (ISN)	AMECO
- start-up incentives for unemployed	Start-up incentives - Public expenditure as a percentage of GDP	OECD	B. Real effective exchange rate	Real effective exchange rates, based on unit labour cost	AMECO
- out-of-work support	Out-of-work income maintenance and support - Public expenditure as a percentage of GDP	OECD	VI. INSTITUTIONAL QUALITY		
B. Employment protection legislation (EPL)	Employment protection. Index scale of 0-6 from least to most restrictive.	OECD	A. Government Effectiveness	Reflects 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. The data ranges from approximately -2.5 (weak) to 2.5 (strong) governance performance.	World Bank Worldwide Governance Indicators (WGI) project
C. Wage bargaining level	The predominant level at which wage bargaining takes place. Ranging from 1 = predominantly local or company level to 5 = predominantly central or cross-industry level	ICTWSS database	B. Regulatory Quality	Reflects perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development. The data provided ranges from approximately -2.5 (weak) to 2.5 (strong) performance.	World Bank Worldwide Governance Indicators (WGI) project
D. Wage bargaining coordination	coordination of wage-setting. Ranging from 1 = fragmented to individual firms or plants to 5 = maximum coordination	ICTWSS database	C. Control of Corruption	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. The data provided ranges from approximately -2.5 (weak) to 2.5 (strong) performance.	World Bank Worldwide Governance Indicators (WGI) project
III. FINANCIAL MARKETS					
A. Non-performing loans	Bank nonperforming loans to gross loans (%) Ratio of defaulting loans (payments of interest and principal past due by 90 days or more) to total gross loans (total value of loan portfolio). The loan amount recorded as nonperforming includes the gross value of the loan as recorded on the balance sheet, not just the amount that is overdue. (GFDD_SI_02)	World Bank retrieved via FRED			

The OECD PMR has three levels of sub-aggregation, i.e. state control (which includes public ownership and Involvement in business operations), barriers to entrepreneurship (which includes complexity of regulatory procedures, administrative burdens on start-ups and regulatory protection of incumbents) as well as barriers to trade and investment (which includes explicit barriers to trade and investment and other barriers to trade and investment).⁽⁵⁶⁾ In turn, these sub-indicators can be disaggregated further. Multicollinearity between these indicators and insufficient degrees of freedom may lower the efficiency of the point estimates in the regression analysis.

⁽⁵⁶⁾ The OECD product market regulation (PMR) indicators have been published for most OECD countries every 5 years between 1998 and 2013 – for SI, SK as of 2008 and for CY, LT, LV and MT as of 2013. Missing years have been interpolated. Index scale of 0-6 from least to most restrictive.