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European Commission
Directorate-General for Economic and Financial Affairs

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Marco Buti
Director-General

The European Commission's Spring 2018 Economic Forecast shows that the period of sustained growth that began in mid-2013 is expected to remain strong at 2.3% in 2018 and ease only slightly in 2019. Nevertheless, it identified primarily downside risks, several of which have been materialising in the meantime, such as the escalating trade protectionism, financial market volatility experienced in recent months as well as faster-than-expected rises in US interest rates in response to pro-cyclical fiscal stimulus in the US. These risks reinforce once again the need for an ambitious push to complete the architecture of the Economic and Monetary Union and to strengthen the capacity of euro area Member States to absorb structural changes such as the ongoing digital revolution.

The experience of the recent years has shown that convergence towards resilient economies is fundamental for improving the functioning of the EMU because euro area Member States need to absorb economic shocks via internal adjustment. Building more resilient economies requires a common understanding of the concept and the implications for policies. Section 1 of the report develops the notion of economic resilience, provides a framework to identify key areas for resilience in a monetary union and identifies a taxonomy of factors and policies that influence the resilience of Member States' economies. The proposed framework does not envisage a one-size-fits-all approach, but leaves room for country-specific policy settings and sharing of best practices. A number of key policy areas are identified including in the internal market (see also QREA 2018.I), highlighting the need for more ambition in completing the single market.

The second section of this issue of the QREA presents an analysis of financial cycles in the euro area. Since the onset of the global financial crisis there has been a higher awareness of the linkages between financial developments and economic activity. The section discusses how the financial cycle can be identified, and it measures the synchronisation between business and financial cycles in individual economies and in the euro area as a whole. It further highlights a link between

cross-border financial flows and the financial cycles of individual euro area countries. Given the importance of financial cycles for the economy, prudential policies that prevent the build-up of imbalances can be seen as a third pillar of the economic policy framework, complementing monetary and fiscal policies. The role of prudential policies is all the more important in the EU, as the free movement of capital is one of the key tenets of the internal market. The EU's financial regulation framework envisages co-ordination between the EU and national macroprudential but how this will evolve in the future will be key. Last but not least, the interactions between the macroeconomy, and national financial cycles will be significantly altered by the completion of the Banking Union and the Capital Markets Union.

Section 3 of the report explores how the ongoing digital revolution may affect market functioning as well as macro-economic outcomes, in particular the euro area Member States' capacity to withstand shocks and to converge. The section highlights an important risk for convergence among the euro area Member States should the speed at which they transit to the digital economy vary significantly. The analysis shows that an increased flow of knowledge in the wake of further digitalisation has the potential to transform worldwide existing comparative advantages as well as potential growth and convergence patterns. As such, not only lagging euro area Member States will have to catch-up with the leading ones, but also the latter will have to transform with a view to fully exploit the opportunities created by knowledge-intensive activities. The ongoing spread of digitalisation calls also for a strengthening of labour markets. Special attention needs to be paid to developing digital skills so that new features, such as machine learning, complement the tasks of workers rather than displace them. Finally, although technology-enabled innovation in financial services has the potential to strengthen economic resilience, it could also intensify macro-economic risks, if not properly regulated.

Finally, the last section of the report touches upon several aspects of policy making. Microsimulation models, as well as dynamic general equilibrium models,

are used often to assess tax policies and structural reforms. However, they are usually operated separately: in the case of microsimulation models, macroeconomic feedbacks are ignored; while in the case of dynamic general equilibrium models, important socio-economic features such as income distribution are not taken into account. Section 4 of the report presents a dynamic scoring framework for analysing tax and benefit reforms in European Member States by combining EUROMOD, a static microsimulation model, with QUEST, the European Commission's dynamic general equilibrium model. An illustrative income tax reform scenario shows that both behavioural responses and macroeconomic feedback effects are important for a comprehensive evaluation of tax reforms, including their distributional and budgetary impact. Accounting for the full macroeconomic feedback effects of tax, or other structural reforms, on the tax base is critical from a fiscal sustainability and growth point of view. In practise it could mean that some reforms could be partially self-financing and with positive employment effects. Unlike the conventional static budgetary analysis, the proposed dynamic scoring framework can account for these important linkages, potentially raising the social acceptance of such reforms.

Overall, this edition of the QREA provides consistent evidence on the policies that are needed to strengthen the resilience of euro area economies. It also outlines some of the main challenges and constraints that policy makers are confronted with in that respect. The ongoing expansion provides a unique opportunity for an ambitious push to strengthen the euro area's economic resilience: at the national level but also at the euro area level through reforms to deepen EMU. A carefully designed strategy is needed to choose reforms that maximise the impact on resilience. At the same time, ambitious reforms and investments across Member States will help face the new challenges and exploit the opportunities brought by the ongoing digitalisation, contributing to avoid further disparities and divergence across the euro area. When assessing the appropriateness of structural and tax reforms it is crucial to take full account not only of the direct costs but also of the second round behavioural responses (e.g., impact on employment and output) which generally affect the fiscal impact and may facilitate their implementation. Finally, the financial cycle within and across countries is another crucial element for the functioning of EMU as it impacts on (relative) business cycle fluctuations. Policies – including macro-prudential – that tame the financial cycles across countries are likely to contribute to financial stability and growth. Equally important are Banking and Capital Markets Union as they would mute the destabilising cross-border flows which have magnified business cycles in the past.

I. Economic Resilience in EMU

This section discusses why convergence towards resilient economies is key for improving the functioning of the Economic and Monetary Union. Economic resilience refers to the ability of countries to withstand shocks and for GDP growth to recover quickly to potential levels. The experience of recent years has shown how the lack of resilience in one or several economies in the euro area can have significant and persistent effects not only on the countries concerned but also on other countries and the euro area as a whole, through multiple channels. This section focuses on which policies can contribute to resilience in the EMU. To do so, it develops the notion of economic resilience, provides a framework to identify key areas for resilience in a monetary union and a taxonomy of factors and policies that influence the resilience of Member States' economies. The proposed framework is not a one-size-fits-all approach, but leaves room for country-specific policy settings and the sharing of best practices. There are notable differences in economic resilience among euro area countries and the broad taxonomy in this section could provide guidance for the prioritisation of reforms. ⁽¹⁾

I.1. Defining economic resilience and its importance in EMU

The economic and financial crisis revealed that many euro area economies had a number of vulnerabilities that left them ill prepared to smoothly absorb and adjust to economic shocks. The depth of the downturn was linked to the limited absorption capacity of Member States but also to the fact that the crisis coincided with the unwinding of accumulated current account imbalances and the bursting of housing bubbles, which resulted in large and persistent drops in output (relative to the size and complexity of the shock itself). The unwinding of these imbalances had repercussions for sovereign debt via sovereign-bank feedback loops, and created spillover effects across Member States that endangered the stability of the euro area as a whole. It resulted in a period of divergence among Member States, across several dimensions.

The crisis highlighted the need to strengthen economic resilience in the Economic and Monetary Union, defined as the ability of a country to avoid or withstand a shock and for GDP growth to recover quickly to its potential level after having fallen into recession. Resilient economic structures prevent economic shocks from having significant and persistent effects on income and employment levels, thereby also reducing economic fluctuations. ⁽²⁾

Economic resilience entails three elements: (i) the vulnerability to shocks (ii) the shock absorption capacity and (iii) the ability to recover quickly after a shock.

Vulnerability refers to whether and how strongly a shock hits the economy. It reflects concepts such as exposure to shocks and the frequency and intensity of shocks. It depends on a host of parameters, including, for example, the structure of the economy, various policy settings, the financial sector and asset markets, and the state of the non-financial sector. Some countries may be more exposed than others by the same shock.

The absorption capacity reflects the ability of an economy to cushion the direct impact of a shock, minimising immediate output and job losses. A shock can be absorbed by spreading its effects across the economy –to other variables than employment and output – temporarily and over time, for example through automatic stabilisers, responsive wages and prices, credit provision and financial risk sharing .

reflection process and issued a set of "resilience principles" for the G20 countries; Note on Resilience Principles in G20 countries, G20, March 18, 2017. The OECD has also undertaken significant related work in recent years, showing a.o. that shocks are more persistent in countries with rigid product and labour markets; See: <https://www.oecd.org/eco/growth/economic-resilience.htm>; Duval, R. and L. Vogel (2008), 'Economic resilience to shocks: The role of structural policies', *OECD Journal: Economic Studies* Vol. 2008/1; 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; Sutherland, D. and P. Hoeller (2014), 'Growth Policies and Macroeconomic Stability', *OECD Economic Policy Papers* No. 8. Important contributions to this debate have also been provided by the IMF and ECB; IMF (2016), 'A Macroeconomic Perspective on Resilience', Note to the G20.

⁽¹⁾ This section was prepared by Gabriele Giudice, Jesper Hanson (during his secondment to the European Commission), and Zenon Kontolemis. The paper represents the author's views and not necessarily those of their respective affiliation.

⁽²⁾ The concept of resilience has attracted considerable attention recently. The German Presidency of the G20 has launched a

The ability of an economy to recover affects how persistent the effects of shocks to the economy are. It reflects the capacity to ensure a swift return to the previous status, when the shock is temporary, or a smooth reallocation of productive resources, which is affected by product and labour market flexibility. ⁽³⁾ The extent of the needed adjustment or reallocation depends on the type of shock. Permanent shocks typically require a significant reallocation of resources. The faster this process is, the stronger the recovery will be.

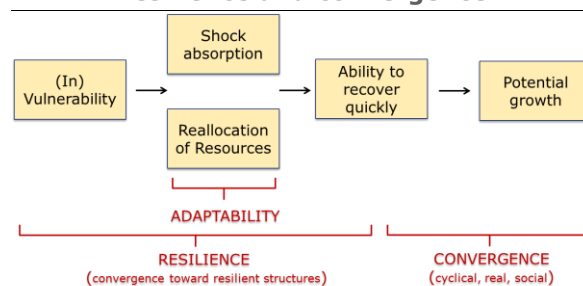
Hence, resilient economic structures can be defined as those which prevent economic shocks from having significant and persistent effects on income and employment levels, and thus are able to reduce the impact of economic fluctuations. This is particularly relevant in a monetary union, where the policy instruments to address the effects of significant economic events are more limited and where inflation differentials can exacerbate real interest rate differentials that can magnify shocks by fuelling economic booms.

Resilient economies are able to avoid dangerous vulnerabilities and deal more efficiently with shocks, which helps prevent unsustainable booms and reduces the depth of recessions, thereby preventing the strong spillover-effects across the euro area witnessed through multiple channels during the crisis.

As such, economic resilience can be seen as a necessary though not a sufficient condition for convergence in the EMU, whether cyclical, real or social. Economic resilience ensures that countries spend relatively short periods in recessions and instead continue to grow along their long-term potential path (Graph I.1). ‘Real convergence’ therefore depends, in the short run, on the resilience and adaptability of economies and in the medium to long term on all those factors that determine growth fundamentals (e.g. labour, physical and human capital, etc.). Put differently, the less frequently trend growth is interrupted by shocks, the faster countries grow and catch up with other economic partners. During such convergence process it is essential to ensure that a socially-acceptable distribution of income is maintained

⁽³⁾ On the impact of the Single Market on resilience, see for example, Jolles, M. and E. Meyermans (2018), ‘Economic resilience, the Single Market and EMU: a self-reinforcing interaction’, Quarterly Report on the Euro Area, Vol. 17, No. 1, pp. 7-22.

Graph I.1: A framework for economic resilience and convergence



Source: DG ECFIN

Resilience fosters cyclical convergence and the effectiveness of the single monetary policy. Preventing unsustainable booms and the deep and lasting recessions that follow, as witnessed during the recent crisis, would help business cycles in the Member States to synchronise. This is important in a monetary union, because the conduct of the single monetary policy is less effective if countries are in different stages of the economic cycle or experience significantly different inflation rates, as some countries would need a more restrictive policy stance than others. Business cycles in the euro area have become increasingly synchronised, meaning that countries more often tend to be in the same phase of the cycle due to policy convergence and trade integration. However, the amplitude of business cycles differs across Member States. Prior to and during the crisis, some Member States experienced strong booms followed by deep busts.

Resilient economies are better able to resume long-term growth and promote positive social outcomes. Insufficiently resilient economies may experience long and persistent downturns and can affect long-term growth and social cohesion. The lack of real convergence seen in recent years in the euro area suggests that the effects can be important for cohesion not only within countries but across the member states of the euro area. Resilient economic structures help prevent the negative social consequences of deep recessions and further promote social outcomes by combining the positive employment effects of efficient labour and product markets with active labour market policies to support the search for new opportunities, including possibilities for lifelong learning and an effective social safety net.

I.2. A stylised description of resilience factors and relevant policies

An appreciation of the tri-faceted nature of economic resilience- vulnerability, absorption and recovery- helps to better identify those factors which affect it and the kinds of policies that could support it. To minimise vulnerabilities, preventive policies that reduce exposure to shocks are needed. Preventive policies have received considerable attention in recent years, with the introduction of the Macroeconomic Imbalance Procedure (MIP) and the reinforcement of the preventive part of the EU's fiscal rules. To improve absorption, responses need to be immediate (by governments, the financial and non-financial sectors) so as to minimise the impact of shocks. Automatic stabilisers and consumption smoothing through savings or borrowing should be emphasised. Finally, stronger and quicker recoveries can be promoted by policies that facilitate the adjustment or reallocation process in the case of more permanent-type shocks, though these may take more time and rely on the institutional frameworks in each Member State.

This section provides a first analysis of factors and policies that influence economic resilience for each of the three phases identified (vulnerability, absorption and recovery). Table I.1 maps the relevant factors for the three phases in the financial, product and labour markets and in the public sector.

Vulnerability: reducing exposure to shocks

Member States are exposed to a wide range of domestic and external shocks that they cannot directly influence. These different shocks affect countries through different channels. One can distinguish between temporary or permanent shocks, supply or demand shocks, and policy shocks. These affect countries in different ways, and their effects may be amplified through indirect channels such as confidence effects. The exposure of a country can change depending on policies and the evolution of its economic structures. For example, a country with poor energy efficiency whose outputs have a high energy intensity and which is highly dependent on foreign energy imports, will be more exposed to a change in global energy prices, which recent experience shows can be very substantial over a relatively short period. Often vulnerabilities interact and accumulate,

increasing the likelihood that a common shock affects the more vulnerable country much harder.

The crisis particularly highlighted the exposure to financial shocks. Sudden interest rate changes or asset prices changes can have strong economic effects. Indebtedness exposes Member States to the impact of changes in market interest rates, which can abruptly change perceptions about sustainability risks. Economies that borrow predominantly through short-term debt and flexible interest rate loans are more exposed to changes in short-term interest rates, which tend to vary more sharply. Microprudential supervision, as well as use of macroprudential instruments can limit financial vulnerabilities. Prudential measures can reduce the risk that diverging real interest rates that fuel asset price bubbles and misallocation of resources (e.g., overinvestment in the construction sector). A debt bias in corporate taxation and tax breaks for housing, such as mortgage interest deductibility, can also contribute towards debt accumulation by firms and households. Measures to improve the sustainability of public finances, including the sustainability of pension and health systems are important to reduce risks to public sector balance sheets.

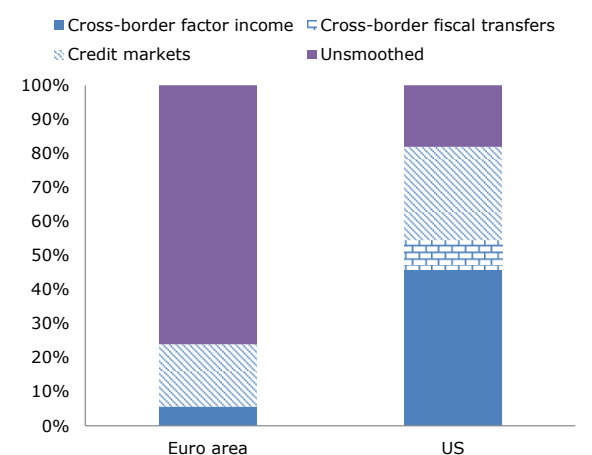
Absorption capacity: cushioning the immediate effect of a downturn

Financial markets can cushion shocks via risk sharing on capital markets, and via the use of savings and access to credit to smooth consumption and production. Graph I.2 shows that shock absorption through cross-country equity holdings and credit markets is lower in the euro area than in the US. ⁽⁴⁾ The crisis showed that a weak banking sector may result in pro-cyclical credit tightening during a downturn (Graph I.3). A healthy financial sector is also important for the transmission of monetary policy, which can more effectively absorb common euro area shocks through changes in interest rates and in liquidity provision if these measures spread appropriately across the euro area economy. It is therefore important to ensure a well-capitalised banking sector. Beyond the banking sector, resilience can be increased by greater use of equity financing. Cross-border equity holdings are relatively small in the

⁽⁴⁾ European Commission (2016), 'Cross-border risk sharing after asymmetric shocks: evidence from the euro area and the United States', Quarterly Report on the Euro Area, Vo.15, No. 2.

euro area, but in contrast to credit exposures, they did not fall during the crisis. ⁽⁵⁾ The measures to create a Capital Markets Union are therefore a priority to ensure that viable firms retain access to finance during recessionary periods and to strengthen the absorption of shocks through cross-border ownership of financial assets.

Graph I.2: Risk Sharing



(1) The figure shows the absorption of asymmetric output shocks across EA Member States and US states. The green bars show the impact of shocks on consumption. In the Euro Area, a 1% decline in GDP leads to a consumption decline of about 0.8% versus only 0.2% in the US. The purple, light blue and dark blue bars show the contribution of risk sharing via credit markets (cross-border borrowing), fiscal transfers, and capital markets and labour income to shock absorption. (2) Capital markets and credit markets absorb less than 6% of asymmetric shocks to euro area GDP, as opposed to the US where capital markets are the main absorption channel. Shock absorption through credit markets is also lower in the euro area than in the US.

Source: Table I.1 in Nikolov, P. (2016), 'Cross-border risk sharing after asymmetric shocks: evidence from the euro area and the United States', Quarterly Report on the Euro Area Vol. 15, no 2.

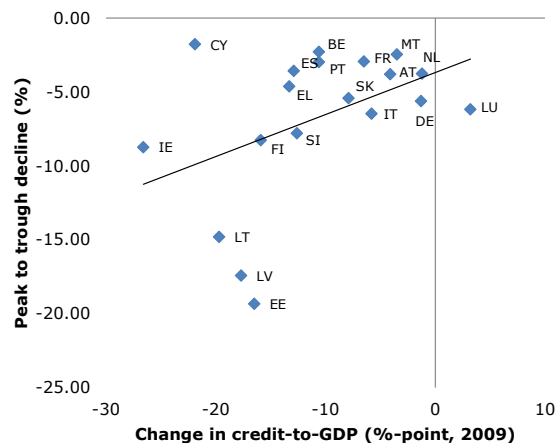
Properly functioning labour market institutions responsive to business cycle conditions may dampen the effect of shocks on employment and are important to enhance the responsiveness of competitiveness. Wage inertia in the face of a shock can result in a sharper rise in unemployment. ⁽⁶⁾ Responsive institutions to cushion shocks include the existence of flexible working time arrangements and flexible wage

⁽⁵⁾ Valiante, D. (2016), 'Europe's Untapped Capital Market: Rethinking integration after the great financial crisis', CEPS Paperback, London: Rowman & Littlefield International.

⁽⁶⁾ Bakker, B.B. (2015), 'Employment and the Great Recession: The Role of Real Wages', IMF Working Paper 15/229.

setting mechanisms, which may reduce the impact on headcount employment levels. ⁽⁷⁾

Graph I.3: Pro-cyclical credit tightening



(1) 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. (2) Credit-to-GDP is measured as non-consolidated private sector credit flow. (3) The decline in credit flows as a share of GDP was larger in countries with a larger fall in GDP during the crisis

Source: AMECO, Eurostat

Smoothly adjusting prices are important to foster adjustments in competitiveness and ensure that changes in labour costs pass through to, or match, adjustments in consumer prices. This prevents the burden of absorption from falling on the purchasing power of households and may also help to regain competitiveness. ⁽⁸⁾ Price flexibility is lower in the euro area compared to the US and is particularly low when prices are regulated. ⁽⁹⁾ Swift price responses are also important to prevent inflation differentials from magnifying the impact of shocks through real interest rate effects. ⁽¹⁰⁾ Addressing barriers to cross-border activities, such as differences or complexities in taxation, may enhance cross-country diversification of firms, reducing exposure to individual economies.

⁽⁷⁾ Flexible working-time arrangements helped euro area firms to adjust, survive and retain their skilled workers at the beginning of the great recession, see e.g. Balleer, A., B. Gehrke, W. Lechthaler and C. Merkel (2016), 'Does short-term work save jobs? A business cycle analysis', European Economic Review, 84, 99-122.

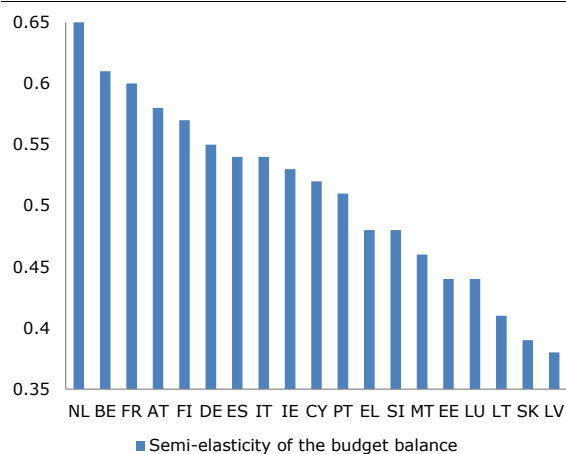
⁽⁸⁾ ECB (2016), 'Increasing resilience and long-term growth: the importance of sound institutions and economic structures for euro area countries and EMU', Economic Bulletin, Issue 5, 2016.

⁽⁹⁾ Dhyne, E., Konieczny, J., Rumler, F. and P. Sevestre (2009), 'Price rigidity in the euro area: an assessment', European Economy Economic Papers No 380. Alvarez, L. et al. (2005), 'Sticky prices in the euro area: a summary of new micro evidence', ECB Working Paper No. 563.

⁽¹⁰⁾ A strong responsiveness to shocks is key to overcome this so-called "Walters' critique". See, for instance, European Commission (2008), "EMU@10", European Economy No. 2.

Finally, governments contribute to shock absorption via automatic stabilisers. For automatic stabilisers to operate optimally, budgetary expenditures need to be sufficiently responsive to the economic cycle and well-targeted to those who are most affected by a shock. Graph I.4 shows that budgetary elasticities differ across countries. Noting that the effectiveness of automatic stabilisation varies across countries and that even countries with smaller budgetary elasticities can stabilise their economies, these mechanisms can be further improved through effective unemployment benefit schemes which reduce income losses and help to support demand, and through the build-up of buffers in the expansionary part of the cycle. Built-in buffers are also needed in viable social security systems, so they are in a position to be able to absorb unexpected shocks. Containing the part of the budget made of inelastic outlays could leave more room for policy action to absorb the shock.

Graph I.4: Semi-elasticity of budget balance



(1) Elasticity of budget balances varies across Member States, affecting automatic stabilisation

Source: Mourre, G., Astarita C. and S. Princen (2014), 'Adjusting the budget balance for the business cycle: the EU methodology', *European Economy Economic Papers* No. 536.

The recovery phase: reallocation of resources

Product market institutions that foster competition and provide a business-friendly environment – by facilitating a speedy entry of new actors and exit of inefficient firms – are important to foster reallocation in the recovery process. A number of papers show that product market regulation and inflexible economic institutions can reduce

resilience to shocks.⁽¹¹⁾ The insights from these work strands are highly relevant for the euro area. There is also substantial evidence suggesting that Member States with less restrictive product markets and enabling business climates normally experience stronger recoveries.⁽¹²⁾ Lack of market entry and competition may also protect profit margins in case of economic booms, thereby fuelling the build-up of imbalances and preventing a timely reallocation to more productive sectors.⁽¹³⁾ A number of reforms are facilitating the ease of entry and expansion of new firms, ensuring the quality of public administration, and limiting sectoral regulations such as retail regulations and regulated professions.⁽¹⁴⁾ An efficient judicial system supports business dynamics by facilitating contract enforcements and via effective insolvency frameworks that enable the winding down of unviable firms and the swift redeployment of resources.

Labour market adjustment is also important for ensuring the smooth transition of workers to new opportunities. Member States with overly protected labour markets tend to see employment levels recover more slowly.⁽¹⁵⁾ Restrictive employment protection legislation increases separation costs and may prevent more productive firms from hiring new employees. This can lead to labour market dualism, with multiple negative implications, including in terms of incentives to accumulate human capital. Flexible employment protection legislation, which make it easier to both separate from employees during downturns and provide higher quality contracts for all during upturns, needs to be complemented by adequate social

⁽¹¹⁾ Pelkmans, J., Montoya, L.A and A. Maravalle (2008), 'How product market reforms lubricate shock adjustment in the euro area', *European Economy Economic Papers* No. 341.; Canova, F., Coutinho, L. and Z. Kontolemis (2012), 'Measuring the macroeconomic resilience of industrial sectors in the EU and assessing the role of product market regulations', *European Economy Occasional Papers* No. 112.; Sondermann, D. (2016), 'Towards more resilient economies: the role of well-functioning economic structures', *ECB Working Paper Series* No. 1984.

⁽¹²⁾ Cf. ECFIN (2017), 'Ease of doing business', Note for the Eurogroup, 15 February 2017; IMF (2017), 'Structural Reforms and External Rebalancing', Culiuc A. and A. Kyobe; Pelkmans, J., Acedo, L. and A. Maravalle (2008), 'How product market reforms lubricate shock adjustment in the euro area', *European Economy Economic Papers* No. 341.

⁽¹³⁾ See, for instance, Praet, P. (2014), 'The financial cycle and real convergence in the euro area', speech at the Annual Hyman P. Minsky Conference on the State of the US and World Economies, Washington DC.

⁽¹⁴⁾ See. ECFIN (2017), 'Investment in the Euro Area: Common principles', Note for the Eurogroup, 4 April 2017.

⁽¹⁵⁾ ECB (2015), 'Comparisons and contrasts of the impact of the crisis on euro area labour markets', *ECB Occasional paper series* 159.

safety nets and active labour market policies to support the taking up of new opportunities in more productive activities. Labour mobility is also a relevant channel of adjustment that has become more important in the EMU. ⁽¹⁶⁾ Improving the portability of pension rights and social security benefits could support labour mobility. Education and training also play a crucial role in the reallocation process of labour.

Financial markets can play a significant role in supporting recoveries by ensuring that financing is available for the most productive and financially-viable firms during the reallocation process. Figure 4 shows that high public and private debt levels are not only associated with vulnerabilities but also with weaker recoveries. A swift resolution of non-performing loans releases resources for productive purposes. In addition, a diversified financial landscape, including developed equity markets and venture capital investors, supports the funding and growth of dynamic firms.

To sustain the economic recovery, governments need to avoid the loss of productive capacity during downturns. Growth-friendly public

expenditure, such as public investment and active labour market policies need to be preserved as much as possible throughout the cycle. The use of spending reviews can promote efficient expenditure allocation and growth-friendly budgetary decision making. ⁽¹⁷⁾

I.3. Conclusion

There are many factors which affect economic resilience that are crucial for the functioning of the EMU given their economic, social and political relevance. This paper identifies a number of priority policy areas for future reforms which merit continued attention and deeper analysis because of their relevance to the three dimensions of resilience. Making progress on these priorities would reduce the vulnerability of euro area economies to shocks, would enhance the degree of shock absorption within the euro area, and would strengthen the ability of euro area economies to recover from shocks. A more thorough analysis is needed to identify in a more granular way the specific policies and legislative action to implement such reforms.

⁽¹⁶⁾ Arpaia, A., Kiss, A., Palvolgyi, B. and A. Turrini (2016), 'Labour mobility and labour market adjustment in the EU', *European Economy Discussion Paper* No. 539.

⁽¹⁷⁾ European Commission (2016) 'Quality of Public Finance – Spending Reviews for Smarter Expenditure Allocation in the Euro Area', Note for the attention of the Eurogroup.

Table I.1: Taxonomy of factors affecting resilience

	Vulnerability	Absorption	Recovery
Financial sector	Leverage and risk taking	Properly functioning Monetary policy transmission mechanism	A procedure for efficient resolution of viable banks.
	Household debt, including mortgages	A healthy banking sector, allowing for income smoothing by households and firms.	A procedure for swift resolution of NPLs
	Corporate debt	Deep capital markets, allowing for funding diversification and equity risk-sharing.	
	Tackling bank-sovereign loops		
Product market/ Business environment		Price flexibility Properly functioning Internal Market where firms can diversify risks (e.g. by increasing exports when domestic demand weakens)	Business regulations Competition – internal market
	Diversification of the economy		Insolvency procedures Judiciary
Labour market		Responsive wages Well-functioning (contract-)bargaining mechanisms	Properly functioning labour market institutions Human capital
		Flexible working time arrangements	Reallocation of labour to more productive firms/sectors, possibly supported by active labour market policies Labour mobility/portability of pension rights
Public sector	Public debt and solvency risk	Adequate automatic stabilisers and budgetary room to apply these	Growth-friendly composition of public expenditure over the cycle
	Long-term sustainability of public finances	Sustainable and well-targeted social security systems	
Taxation	Debt bias in taxation, i.e. tax features favouring corporate and household debt Address tax distortions in the housing sector to reduce high household borrowing levels	Differences and complexities in corporate taxation make it difficult for firms to diversify risks through cross-border activities	Labour-supply friendly tax system

Source: European Commission

II. Financial cycle in euro area

This section explores the issue of financial cycles in the euro area, taking into account the broader and expanding literature in this area. The measure of the financial cycle explored in this section synthesises information on credit flows and house prices in the Member States and at the aggregate euro area level. When equity is also considered, the amplitude and leading properties of the financial cycle are seen to increase. The synchronisation between domestic financial and business cycles appears relatively strong in all but a few euro area Member States. Financial cycles tend to be somewhat less synchronised across Member States than business cycles, but a fair degree of correlation is still in evidence, especially at the level of individual financial variables.

The pre-crisis upswing phase of the euro area financial cycle was preceded by an increase in cross-border debt flows. In the debtor countries, the financial cycle appears to have been at least partly fuelled by debt inflows. The post crisis period saw a slowdown in cross-border debt investment activity, a reversal in previous debt flows and a subsequent downswing in the financial cycle of debtor countries.

An econometric analysis of a positive shock to the financial cycle shows that it can boost economic activity and economic sentiment temporarily, although at the cost of a medium-term correction and increase in uncertainty. Expansionary phase of the financial cycle may be linked to the build-up of macroeconomic imbalances, which call for a comprehensive and timely approach to macroprudential policy. ⁽¹⁸⁾

II.1. Introduction

Since the global financial crisis, an intense discussion on the interlinkages between macroeconomic and financial developments has emerged. There is now a large body of empirical evidence that suggests that adverse financial developments and different financial frictions can have strong negative impacts on real economic activity. In the euro area, the double dip recession that followed 2008 was closely linked to financial factors, and financial developments have been behind the prolonged period of low investment activity. ⁽¹⁹⁾

Whereas the idea that financial systems behave procyclically is not new, ⁽²⁰⁾ recent literature empirically documents that financial developments show *cyclical behaviour* akin to the business cycle, leading to the coining of the term *financial cycle*. Specifically, the financial cycle can be defined as a medium-term co-movement of key financial variables, namely credit and asset prices. The

upward swing in the financial cycle can be accompanied by an accumulation of imbalances that may result in financial turmoil once these unwind. Evidence from international data confirms that excessive credit growth is a common precursor of banking crises ⁽²¹⁾ and that economic recoveries following financial crises tend to be more sluggish. ⁽²²⁾ In fact, prolonged downturns following a credit-driven expansion that resulted in the misallocation of productive resources can even impact potential growth due to the risks of hysteresis and the need to reallocate resources in the presence of financial frictions. ⁽²³⁾

The linkages between business and financial cycles have spurred a debate not only over how to increase the effectiveness of policies to ensure

⁽¹⁸⁾ This article has been prepared by Daniel Monteiro and Bořek Vašíček. The authors wish to thank Reuben Borg and Stan Maes for their useful comments.

⁽¹⁹⁾ See for example: Balta, N. and B. Vašíček (2016), 'Financial channels and economic activity in the euro area', *Quarterly Report on the Euro area*, Vol. 15, No. 2, pp. 19-31.

⁽²⁰⁾ Fisher, I. (1933), 'The debt-deflation theory of great depressions', *Econometrica*, Vol. 1, No. 4, pp. 337-357; Hayek, F. A. (1933), *Monetary Theory and the Trade Cycle*, Clifton, New Jersey; Minsky, H. P. (1982), *'Can It Happen Again?', Essays on Instability and Finance*, M. E. Sharpe, Armonk.

⁽²¹⁾ Drehmann, M. and M. Juselius (2014), 'Evaluating early warning indicators of banking crises: Satisfying policy requirements', *International Journal of Forecasting*, Vol. 30, Issue 3, pp. 759-780; Babecký, J., T. Havránek, J. Matějů, M. Rusnák, K. Šmídková and B. Vašíček (2014), 'Banking, debt, and currency crises in developed countries: Stylized facts and early warning indicators', *Journal of Financial Stability*, Vol. 15, pp. 1-17.

⁽²²⁾ Reinhart, C.M. and K.S. Rogoff (2014), 'Recovery from financial crises: Evidence from 100 episodes', *American Economic Review*, Vol. 104(5), pp. 50-55, May; Jordà, O., M. Schularick and A.M. Taylor (2013), 'When credit bites back', *Journal of Money, Credit and Banking*, Vol. 45, Issue s2, pp. 3-28.

⁽²³⁾ Ball, L. (2014), 'Long-Term Damage from the Great Recession in OECD Countries', *NBER Working Paper*, No. 20185; Furceri, D. and A. Mourougane (2012), 'The effect of financial crises on potential output: New empirical evidence from OECD countries', *Journal of Macroeconomics*, Vol. 34, Issue 3, pp. 822-832; Oulton, N. and M. Sebastián-Barriol (2017), 'Effects of financial crises on productivity, capital and employment', *Review of Income and Wealth*, Vol. 63, Issue s1, vol. S90-S112.

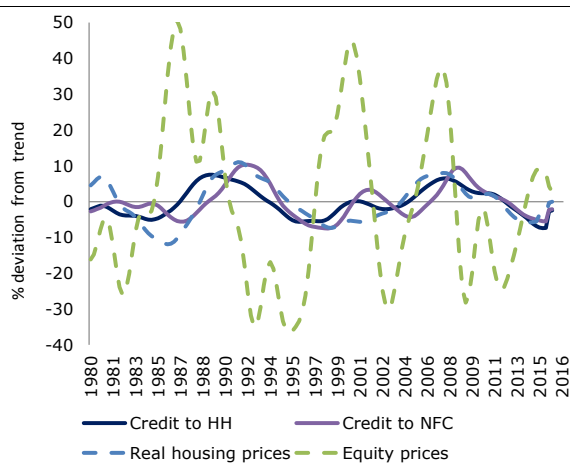
financial stability (macro- and micro-prudential policies) – which has led to significant evolution of the framework at European level ⁽²⁴⁾ – but also on their coordination with policies aimed at macroeconomic stability (monetary and fiscal policies). This latter debate is a pressing one for the euro area given its drive for integrated policies in a context of heterogeneity and strong financial linkages between Member States.

This section revisits the issue of the financial cycle from the euro area perspective. It discusses ways to track the financial cycle in the euro area and provides some evidence on its synchronisation with the business cycle and across countries. In addition, it documents the link between the financial cycle of individual Member States and intra-euro area capital flows, and provides evidence on the impact of the financial cycle on overall macroeconomic developments in the euro area. Finally, it discusses some tentative implications for the current policy debate on the link between macroeconomic and financial developments, the role of macroprudential policies and institutional changes proposed for the euro area.

II.2. Tracking financial cycles in the euro area

The concept of the financial cycle describes cyclical financial developments (at country level) in a single metric. This is achieved by extracting long-term developments (trend) from the overall patterns to identify medium-term fluctuations (cycle) in financial variables, akin to the trend-cycle decomposition of GDP. However, there are several empirical challenges in tracking the financial cycle.

Graph II.1: **Cyclical components of key financial variables in the euro area**



(1) The euro area financial variables were obtained as follows: First, the cyclical component was derived (using a band-pass filter with a frequency band of 8-80 quarters) for each of the following (logged) variables: i) real credit to households, ii) real credit to non-financial corporations, iii) real house prices, and iv) equity prices at a country level (8 EA countries with sufficiently long time series: BE, DE, ES, FI, FR, IT, LU, NL). Second, the country-level cyclical components were aggregated (for each variable) using the share of GDP of each country in overall EA-8 GDP.

Source: ECB, BIS, authors' calculations

What financial indicators are the most relevant? The financial cycle can be tracked both by indicators of quantity and prices. Most studies employ i) *credit indicators*, namely total credit to the private sector, which is sometimes disaggregated into credit to households and to non-financial corporations and expressed as a ratio of GDP or total assets, as well as ii) *real housing prices* (or a derived variable, such as the price-to-income ratio), which show robust links to past financial crises. ⁽²⁵⁾ This set of variables is sometimes coupled with equity prices, benchmark interest rates and yields, and other macro-financial variables. Graph II.1 plots the cyclical developments of four key financial variables, namely loans to households, loans to non-financial corporations, real house prices and equity prices for the euro area. ⁽²⁶⁾ While the co-movement of credit variables and housing prices is evident, the cyclical dynamics of equity prices feature a substantially larger *amplitude* and far

⁽²⁴⁾ The European Systemic Risk Board (ESRB) was established in 2010 for the macro-prudential surveillance of the EU financial system in order to prevent and mitigate systemic risks to financial stability. The Single Supervisory Mechanism (SSM) was established in 2013 as one of the pillars of the banking union. It grants the ECB a supervisory role to monitor the implementation of the single rulebook and the financial stability of banks based in the euro area. The Capital Requirements Directive IV (CRD IV) and the associated Capital Requirements Regulation (CRR) were passed in 2013 and introduced new macro-prudential instruments such as the counter-cyclical capital buffer and the possibility of increasing risk weights on mortgage loans.

⁽²⁵⁾ Jordà, Ò., M. Schularick and A.M. Taylor. (2015), 'Betting the house', *Journal of International Economics*, Vol 96, Supplement 1, pp. S2-S18.

⁽²⁶⁾ The authors of this section would like to thank G. Rünstler and co-authors for having provided the underlying country data, which are used to derive cyclical components in Graph II.1 and elsewhere in this section. For an extensive analysis of financial cycles in the EU using different methods, see ECB (2018), 'Real and Financial Cycles in EU countries: Stylized facts and modelling implications', *ECB Occasional paper*, No. 205.

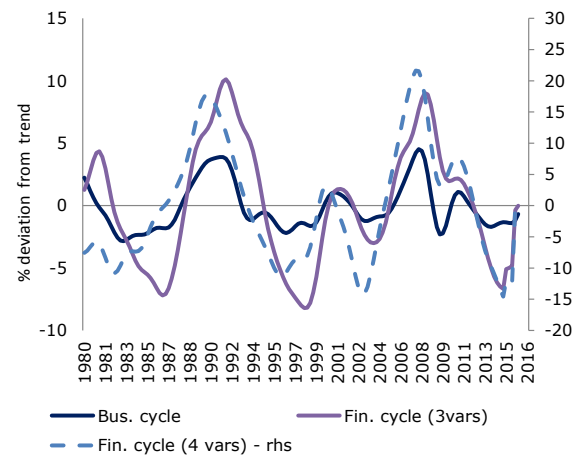
less synchronisation in the timing of *turning points*. In fact, equity cycles appear to anticipate somewhat credit and housing cycles, which can be possibly understood as a consequence of the fact that efficient equity markets immediately reflect future expectations that may take longer to translate and materialise into investment decisions and the real economy.

Identifying the overall financial cycle. There is a clear trade-off between preserving the information contained in *individual* financial variables and identifying *systemic* financial developments using composite indicators. Graph II.2 presents the financial cycle for the euro area as a composite indicator (based on a common factor) of cyclical developments of individual financial variables plotted in Graph II.1. Given the rather distinct cycles of equity prices, one measure of the financial cycle includes this variable, while the other excludes it. It can be noticed that the presence of equity prices in the composite indicator not only augments the amplitude of the financial cycle⁽²⁷⁾ but also tends to anticipate the cyclical turning points. In face of the low synchronisation of equity prices with the other financial variables,⁽²⁸⁾ the financial cycle used for further analysis will be based on credit and housing prices only.⁽²⁹⁾

The duration of the financial cycle can be estimated by the analysis of the series' turning points. Most studies agree that financial cycles tend to be longer (lasting between 12 and 18 years) and to have a larger amplitude than business cycles. There is nevertheless evidence that GDP is also subject to

longer-term fluctuations that broadly align with credit and housing cycles.⁽³⁰⁾

Graph II.2: **Financial and business cycles in the euro area**



(1) The euro area financial cycle was obtained as follows: First, the cyclical component was derived (using a band-pass filter with a frequency band of 8-80 quarters) for each of the following (logged) variables: i) real credit to households, ii) real credit to non-financial corporations, iii) real house prices, and iv) equity prices at a country level (8 EA countries with sufficiently long time series: BE, DE, ES, FI, FR, IT, LU, NL). Then, the euro area financial cycle was obtained as the first principal component of the aggregated EA-8 variables: credit to households, credit to non-financial corporations and real house prices (3 vars), or these three variables plus equity prices (4 vars). Finally, the principal component was re-normalised to have the same standard deviation as the mean standard deviation of the underlying four (resp. three) variables.

The euro area business cycle was obtained by aggregating the cyclical components of the EA-8 countries using the share of GDP of each country in overall EA-8 GDP as weights.

Source: ECB, BIS, authors' calculations

While the larger amplitude of the financial cycle in the euro area is apparent in Graph II.2, the relative length of both cycles is not easy to compare in view of the limited time span of financial variables. Moreover, it should be noted that the preselected parameters of statistical filters can affect the estimated length of the financial cycle. The band-pass filter used in this chapter is applied with a rather wide frequency of 8-80 quarters to all the variables (i.e. the cycles are allowed to last between from 2 till 20 years) in order to minimise the impact of the subjective assumptions on of the estimated cycle length.⁽³¹⁾

⁽²⁷⁾ While principal component analysis normalises the underlying variables (with the first eigenvalue determining the variance of the first principal component), the factor used as a measure of financial cycle was re-normalised here and elsewhere in this article to have the same standard deviation as the mean standard deviation of the underlying 3, resp. 4 variables.

⁽²⁸⁾ This is reflected also in substantially lower explanatory power of the first principal component when equity prices are included. In that case, the first principal component explains 60% of the overall variability in the series, as opposed to 80% when equity prices are excluded.

⁽²⁹⁾ This is consistent with other studies that used different filtering methods. See for example: Galati, G., I. Hindrayanto, S.J. Koopman and M. Vlekke (2016), 'Measuring financial cycles in a model-based analysis: Empirical evidence for the United States and the euro area', *Economics Letters*, Vol. 145, pp. 83-87; Menden, C. and C.R. Proaño (2017), 'Dissecting the financial cycle with dynamic factor models', *Quantitative Finance*, 17(12), pp. 1965-1994; Schüler, Y.S., P. Hiebert and T.A. Peltonen (2015), 'Characterising the financial cycle: a multivariate and time-varying approach', *ECB Working Paper*, No. 1846.

⁽³⁰⁾ See for example ECB (2018), 'Real and Financial Cycles in EU countries: Stylized facts and modelling implications', *ECB Occasional paper*, No. 205.

⁽³¹⁾ For the use of the band-pass filter in economic analysis see, for example, Christiano, L.J. and T.J. Fitzgerald, (2003), 'The band pass filter', *International Economic Review*, Vol. 44, No. 2, pp. 435-465. Multivariate methods have also been proposed that do not

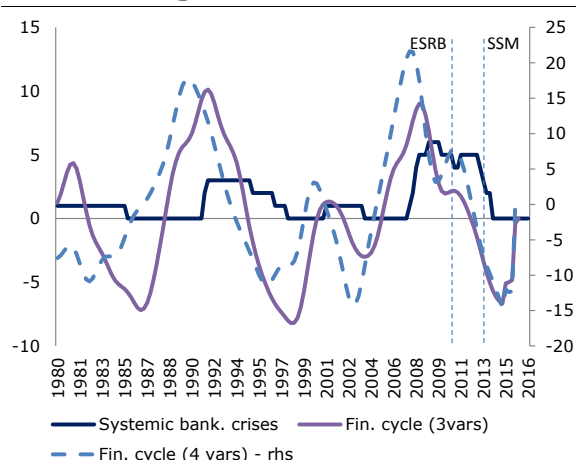
Why is the financial cycle of interest? Graph II.2 suggests there is a visible co-movement between financial and business cycles in the euro area. As before, the measure of the cycle incorporating equity developments appears to lead both the business and the three-variable financial cycles, possibly reflecting the ability of equity markets to anticipate and immediately price in expectations. While synchronisation does not imply causality, there is widespread agreement that the upswing in the financial cycle may at times be linked to the building-up of imbalances whose unwinding (i.e. the downswing in the financial cycle) can have a detrimental effect on the real economy. The term *balance sheet recession* ⁽³²⁾ that has been often used to characterise the global financial crisis, refers precisely to the situation where private indebtedness (accumulated during the upswing in the financial cycle) is perceived as too high in a given adverse economic context, inducing changes in the behaviour of private agents. Over time, agents increase savings in order to decrease their debt (deleveraging), cutting down on consumption and investment, which deepens the recession. The decline in asset prices used as collateral for loans implies that nominal debt can now exceed the value of assets, resulting in negative equity and in the *de facto* insolvency of many debtors. The creditors (typically banks) may become illiquid and insolvent themselves, which may result in a banking and financial crisis.

Market actors do not internalise the systemic risks they generate for the system. For example, fire sales and credit crunches induce externalities. Specifically, the sell-off of specific assets can affect other asset categories and cause a generalised decline in asset prices, a deterioration of the balance sheets of intermediaries and investors, a decline in the value of collateral, and the drying up of bank financing. The existence of such externalities needs to be tackled by public action, namely by macroprudential policy.

suffer from some of the band-pass filter's shortcomings. See for example Rünstler, G. and M. Vlekke, M. (2018), 'Business, housing, and credit cycles', *Journal of Applied Econometrics*, Vol. 33, Issue 2, pp. 212-226.

⁽³²⁾ The term is mostly attributed to Richard Koo and was widely used to refer to the recession in Japan in the 1990s and to the recession in the US and other countries in the context of the global financial crisis.

Graph II.3: Financial cycle and systemic banking crises in the euro area



(1) The construction of the financial cycle (EA-8 countries: BE, DE, ES, FI, FR, IT, LU, NL) is explained in the note of Graph II.2. The banking crises refer to the number of systemic banking crises in EA-8 countries.

Source: ECB, BIS, authors' calculations; banking crises are taken from Lo Duca, M. et al. (2017): A new database for financial crises in European countries: ECB/ESRB EU crises database. Developed by FSC MPAG and ESRB AWG, ECB Occasional Paper, No. 194.

Graph II.3 comparing the financial cycle with a measure of the occurrence of *systemic banking crises* ⁽³³⁾ in the euro area countries suggests that peaks in the financial cycle are often followed by systemic banking crises. In fact, the financial cycle measure that includes equity as well as credit and housing prices seems to be a leading indicator of banking crises. ⁽³⁴⁾ The statistical link between the peak of the euro area financial cycle and the onset of systemic banking crises in several Member States is evident around 1991 and 2008. The graph also shows that banking crises usually last for several years, coinciding with the downward phase of the financial cycle. ⁽³⁵⁾ The cyclical development of key financial variables can be seen as much as a macroeconomic fact as the business cycle. As for the latter, it is important to avoid excessive

⁽³³⁾ The identification of systemic banking crises come from Lo Duca, M. et al. (2017): A new database for financial crises in European countries: ECB/ESRB EU crises database. Developed by FSC MPAG and ESRB AWG, *ECB Occasional Paper*, No. 194.

⁽³⁴⁾ Schüler et al. (2015), op. cit. show that a financial cycle indicator composed of credit and asset prices is a robust predictor of systemic banking crises (in 13 EU countries) on a horizon of up to three years, outperforming the popular credit-to-GDP gap.

⁽³⁵⁾ From the EA-8 sample (BE, DE, ES, DE, FR, LU and NL), the systemic banking crises hit IT, FI and FRA in 1991, DE in 2000 and BE, DE, ES, DE, FR, LU and NL after 2008. Even around 2000 when a banking crisis hit the largest EU Member State, Germany, the financial cycle of the euro area attained a local maximum (and the German financial cycle was at its peak: see Graph II.5, right-hand panel).

upswings that are inevitably followed by costly readjustments. Therefore, macroprudential policy (discussed in sub-section II.6) aims at smoothing the financial cycle at country level. At the euro area level, numerous institutional changes were implemented in the recent years and others are being discussed to reduce the vulnerabilities (related, for example, to intra-euro area financial flows as discussed in sub-section II.4) but also to make the euro area more resilient to adverse shocks (see also Graph II.3).

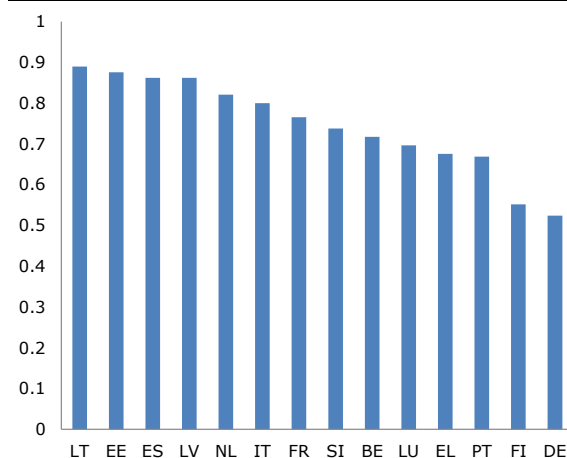
II.3. Synchronisation between cycles across the euro area

Most empirical studies agree that the financial cycle has a longer length and a higher amplitude than the business cycle, but the two cycles also seem to interact⁽³⁶⁾, as the peaks and troughs of the financial cycle often coincide with turning points in the business cycle (see Graph II.2).⁽³⁷⁾ The synchronisation between business and financial cycles has implications for the nexus between monetary and macroprudential policy. While monetary policy aims to stabilise inflation and the business cycle, it has implications for credit developments and thus also for the financial cycle. Consequently, there has been an ongoing discussion on whether monetary policy decisions should take financial stability concerns into account ('leaning against the wind')⁽³⁸⁾ in as much as such policies do not only bring benefits for financial stability but also carry macroeconomic costs.⁽³⁹⁾ Macroprudential policies in turn aim to maintain overall financial stability by affecting credit supply, and thus real economic variables such as consumption and investment.

A common measure of synchronisation is *concordance*, which is the proportion of time when two series, in this case the business and financial

cycles, are in the same phase, i.e. both displaying positive or negative values.⁽⁴⁰⁾ Graph II.4 suggests that the domestic financial and business cycles of Member States appear quite synchronised. At the euro area level, they are in the same phase 70% of the time. However, concordance varies among Member States, with Germany showing the least synchronisation between its domestic business and financial cycle.

Graph II.4: **Concordance between domestic business and financial cycles in selected euro area countries**



(1) The value of concordance is bounded between 0 and 1. It expresses the proportion of time when the domestic business and financial cycles are in the same phase, i.e. both displaying positive or negative values.

Source: ECB, BIS, authors' calculations

It is also possible to look at synchronisation between countries. In fact, the issue of business cycle synchronisation between Member States has been discussed ever since the idea of a common currency was born. For a better cross-country comparison, Graph II.5 plots the business cycles and financial cycles of individual Member States. The graph shows quite a high degree of synchronisation between the business cycles of Member States but also a degree of decoupling since the global crisis. The amplitude of the business cycle, by contrast, varies significantly across Member States, a fact that may be related to structural differences (smaller countries tend to show a higher amplitude, for example) but which may also be linked to

⁽³⁶⁾ Drehmann, M., C. Borio and K. Tsatsaronis (2012), 'Characterising the financial cycle: don't lose sight of the medium term', *BIS Working Papers*, No. 380; Borio, C. (2014), 'The financial cycle and macroeconomics: What have we learnt?', *Journal of Banking & Finance*, No. 45, pp. 182-198.

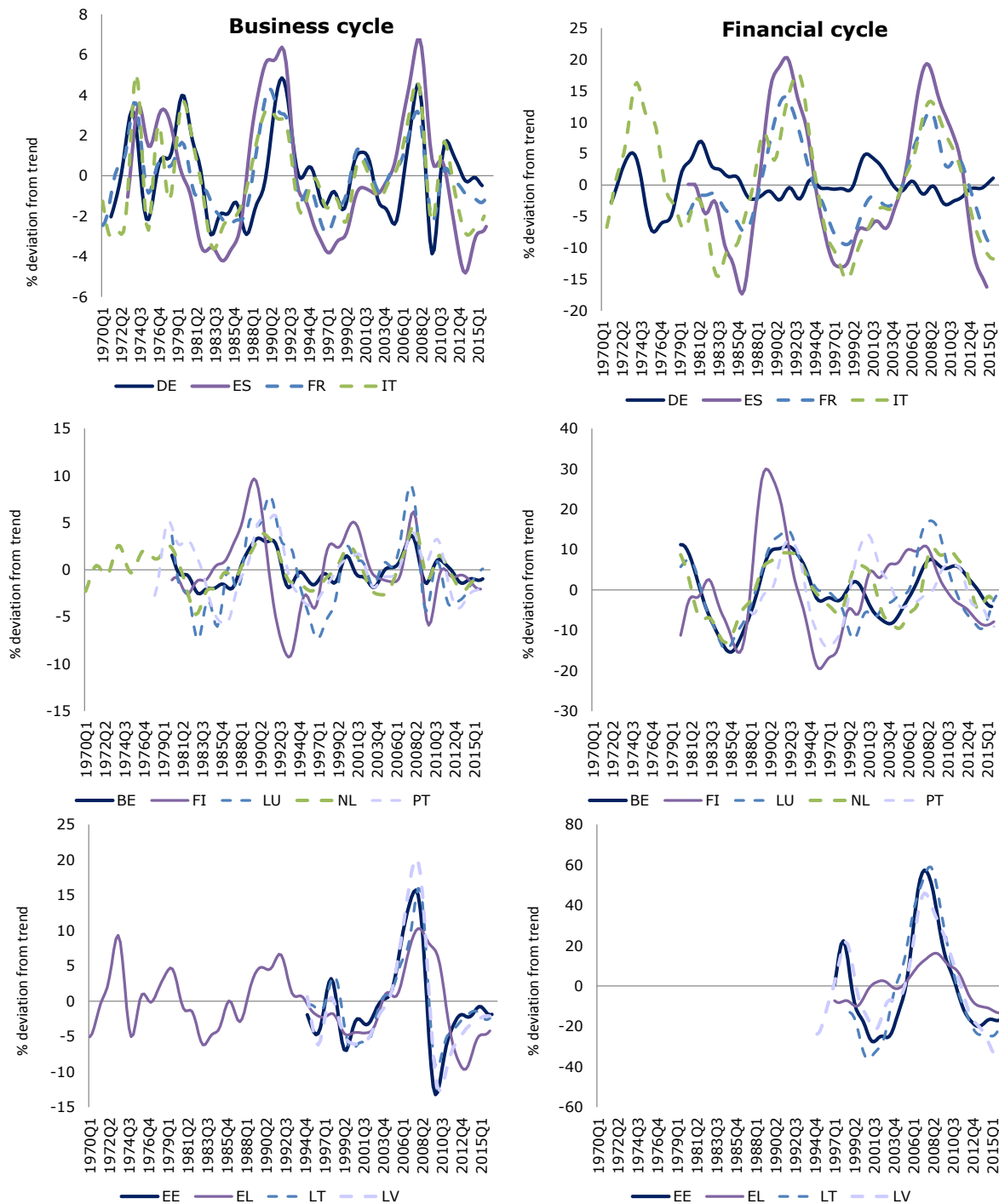
⁽³⁷⁾ Claessens, S., M.A. Kose and M.E. Terones (2012), 'How do business and financial cycles interact?', *IMF Working Paper*, No. 11/88; Jordà, O., M. Schularick and A.M. Taylor (2017), 'Macrofinancial history and the new business cycle facts', Chapter in *NBER Macroeconomics Annual 2016*, Vol. 31, pp. 213-263.

⁽³⁸⁾ Borio, C. and P. Lowe (2002), 'Asset Prices, Financial and Monetary Stability: Exploring the Nexus', *BIS Working Paper*, No. 114.

⁽³⁹⁾ Svensson, L.E.O (2017), 'Re-evaluating the result that the costs of 'leaning against the wind' exceed the benefits', Voxeu, 24 January 2017.

⁽⁴⁰⁾ Harding, D. and A. Pagan (2003), 'A comparison of two business cycle dating methods', *Journal of Economic Dynamics and Control*, Vol. 27, Issue 9, pp. 1681-1690. The value of concordance is bounded between 0 and 1.

Graph II.5: Domestic financial cycle and business cycle in euro area countries



(1) Firstly, the cyclical components were derived (using a band-pass filter with a frequency band of 8-80 quarters) for the following (logged) variables: real credit to households, real credit to non-financial corporations, and real house prices at a country level. Secondly, the financial cycle was calculated as the first principal component of the series previously obtained.

Source: ECB, BIS, authors' calculations

potentially divergent financial cycles (see right-hand panel).

Financial cycles are in general less synchronised across Member States than business cycles and the differences in amplitude are even more

pronounced. For example, the German and Finnish financial cycles show little synchronisation with other Member States. While the German financial cycle shows a very small amplitude and negative correlation with most other Member States, the Finnish financial cycle features much larger

amplitudes. ⁽⁴¹⁾ This is consistent with Graph II.4, where Germany and Finland attained the lowest concordance between their domestic financial and business cycles. The financial cycles of Baltic countries show larger amplitudes than other Member States and are rather synchronised with each other.

Another way to look at the synchronisation from the euro area perspective is to compare the concordance between the domestic financial (or business) cycle of each Member State and the common financial (or business) cycle developments across the Member States. ⁽⁴²⁾ This is done in Graph II.6, which shows that the synchronisation is relatively lower for new Member States, which may be related to their ongoing convergence process but also possibly the relatively small size of their economies. ⁽⁴³⁾ Graph II.6 also reconfirms that the German financial cycle is substantially less synchronised with the other euro area countries than its business cycle. In fact, financial developments appear significantly more a-cyclical in Germany than in other Member States and the amplitude of the cycle is relatively smaller both for credit and housing prices. ⁽⁴⁴⁾ While it is difficult to pin down a single reason for the German financial cycle singularity, there are a few intuitive explanations. First, Graph II.2 suggests that re-unification may have played some role as the cycle amplitude decreased since 1990s. Second, there is cross country evidence ⁽⁴⁵⁾ that length and amplitude of financial cycle increase with share of private home ownership, which stands at around 50% in Germany compared to values above 60% for the UK and the US and above 70% for Italy and Spain. Third, the bank funding seems to play

role as well. ⁽⁴⁶⁾ Namely, funding strategies relying on securitisation and wholesale sources seem to be linked to higher house credit boom and bust, while the retail deposits represent the principal funding source for German banks.

Whereas the previous analysis of concordance looked at financial cycles as a composite indicator of several financial variables, one may compare developments across Member States for each financial variable (e.g. housing prices). Such analysis (not reported here in detail) suggests that there each type of financial variable is significantly synchronised across the Member States. Credit to non-financial corporations and equity prices, for example, appear more synchronised across Member States than they do within them. ⁽⁴⁷⁾ Some of this synchronisation can be seen as an outcome of the euro, which eliminated currency risks, led to a decline and convergence in interest rates and increased cross-border financial flows. Empirical evidence also suggests that a consequence of these developments was both a decline in the synchronisation of mortgage credit to households as well as an increase in the synchronisation of credit to non-financial corporations. ⁽⁴⁸⁾ Consequently, it maybe that the euro introduction affected individual components of the financial cycle at the country level but the aggregate euro area cycle did not change significantly around 1999 as suggested by Graph II.2. The formal statistical analysis suggests that there is slight decrease in persistence of financial cycle (and even the business cycle) of the aggregated euro area, there is no indication that the euro introduction would represent a major structural break. ⁽⁴⁹⁾

⁽⁴¹⁾ Rünstler and Vlekke (2018), op. cit. argue that the financial cycle is longer for countries with higher rates of home ownership.

⁽⁴²⁾ The common developments across the euro area are in this case represented by the first principal component of domestic financial and business cycles of euro area countries (BE, DE, EE, EL, ES, FI, FR, IT, LT, LU, LV, NL, PT, SI) rather than a GDP-weighted average of domestic cycles. However, the results using GDP-weighted averages are rather similar.

⁽⁴³⁾ The low synchronisation of the new Member States is not driven by their smaller size but rather by genuinely distinct developments.

⁽⁴⁴⁾ Similar features of the German financial cycle have been reported elsewhere; see for example Alcidi, C. (2017), 'Fiscal Policy Stabilisation and the Financial Cycle in the Euro Area', DG ECFIN *European Economy - Discussion Papers*, No. 052; ECB (2018), op. cit., Strohsal, T. C. Proaño and J. Wolters (2015), 'Characterizing the financial cycle: Evidence from a frequency domain analysis', *Discussion Paper Deutsche Bundesbank* No 22/2015.

⁽⁴⁵⁾ Huber, S. (2016), 'Housing booms and busts: convergence and divergence in OECD countries', Universitat Pompeu Fabra, mimeo; Rünstler and Vlekke (2018), op. cit.

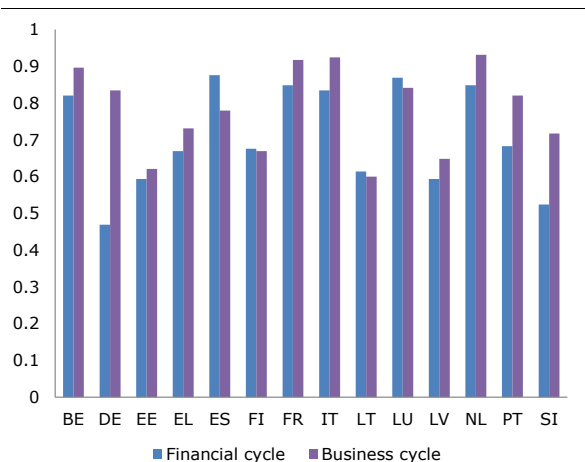
⁽⁴⁶⁾ Cerutti, E., J. Dagher and G. Dell'Ariccia, G. (2017). 'Housing finance and real-estate booms: a cross-country perspective'. *Journal of Housing Economics*, Vol. 38, 1-13.

⁽⁴⁷⁾ Similar results are obtained by means of wavelet analysis by Scharnagl, M. and M. Mandler (2016), 'Financial cycles in the euro area: a wavelet analysis', Bundesbank, mimeo.

⁽⁴⁸⁾ Samarina, A., L. Zhang and D. Bezemer (2017), 'Credit cycle coherence in the eurozone: Was there a euro effect?', *Journal of International Money and Finance*, Vol. 77, pp. 77-98.

⁽⁴⁹⁾ While the visual inspection of financial cycle and its component does not point to major changes in properties of financial cycles, a formal statistical analysis detects several potential structural breaks but most of them occur in periods distant from 1999, the most pronounced one being 2008, i.e. the Global financial crisis.

Graph II.6: **Concordance of domestic financial and business cycles with the rest of the euro area**



(1) The reference euro area financial is obtained as the first principal component of financial cycles of euro area countries (BE, DE, EE, EL, ES, FI, FR, IT, LT, LU, LV, NL, PT, SI). The business cycle is proxied also by the common cycle obtained through principal component analysis.

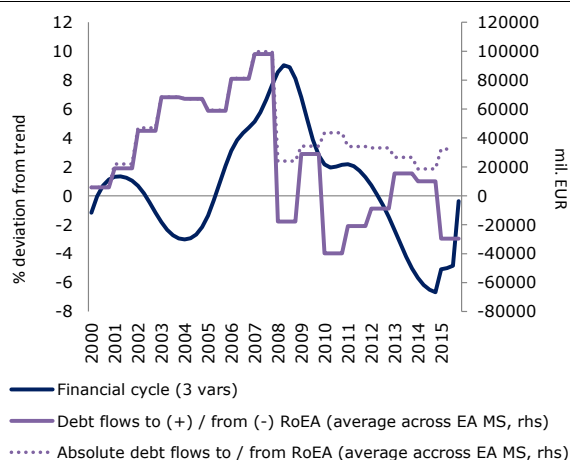
Source: ECB, BIS, authors' calculations

II.4. Financial cycle and cross-border financial flows in the euro area

Cross-border financial flows, in particular portfolio and other investment as well as interbank credit, can have a significant impact on credit provision in the domestic market and on the evolution of house and stock prices, thereby driving national financial cycles. These cross-border dynamics can furthermore imply a decoupling between financial and trade flows, pointing to the usefulness of looking beyond current account imbalances and of keeping track not only of net but also of gross capital flows in understanding economic developments.⁽⁵⁰⁾ Not only can international flows drive domestic cycles, but the converse is also possible, for example when a domestic boom attracts external financing from countries with more subdued dynamics, or where savings are higher.

⁽⁵⁰⁾ Avdjiev, S., B. Hardy, S. Kalemli-Ozcan and L. Servén (2017), 'Gross Capital Flows by Banks, Corporates and Sovereigns', *National Bureau of Economic Research Working Paper*, No. 23116.

Graph II.7: **Financial cycle and average debt flows in the euro area**



(1) The construction of the financial cycle (EA-8 countries) is explained in the note of Graph II.2.

Source: Eurostat, BIS, authors' calculations. Financial flow data is based on an update of the database described in Hobza, A. and Zeugner, S. (2014). 'Current accounts and financial flows in the euro area', *Journal of International Money and Finance*, vol. 48, pp. 291-313, authors' calculations

While country-level variables are often used to estimate financial cycles, the latter can also have a very pronounced international dimension, as suggested by the concordance measures seen in the previous sub-section and by the role of cross-border flows. The existence of global financial cycles – as manifested, e.g. by co-movements in gross capital flows, asset prices, banking sector leverage and credit growth across countries – has been argued in the literature. The dynamics of global cycles can generally be linked to developments in leading economies, particularly the US, and can be tracked by indicators of risk aversion (e.g. the VIX), interest rates, or economic growth.⁽⁵¹⁾

As discussed in the previous sub-section, there is a significant degree of synchronisation in financial variables across the euro area, suggesting the possibility of supra-national financial cycles. To the extent that a euro area cycle exists, its emergence is likely to have resulted from the elimination of exchange rate risk and the convergence of interest rates brought about by a common monetary policy, which reinforced cross-border financial flows and

⁽⁵¹⁾ To the extent that the international financial cycle tends to be driven by business-cycle phenomena (as opposed to, say, a gradual build-up in credit), its length is deemed to be similar to the real business cycle.

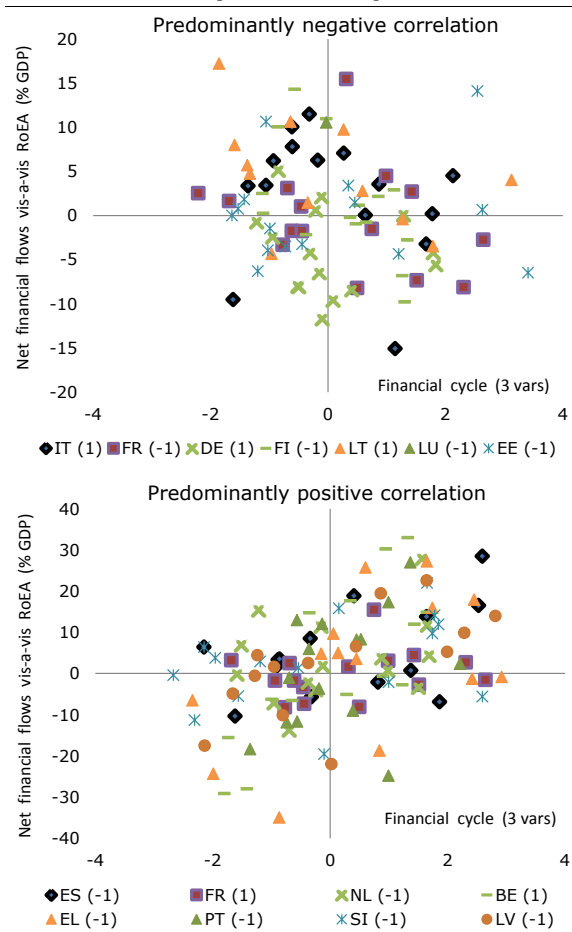
ultimately shaped the financial cycles of individual Member States.

Graph II.7 suggests there is a link between cross-border financial flows⁽⁵²⁾ and the financial cycle at the euro area level.⁽⁵³⁾ Namely, the pre-crisis upswing in the financial cycle was preceded by large and sustained financial outflows from euro area Member States to the rest of the euro area through the form of investment in debt instruments. The sharp reversal of these flows in 2008 coincided with a turning point in the euro area financial cycle, which marked the beginning of a downswing that lasted until 2014. The post-crisis period was characterised not only by disinvestment in cross-border debt instruments, but also by lower cross-border activity when compared with the pre-crisis period (as measured in Graph II.7 by average absolute debt flows). At country level, however, there is no evidence of a systematic relationship across Member States between net cross-border debt flows and individual financial cycles during the 2000-2015 period. As depicted in Graph II.8, the correlation between the two variables changes sign depending on the country concerned, but also on whether it is measured contemporaneously, with a lag or with a lead.⁽⁵⁴⁾

The role of cross-border flows was highlighted by the euro area debt crises, as the reversion in these flows amplified differences in economic performance and credit growth across creditor and debtor countries.⁽⁵⁵⁾ As shown in Graph II.9, the crisis witnessed a reversal from positive net debt inflows to net debt outflows in some of the debtor countries most severely affected by the crisis. In this group of countries, sustained net debt inflows preceded and possibly fuelled the expansion in the financial cycle, as shown in a synthetic measure of the cycle in Graph II.9. Following the collapse in

net debt inflows, the financial cycle is seen to eventually enter into a contractionary phase. These dynamics arguably have their counterpart in creditor countries, where debt outflows are seen to reverse into inflows, or at least to move into balanced dynamics, with the onset of the crisis. In the group of creditor countries shown in Graph II.9, the expansion in the synthetic measure of the cycle anticipates, rather than lags, the increase in the debt inflows.

Graph II.8: **Financial cycle vs. net debt inflows, selected euro area countries (2000-2015)**



(1) In the legend, the numbers next to the country codes describe whether the financial cycle is plotted against financial flows lagged by one year (-1), or against financial flows leading by one year (1). FR is represented in both graphs due to the absence of a clearly predominant sign of correlation. Outlier data points are not depicted in the graphs.

Source: Eurostat, BIS, authors' calculations. Financial flow data is based on an update of the database described in Hobza, A. and S. Zeugner, S. (2014) op. cit.

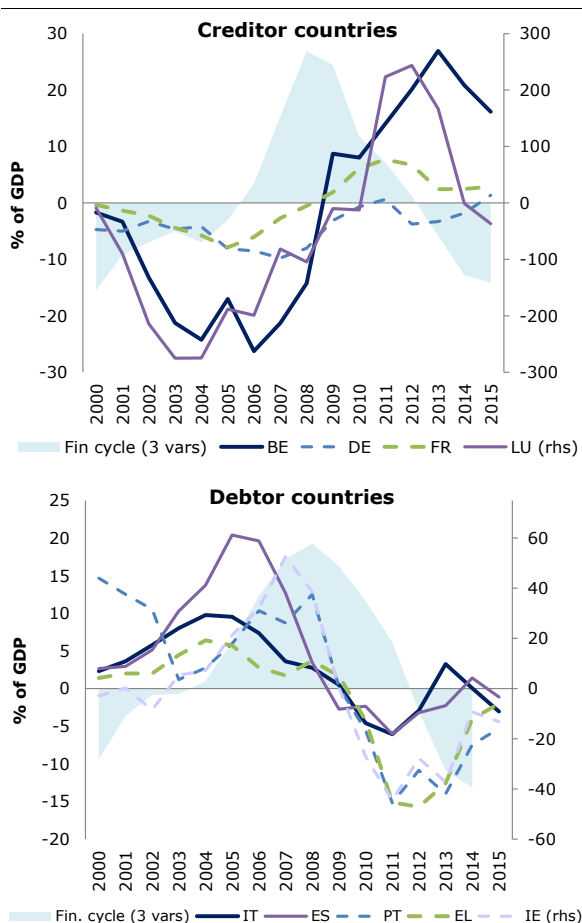
⁽⁵²⁾ The financial flow data refers to overall bilateral debt flows between countries, irrespective of the institutional sector originating or receiving the flows. It includes portfolio investment and other investment (e.g., loans), but excludes official debt flows such as financial assistance and asset purchase programmes.

⁽⁵³⁾ The financial cycle for the euro area is proxied (as in Graphs II.2 and II.3) by GDP-weighted average of financial cycles of 8 EA countries with sufficiently long time series: BE, DE, ES, FI, FR, IT, LU, NL. The net debt inflows also refer to these 8 EA countries, with the counterparty for each of these 8 countries being the rest of the euro area

⁽⁵⁴⁾ In fact, correlations are generally stronger when measured with a lead or lag, rather than contemporaneously, meaning that the latter are not shown in Graph II.8.

⁽⁵⁵⁾ Lane, P.R and P. McQuade (2014), 'Domestic credit growth and international capital flows', *Scandinavian Journal of Economics*, Vol. 116, No. 1, pp. 218-252.

Graph II.9: Net debt inflows vis-à-vis RoEA in creditor and debtor countries



(1) The net debt inflows are the difference between debt inflows (+) and outflows (-) vis-à-vis RoEA (% of the GDP, 3-year centered moving average). France was included among the set of creditor countries notwithstanding its modestly negative NIIP due to the similarity in net debt flow dynamics when compared with other countries in this group. The financial cycle shown in each chart is an aggregate measure of the financial cycles of the plotted countries. The financial cycle was re-scaled for depiction purposes.

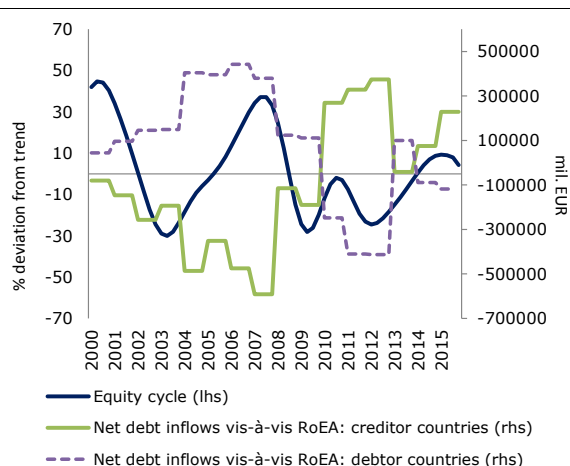
Source: Eurostat, BIS, authors' calculations. Financial flow data is based on an update of the database described in Hobza, A. and S. Zeugner, S. (2014) op. cit.

These observational facts notwithstanding, it should be noted that it is rather difficult to establish one-way causality between current account imbalances, intra-euro area financial flows and national financial cycles in the Member States.⁽⁵⁶⁾ In addition, as European banks intermediate cross-border flows well beyond the European continent, bank conditions in the EU

⁽⁵⁶⁾ For example Unger, R. (2017), 'Asymmetric credit growth and current account imbalances in the euro area', *Journal of International Money and Finance*, Vol. 73, pp. 435-451 argues that flows of bank loans to the non-financial corporations together with changes in competitiveness was the most important determinant of the build-up of current account imbalances in the deficit countries.

(such as liquidity, funding and credit) potentially affect, alongside the conditions in the US, the global financial cycle.⁽⁵⁷⁾

Graph II.10: Equity cycle and net debt inflows in creditor and debtor countries



(1) The equity cycle was calculated as described in the note to Graph II.1. The net debt inflows are the difference between debt inflows (+) and outflows (-) vis-à-vis RoEA

Source: Eurostat, BIS, authors' calculations. Financial flow data is based on an update of the database described in Hobza, A. and S. Zeugner, S. (2014), op. cit.

As mentioned in sub-section II.2, the equity cycle tends to lead the financial cycle when measured based on credit and house price variables. Graph II.10 relates an indicator of the euro area equity cycle to cross-border debt flows in selected creditor and debtor countries. It can be observed that the post-2003 upswing in equity prices coincided with greater investment by creditor countries in debt instruments of riskier debtor countries. When a bear market emerged in 2007, debt flows reverted towards safer creditor countries. Following a recovery in equities since 2012, this apparent flight to safety moderated once more. Overall, these dynamics suggests a tendency for euro area capital to flow towards the safer debt instruments of creditor countries in the presence of equity bear markets, and to riskier debtor countries when equity markets are bullish. The presence of a common safe asset in the euro area capable of absorbing capital flows when risk perceptions shift could arguably introduce a stabilising element to euro area financial flows.⁽⁵⁸⁾

⁽⁵⁷⁾ H. Rey, H. Shin, E. Cerutti, S. Claessens and L. Ratnovski, L. (2017), 'Global liquidity and cross-border bank flows', *Economic Policy*, Vol. 32, Issue 89, pp. 81-125.

⁽⁵⁸⁾ For a listing of the different proposals for a common euro area safe asset see, e.g., M. Buti, G. Giudice, J. Leandro (2018),

II.5. Financial cycle and macroeconomic developments in the euro area

The relation between macroeconomic and financial developments in general, and business and financial cycles in particular, has elicited lively discussions in academic and policy circles in recent years. The finding that the financial cycle is longer, has led to the interpretation that financial and business cycles are inherently different phenomena and that the financial cycle can be an autonomous driver of the business cycle.⁽⁵⁹⁾ However, this view has also been challenged more recently, with arguments stressing that the strong medium-term co-movement of financial variables and output point to potential common drivers of both.⁽⁶⁰⁾

This sub-section provides some evidence on the macroeconomic impact of the financial cycle in the euro area using a panel Bayesian Vector Autoregression (BVAR) model.⁽⁶¹⁾ The model allows for the tracking of the effects of financial cycle dynamics (measured as a common component of credit to households, credit to non-financial corporations and real house prices) on economic sentiment, perceived uncertainty, the business cycle (i.e., the cyclical component of real GDP), inflation and short-term interest rates in the euro area.⁽⁶²⁾

Graph II.11 presents how the macroeconomy of the euro area responds to an upward shock to the financial cycle (upper left-hand figure). Such a shock can be thought of as an (unexpected) expansion in credit and housing prices. The graph suggests that such financial expansion affects both subjective indicators (sentiment, uncertainty) and key macroeconomic variables (output, inflation,

interest rates). Importantly, while the expansion in credit and housing prices has an expansionary effect on the economy in the short-term, it is followed by correction and negative impacts on economic activity in the longer term.⁽⁶³⁾

The detailed results in Graph II.11 show that the financial expansion quickly improves economic sentiment and expands output. However, the positive impact of economic activity is only temporary and after around three years the output is corrected downwards. At that time, economic sentiment is already on a declining path and economic agents' perceptions of uncertainty is increasing, possibly anticipating a downturn in the business cycle. Moreover, the initial increase in output is followed by a pick-up in inflation, and corresponding monetary tightening (higher short-term interest rates), which all have further dampening effects on output. All in all, the financial cycle seems to reinforce the cyclical fluctuation of output both in its expansionary and contractionary phases. Importantly, the contractionary phase is relatively long, as the output gap remains negative for several years.

Further analysis of the panel BVAR suggests that the impact of the financial cycle on the business cycle is stronger than the reverse.⁽⁶⁴⁾ Interestingly, when the financial cycle includes equity prices (in addition to credit and real housing prices, see Graph II.2), the impact of the financial cycle on the business cycles is stronger, while the impact of the business cycle on the financial cycle weakens. These findings are corroborated by studies for the US.⁽⁶⁵⁾

'Deepening EMU requires a coherent and well-sequenced package', VoxEU.org (25 April).

⁽⁵⁹⁾ Drehman et al. (2012), op. cit.

⁽⁶⁰⁾ ECB (2018), 'Real and Financial Cycles in EU countries: Stylized facts and modelling implications', *ECB Occasional paper*, No. 205.

⁽⁶¹⁾ The data availability allows including 14 euro area countries (BE, DE, EE, EL, ES, FI, FR, IT, LT, LU, LV, NL, PT, SI).

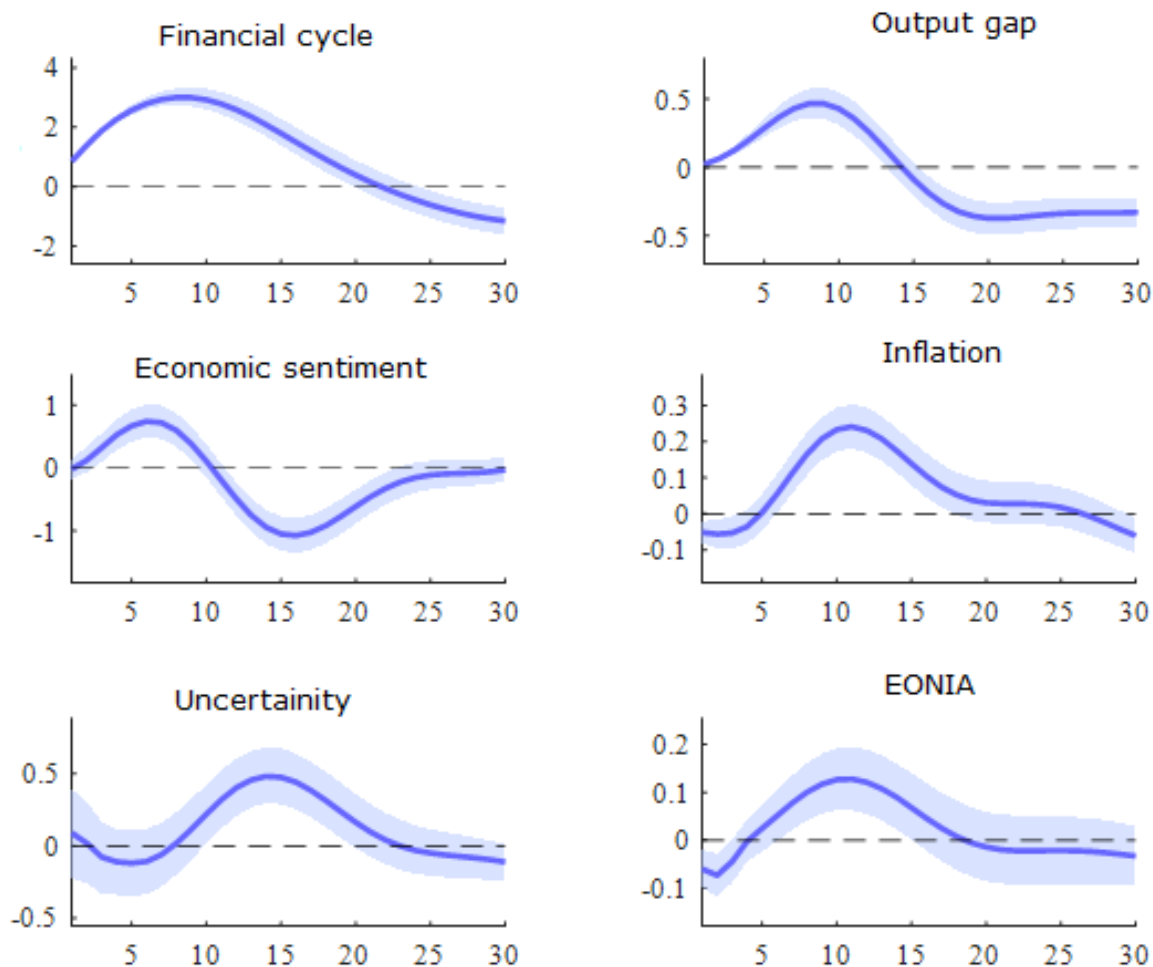
⁽⁶²⁾ The model setting is largely as in Vašíček, B. (2017), 'Impact of uncertainty shocks in the euro area', *Quarterly Report on the Euro Area*, Vol. 16, No 3, pp. 25-40. Specifically, the BVAR model is estimated on quarterly data for 1996-2016. The model includes 6 variables (all of them stationary) in the following order: financial cycle (3 vars), the economic sentiment indicators (ESI), the uncertainty measure derived from the European Commission's business and consumer surveys (BCS) (for more details see Vašíček, 2017, op.cit.), output gap (GDP detrended by the band-pass filter), year on year change in HICP and short-term interest rate (EONIA). The macroeconomic data come from Eurostat and ECB, and the ESI and the uncertainty measure come from the European Commission. The model is estimated with four lags.

⁽⁶³⁾ A pooled estimator is used and the reported impulse-response functions rely on the Cholesky factorisation. While the ordering of output, inflation and short-term interest rate is in standard monetary VARs, the additional variables are ordered first. However, alternative ordering delivers almost identical results. Specifically, the impact of financial cycle on the business cycle does not change when the latter is ordered first, nor if the other variables are excluded.

⁽⁶⁴⁾ This is indicated by the forecast error variance decomposition and the result holds when business cycle is ordered in the VAR first.

⁽⁶⁵⁾ Menden and Proaño (2017), op. cit. report similar findings for the US. Specifically, they confirm bi-directional causality between financial and business cycle but they also show that the financial cycle improves the GDP forecast and is useful in predicting recessions.

Graph II.11: **Impact of financial cycle on macroeconomic developments, panel of selected euro area countries**



(1) The graph represents the estimated impulse response of 6 variables included in the panel BVAR model (financial cycle, the economic sentiment indicator (ESI), an uncertainty measure derived from the BCS, a short term interest rate (EONIA), year-on-year change in HICP and the output gap) following a one standard deviation shock to the financial cycle (first variable in the model). The panel BVAR model is estimated for 14 euro area countries (BE, DE, EE, EL, ES, FI, FR, IT, LT, LU, LV, NL, PT, SI). The horizontal axis represents quarters. The vertical axis represents percentage points.

Source: Authors' calculations.

II.6. Financial cycle and macroprudential policy

Given the importance of financial cycles for the economy, prudential policies can be seen as a third pillar of the economic policy framework, complementing monetary and fiscal policies. While microprudential policy aims at safeguarding the stability of individual financial institutions by addressing their credit, market, and liquidity risks; macroprudential policy intends to safeguard the stability of the whole financial system by addressing excessive credit, maturity mismatches and contagion within the financial system. Macroprudential policy aims at limiting systemic risk through the use of primarily prudential tools. It has a 'cross-sectional' or 'structural' dimension

(targeted at the vulnerabilities related to interconnectedness at a given point in time) and a 'time' or 'cyclical' dimension (targeted at vulnerabilities related to the build-up of risks over time).⁽⁶⁶⁾ The analysis in the previous sub-sections suggests that it may be useful to consider a broad scope for prudential policies, encompassing not only the banking sector, but the wider financial system.

The European Systemic Risk Board (ESRB) was established in December 2010 and is responsible

⁽⁶⁶⁾ Detken et al. (2014), 'Operationalising the countercyclical capital buffer: indicator selection, threshold identification and calibration option', ESRB Occasional Paper No 5.

for macroprudential oversight of the financial system in the EU. The ESRB is set up as a coordination platform and information hub, which monitors risk from an EU-wide perspective across all sectors, and sets guidance on the use of macroprudential instruments. ⁽⁶⁷⁾

Macroprudential policy uses a variety of tools, ranging from capital and liquidity requirements to borrower-based and housing-related tools (for example limits on loan-to-value ratios or debt-to-income ratios). ⁽⁶⁸⁾ Given that some macroprudential policy instruments have only been added to the policy toolset – or more widely applied – in recent years, there is still limited evidence on their effectiveness and transmission channels. ⁽⁶⁹⁾ Recent studies have found that borrower-based measures have a relatively significant effect on the demand for credit and, in turn, on consumption and investment. Capital-based measures can exert their effect on the supply of credit. Some evidence also suggests that the use of macroprudential tools may have a positive effect on long-term economic performance, but also that this effect depends on the development level and openness of the economy. ⁽⁷⁰⁾ The limited evidence available for euro area countries suggests that instruments affecting the cost of bank capital are able to slow down credit growth and could reinforce the effects of monetary policy tightening. Loan-to-value ratios are also able to slow down housing booms, especially when monetary policy is loose. ⁽⁷¹⁾ A crucial issue for macroprudential policy is identifying the nature of ‘excessive’ credit growth in real time. The evidence suggests that credit booms accompanied by rapidly increasing

housing prices and loan-to-deposit ratios typically precede systemic banking crises. ⁽⁷²⁾

The nexus between macroprudential and other policies, notably monetary policy, has been extensively discussed in recent years, given the emergence of macroprudential policy making as a new policy area and its complementary nature with monetary and other regulatory policies. While each policy pursues different objectives (e.g., price stability versus financial stability) and uses different instruments, they complement each other as they both affect monetary and credit conditions in the economy. Their interaction and coordination faces particular challenges in a financially-integrated euro area where a single monetary policy is coupled with largely decentralised and only partly integrated macroprudential and regulatory policies.

Recent evidence suggests that macroprudential policies can have cross-border spillover effects, especially for countries with strong trade and financial linkages. ⁽⁷³⁾ In particular, empirical evidence for the euro area confirms the existence of cross-border effects for some macroprudential instruments (loan-to-value ratios and sector-specific capital buffers) but also that the sign and magnitude of the spillovers depend on factors such as bank ownership structures and country characteristics. ⁽⁷⁴⁾ Finally, stylised macrofinancial models of currency unions suggest that macroprudential tools (specifically, loan-to-value ratios) applied at Member State level can be used as a stabilisation tool and to prevent the emergence of imbalances among members of a monetary union. ⁽⁷⁵⁾ There is, furthermore, evidence that macroprudential policies have positive spillover effects across the currency union, which strengthens the case for macroprudential policy coordination. ⁽⁷⁶⁾

⁽⁶⁷⁾ ESRB (2018), ‘A review of macroprudential policy in the EU in 2017’. ESRB (2017), ‘A review of macroprudential policy in the EU in 2016’. ESRB (2016), ‘A review of macroprudential policy in the EU in 2015’.

⁽⁶⁸⁾ ESRB (2014), ‘ESRB Handbook on Operationalising Macroprudential Policy in the Banking Sector’. Other instruments, like exchange-rate based tools are more common in emerging economies.

⁽⁶⁹⁾ Behn, Gross, Peltonen (2016), ‘Assessing the costs and benefits of capital-based macroprudential policy’, ESRB WP No 17, July.

⁽⁷⁰⁾ See for example: Akinci, O. and J. Olmstead-Rumsey (2018), ‘How effective are macroprudential policies? An empirical investigation’, *Journal of Financial Intermediation*, Vol. 33, pp. 33-57; Boar, C., L. Gambacorta, G. Lombardo and L. Pereira da Silva (2017), ‘What are the effects of macroprudential policies on macroeconomic performance?’, *BIS Quarterly Review*, Cerutti et al. (2017), op. cit.

⁽⁷¹⁾ Zhang, Y. and T. Tressel (2017), ‘Effectiveness and channels of macroprudential policies: lessons from the euro area’, *Journal of Financial Regulation and Compliance*, Vol. 25, Issue 3, pp. 271-306.

⁽⁷²⁾ Richter, B., M. Schularick and P. Wachtel (2017), ‘When to Lean Against the Wind’, *CEPR Discussion Papers*, No. 12188.

⁽⁷³⁾ Kang, M.H., F. Vitek, M.R. Bhattacharya, M.P. Jeasakul, M.S. Muñoz, N. Wang and R. Zandvakil (2017), ‘Macroprudential Policy Spillovers: A Quantitative Analysis’, *IMF Working Paper*, No. 17/170.

⁽⁷⁴⁾ Noccioia, L. and D. Żochowski (2016), ‘Cross-border spillovers from macroprudential policy in the euro area’, *BIS Papers*, No. 86g.

⁽⁷⁵⁾ Brzoza-Brzezina, M., M. Kolasa and K. Makarski (2015), ‘Macroprudential policy and imbalances in the euro area’, *Journal of International Money and Finance*, Vol. 51, pp. 137-154.

⁽⁷⁶⁾ Rubio, M and J.A. Carrasco-Gallego (2016), ‘Coordinating macroprudential policies within the Euro area: The case of Spain’, *Economic Modelling*, Vol. 59, pp. 570-582..

II.7. Conclusions

There has been growing evidence of the interlinkages between financial and macroeconomic developments. Historical evidence suggests that credit booms are often followed by financial crises and major economic downturns.⁽⁷⁷⁾ The period before the global financial crisis of 2008 was characterised by confidence effects, including expectations on asset returns, and an increase in international capital flows, which resulted in a ‘credit supply’ shock in some euro area Member States.⁽⁷⁸⁾ This was followed in the crisis period by sudden reversals as confidence waned, liquidity became an issue, and risk aversion set in.

This section illustrates that the financial cycle in the euro area countries can be captured by cyclical co-movements of credit and housing prices, and seems to be led by the evolution of equities. For most Member States, there is also a close link between their domestic financial and business cycles. The existence of genuine euro area-wide financial and business cycles hinges on the synchronisation of national cycles. This synchronisation is apparent for both types of cycles but it is stronger for business than for financial cycles. The asymmetries of financial cycles across the Member States seem to be driven, by factors including different perspectives on potential asset returns and intra-euro area financial flows. These asymmetries can be seen as positive because they allow cross-border risk sharing, but they need to be paired with a robust and integrated supervisory, regulatory, and budgetary framework at the euro area and EU level, as otherwise they may amplify economic fluctuations and drive cyclical divergence across the Member States.

The recognition of the nexus between financial and business cycles has broad policy implications. First, to understand the cyclical position of the economy, one may need to consider both macroeconomic and financial developments.⁽⁷⁹⁾ Consequently, some have argued that the weak economic dynamics of recent years, notably in the euro area, may reflect the temporal impact of the financial

cycle rather than permanently weakened aggregate demand.⁽⁸⁰⁾ On the contrary, the current robust and broad-based economic expansion seems to get very little push from the financial developments as the credit and, in most Member States also the house price dynamics are rather moderate. Second, an increase in cross-border flows and a disconnect between net and gross financial flows calls for detailed surveillance of the latter. Indeed, a domestic credit boom financed from abroad can arise even if the net capital flows (and current account) remain stable. Capital inflows intermediated by the cross-border banking system are prone to reversal. This may call for macroprudential tools that are able to support equity and FDI capital inflows that are more resistant to negative shocks⁽⁸¹⁾, whilst also reducing the divergence of financial cycles across Member States.

Recent governance changes and proposals for the euro area are altering the way financial developments interact with the macroeconomy but also the financial cycles of the Member States themselves. The EU financial regulatory framework, notably the Capital Requirement Directive / Capital Requirement Regulation, the Single Supervisory Mechanism and the European Systemic Risk Board, sets up a co-ordination mechanism among national and EU-level authorities involved in macroprudential policy-making. The Banking Union package aims to de-link national banking-sector risks from sovereign risks and may in turn reduce the destabilising impact of capital flows. However, some asymmetry of financial cycles will always be inevitable and thus cross-border private risk sharing mechanisms are needed. The Capital Markets Union package aims to increase private risk sharing but also deals with asymmetries of financial integration within the euro area, where interbank markets are much more integrated than stock markets, sovereign bond markets, or retail lending.⁽⁸²⁾

⁽⁷⁷⁾ Gourinchas, P.O. and M. Obstfeld (2012), 'Stories of the Twentieth Century for the Twenty-First', *American Economic Journal: Macroeconomics*, No. 4, pp. 226-265.

⁽⁷⁸⁾ Lane, P.R. (2013), 'Capital flows in the Eurozone', *European Economy Economic Paper*, No. 497.

⁽⁷⁹⁾ Borio, C., P. Disyatat and M. Juselius (2016), 'Rethinking potential output: Embedding information about the financial cycle', *Oxford Economic Papers*, Vol. 69, Issue 3, pp. 655-677.

⁽⁸⁰⁾ This counterargument against the secular stagnation hypothesis, i.e. the claim that aggregated demand is permanently weakened due to a decline in productivity growth and changes in saving behaviour, was put forth by Borio, C. 'Secular stagnation or financial cycle drag?', *Business Economics*, Vol. 52, Issue 2, pp. 87-98.

⁽⁸¹⁾ Broner, F, T. Didier, A. Erce and S. Schmukler (2013), 'Gross capital flows: Dynamics and crises', *Journal of Monetary Economics*, Vol. 60, pp. 113-33.

⁽⁸²⁾ ECB (2017), 'Economic Bulletin', Issue 1/2017.

III. Digitalisation of the euro area economy and impact on resilience

This section examines how the ongoing digital revolution affects markets functioning and macro-economic outcomes, in particular the capacity of euro area Member States to withstand shocks. In product markets, the digital revolution is expected to strengthen cross-border production and trade, increase the share of tradable services in total output as well as to lower administrative burdens and capital costs of starting and operating a business. Nevertheless, increased knowledge flows from technologically advanced economies to developing economies may change existing comparative advantages, thereby potentially adversely affecting Member States' economic resilience if they are not accompanied by adequate structural reforms and investments. In labour markets, the digital revolution is expected to have an impact on employment composition, work organisation, wage setting and contract types. While these labour market developments may improve economic resilience, increased labour market polarisation, skills mismatch and a higher structural unemployment are important risks triggered by the skills-biased nature of digital technologies. In financial markets, digital payment systems and FinTech credit are likely to strengthen the capacity to withstand shocks as they broaden funding sources. The increased role of data and technology in the financial sector value chain and product mix also puts new requirements on regulators and supervisors that will need skills and expertise in this field if they are to implement their mandates effectively, supporting the opportunities emerging from digitalisation, while mitigating risks that may occur.

Given the potentially ambiguous impact of digitalisation, policies are needed to ensure that product, labour and financial markets function smoothly and efficiently and that Member States have the capacity to withstand macroeconomic shocks in an increasingly digital economy. It is also essential to promote wide-reaching innovation and investment. For the euro area, different rates of transition to the digital economy could prove a significant risk to convergence and macroeconomic stability. Due care is needed to ensure that the uneven distribution of the legacy of the crisis across the euro area does not hinder the smooth transition, as factors such as high indebtedness could limit Member States' capacity to adjust and innovate. ⁽⁸³⁾

III.1. Introduction

This section explores how the different dimensions of the ongoing digital revolution ⁽⁸⁴⁾ could impact euro area Member States' economies, including their growth potential and their capacity to convergence and withstand shocks. ⁽⁸⁵⁾ This analysis is based on a literature review rather than a rigorous analysis using, for instance, a dynamic general equilibrium model.

Digital technologies affect all dimensions of economic activity, not only in their specific new sectors, but also as they impact most existing activities, given their nature as general purpose technologies. However, understanding their net impact on growth and economic resilience is not straightforward. For instance, the main question remains unanswered whether digital technology will be able to foster a major revival in productivity growth. Even so, while digitalisation could lead to an increase in the demand for high quality jobs on the one hand, on the other, they can also create or strengthen monopoly power and impact income distribution and job opportunities, especially for the low-skilled.

For Member States in a currency union the potentially asymmetric nature of these effects risks being amplified, especially in the absence of adequate shock absorption tools, as these countries have fewer adjustment channels. This challenge is particularly significant as the ongoing transition towards the digital economy starts in a context where initial conditions in terms of digital

⁽⁸³⁾ This section was prepared by Raffaele Fagnoli and Eric Meyermans. The authors wish to thank Peter Kerstens, Werner Roeger and Lucia Vergano for useful comments.

⁽⁸⁴⁾ In this section "ongoing digital revolution" refers to the process whereby a broad range of socio-economic activities are being digitalised. Digitalisation should be distinguished from digitisation, with the latter referring to conversion of analogue information streams into digital bits, while the former refers to the way socio-economic interactions are restructured around digital communication and media infrastructures.

⁽⁸⁵⁾ 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. See, for instance, European Commission (2017), 'Economic resilience in EMU. Thematic discussions on growth and jobs. Note for the Eurogroup', September 2017.

infrastructure and skills vary strongly across euro area countries.

This section starts by briefly describing the key characteristics of the ongoing digital revolution that are relevant for this analysis. Sub-section 3 highlights relevant differences across the euro area Member States in the use and development of new digital technologies, and the challenges these may create for lagging countries to catch-up with the leaders and for the latter to be able to stay on the frontier of global innovation.

Sub-section 4 examines how the digital revolution affects product markets, in particular in terms of transformation of existing comparative advantages, location of production and international competition, thereby creating both new opportunities and challenges for economic resilience and potential growth. Special attention is paid to ongoing developments in global value chains (GVCs) and e-commerce.

Sub-section 5 explores the effects of the digital revolution on labour markets' notably on the composition of employment, wage setting and contract types as well as on total employment which is mainly driven by income and substitution effects.

Sub-section 6 briefly examines the consequences of technology-enabled innovation in financial services (i.e. FinTechs) on the financial sector. Here the focus is on digital payment systems, FinTech credit and virtual currency schemes. While FinTech firms are still facing national barriers to scale up services across the Single Financial Market they have a strong potential to strengthen Member States' economic resilience but also may pose new systemic risks. The last sub-section draws some policy conclusions, while recognising that there are still significant unknowns in this area.

Digitalisation also has a significant impact on public finance as the ongoing digital revolution erodes traditional corporate revenue sources. In turn, further digitalisation increases the opportunities to exploit the disconnection between where value is created and where taxes are paid. This affects tax revenues, with the effects unevenly distributed within and beyond borders. ⁽⁸⁶⁾

⁽⁸⁶⁾ Such loss of public revenue may occur when, for instance, digital companies operating in Europe have little or no physical presence

However, the analysis of fiscal transmission mechanisms falls beyond the scope of this section. ⁽⁸⁷⁾

Furthermore, secure network and information systems are essential to keep the online economy running. ⁽⁸⁸⁾ However, in a stronger digitally-connected economy, activities may become even more subject to cyber-risks making it more pressing to implement without further delay measures to mitigate such risks. ⁽⁸⁹⁾ Putting in place strong prevention detection, containment, recovery and repair mechanisms will help maximise benefits of digitalisation and minimise the risks from cyber-attacks. Nevertheless, an in-depth analysis of the impact of cyber-risks on economic resilience falls beyond the scope of this section. ⁽⁹⁰⁾

The macro-economic developments considered involve 'unknown-unknowns' making the subsequent analysis incomplete and potentially subject to major revisions if new information becomes available.

III.2. The ongoing digital revolution: from automation to artificial intelligence

The analysis in this section starts from the recognition that information and communication technology is a general purpose technology, therefore impacting the economy and society through multiple channels. ⁽⁹¹⁾ So far, the impact of

in Europe, or when new forms of work in the on-demand economy are subject to lower effective social security contributions. See also OECD (2015), Addressing the Tax Challenges of the Digital Economy, Action 1 2015, Final Report.

⁽⁸⁷⁾ On 21 March 2018, the European Commission proposed new rules to ensure that digital business activities are taxed in a fair and growth-friendly way in the EU. Two distinct legislative proposals were made aimed at i) reforming corporate tax rules so that profits are registered and taxed where businesses have significant interaction with users through digital channels and ii) introducing an interim tax which covers the main digital activities for which the mismatch between the place of taxation and value creation is the starkest (until the comprehensive reform has been implemented).

⁽⁸⁸⁾ See, for instance, High Level Group of Scientific Advisors (2017), 'Cybersecurity in the European Digital Single Market', Scientific Opinion 02, available at https://ec.europa.eu/research/sam/pdf/sam_cybersecurity_report.pdf

⁽⁸⁹⁾ As has been taken into consideration in the European, Commission's Digital Market Strategy and its FinTech Acton Plan.

⁽⁹⁰⁾ See, for instance, High Level Group of Scientific Advisors (2017), op cit.

⁽⁹¹⁾ Generic features of a general purpose technology are that it can be used in a broad range of applications, that it has a wide scope for improvement and elaboration, and that it shows a strong complementarity with existing or potential new technologies. See, for instance, David, P. and G. Wright (2003), 'General Purpose

the digital revolution has come in two waves.⁽⁹²⁾ At its onset in the mid-1980s, the digital revolution was mainly characterised by automation of tasks that could be codified and by the physical fragmentation of the different stages of the production process such as in the case of global value chains.

In recent years, the digital revolution has entered a second wave, driven by a wide range of potentially disruptive technologies. Most of these are directly enabled by digital technologies or their development is driven by innovations in fields such as the low-carbon and circular economy⁽⁹³⁾ and key enabling technologies (KETs).⁽⁹⁴⁾

Building on digital innovations unleashed by the first wave, the second wave seems characterised by more pervasive and accelerated innovation trends which have the potential to further affect the economy by reshaping markets, production, business models, work organisation and public administration.

The digital revolution considered in this section is based on many innovations, which significantly differ in terms of stage of development, timeframe for widespread adoption, and their possible transmission channels on economics and social aspects. Even the understanding of their scope and potential impact is currently very diverse.

The overall impact of these technologies on the economy depends on their combination and interactions. Against this background, classifying the emerging technologies according to the sector of application, economic impact or technological features is not straightforward, and even the concept of a 'single' ongoing digital revolution is open to question. McAfee and Brynjolfsson (2017) have recently proposed a classification based on

the identification of three major ongoing 'revolutions', i.e. machine learning, digital platforms and crowd-sourced collaboration.⁽⁹⁵⁾

Machine learning embodies big data⁽⁹⁶⁾ and smart algorithms⁽⁹⁷⁾ in combination with strong computational power allowing for statistical pattern recognition which in turn enable computers to perform complex non-routine tasks. Examples of machine learning include language recognition and medical applications, as well as applications to hire workers or forecast demand for a particular service.⁽⁹⁸⁾

Digital platforms bring together buyer and seller who do not know each other before entering the platform.⁽⁹⁹⁾ They generate, accumulate and control an enormous amount of data that might constitute important inputs for other actors.

Crowd-sourced collaboration facilitated by digital platforms allows a single entity to engage resources spread across the world. For example, crowd funding is a way of financing businesses or any other activity from a variety of sources via digital platforms.⁽¹⁰⁰⁾

III.3. Differences across Member States, within a still fragmented Digital Single Market

Several factors continue to generate differences across the euro area Member States in terms of

Technologies and Surges in Productivity: Historical Reflections on the Future of the ICT Revolution', in David, P and M. Thomas (Eds., 2003), *Economic Future in Historical Perspective*, Oxford University Press.

⁽⁹²⁾ See, for instance, McAfee, A. and E. Brynjolfsson (2017), *Machine, Platform, Crowd: Harnessing Our Digital Future*, W.W. Norton & Company

⁽⁹³⁾ Including the circular economy, clean energy and low carbon economy initiatives underpinned by digitalisation like digital road solutions supporting the move towards zero emission mobility.

⁽⁹⁴⁾ KETs cover micro-/nano-electronics, nanotechnology, photonics, advanced materials, industrial biotechnology and advanced manufacturing technologies such as bio-based products, smart vehicles, sustainable construction and smart grids. See for instance http://ec.europa.eu/growth/industry/policy/key-enabling-technologies_en

⁽⁹⁵⁾ McAfee, A. and E. Brynjolfsson (2017), op cit.

⁽⁹⁶⁾ While no universal agreed definition exists, "big data" can be understood as "large routinely or automatically collected datasets, which are electronically captured and stored. It is reusable in the sense of multipurpose data and comprises the fusion and connection of existing databases for the purpose of improving performance." See, Gesundheit Österreich Forschungs- und Planungs GmbH (2016), 'Study on Big Data in Public Health, Telemedicine and Healthcare', Final Report

⁽⁹⁷⁾ In the absence of an explicit knowledge of the rules that govern tasks, smart algorithms allow to infer the tasks to be carried. For more details on such algorithms, see, for instance, Domingos, P. (2016), *The Master Algorithm : How the Quest for the Ultimate Learning Machine Will Remake Our World*, Ingram Publisher Services.

⁽⁹⁸⁾ See, for instance, The Economist, March 31 2018, Special Report on Artificial Intelligence in business.

⁽⁹⁹⁾ On two-sided digital platforms, which are the most common type of platforms, an intermediary brings together the two sides of a transaction whereby the volume of the transaction depends on the structure (and not only on the overall level) of the fees charged by the platform. See, for instance, Rochet, J and J. Tirole (2006), 'Two-Sided Markets: A Progress Report', *The RAND Journal of Economics*, Vol. 37, No. 3, pp. 645-667

⁽¹⁰⁰⁾ See, for instance, Yin X., Liu W., Wang Y., Yang C., Lu L. (2014), 'What? How? Where? A Survey of Crowdsourcing'. In: Li S., Jin Q., Jiang X., Park J. (eds), *Frontier and Future Development of Information Technology in Medicine and Education*, Springer.

their use and development of new digital technologies, and the speed at which they realise the full potential of the digital economy.⁽¹⁰¹⁾ Without being exhaustive, this section highlights briefly differences among euro area Member States in terms of digital performance, investment and other relevant macro-economic conditions, and how these affect key areas for the functioning of the Digital Single Market.

III.3.1. Digital performance divide

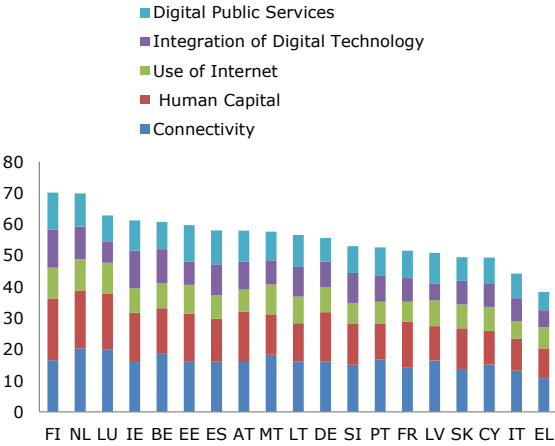
Graph III.1 shows the Digital Economy and Society Index (DESI) which covers Member States' performance in terms of the different dimensions of the digital economy.⁽¹⁰²⁾ The DESI indicator suggests that the variation across Member States is biggest in terms of human capital and integration of digital technology, while their ranking is comparable across other dimensions.

Further available evidence shows that R&D expenditures by the ICT sector continue to differ strongly across Member States in 2015 (Graph III.2). The highest levels (as percent of GDP) are recorded in Austria, Germany and Finland, and the lowest in Cyprus, Latvia and Lithuania.⁽¹⁰³⁾

III.3.2. Sluggish digital investment

To build the physical digital infrastructure, to produce new "intelligent" machines and to integrate new technologies in the production process significant and well-designed investment is needed.⁽¹⁰⁴⁾ However, aggregate data on investment do not seem to capture an increase in the rate of investment arising from the digitalisation process.⁽¹⁰⁵⁾

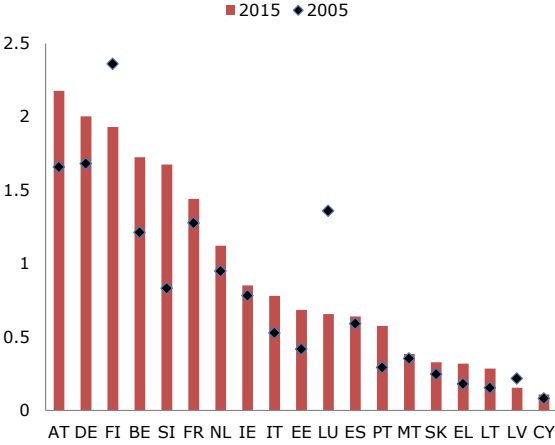
Graph III.1: The Digital Economy and Society Index (DESI) - 2018



(1) The Connectivity dimension measures the deployment of broadband infrastructure and its quality. The Human Capital dimension measures skills ranging from basic skills (that enable individuals to interact online and consume digital goods and services) to advanced skills (that empower the workforce to take advantage of technologies for enhanced productivity growth). The Use of Internet dimension measures the depth of online activities ranging from consumption of online content (music, games, etc.) to modern communication activities such as online banking. The Integration of Digital Technology dimension measures the digitisation of businesses. The Digital Public Services dimension measures the digitisation of public services.

Source: European Commission

Graph III.2: ICT sector's business expenditures on R&D (% of GDP)



Source: 2018 PREDICT Dataset.

Besides the sluggish cyclical investment recovery, the downward trend of business investment in non-residential assets across the euro area, experienced since early 2000, and the marginal increase in R&D investment (as a percent of GDP), which are the investments directly related to innovation, is at odds with the view that

⁽¹⁰¹⁾ In this section, 'digital economy' refers to the full range of our economic and social activities supported by the internet and related information and communication technologies.
⁽¹⁰²⁾ DESI is a composite indicator tracking the evolution of Member States' performance based on 30 indicators covering five dimensions: connectivity, human capital, use of internet, integration of digital technology and digital public services.
⁽¹⁰³⁾ The 2018 PREDICT dataset shows that in 2015, ICT sector's business expenditures on R&D was 3.3% of GDP in South Korea, followed by Japan (2.6%), Taiwan (2.4%) and US (2.0%).
⁽¹⁰⁴⁾ For instance, the Roland Berger Strategic Consultancy estimates that in order to become a leader in the Industry 4.0 revolution, Europe would need an average of additional 90 billion investment per year over the next 15 years.
⁽¹⁰⁵⁾ In 2017 total investment (as share of GDP) in the euro area was on average still about 0.8 percentage point below of the average level for the period 1995–2004 and well below the pre-crisis peak.

digitalisation could generate sizeable new investment.

However, recent research suggests that innovation does not only arise from investment in R&D activities but also from investment in intangible assets.⁽¹⁰⁶⁾ While tangible investments have suffered more from confidence and uncertainty shocks triggered by the financial and sovereign debt crisis, intangible assets have proved more resilient to cyclical conditions, maintaining their upward structural trend.⁽¹⁰⁷⁾

Although this type of investment could keep increasing in the future, their scalable nature and their strong potential for synergies and spill-overs suggest that intangible investment might not drive aggregate investment up since, as in the case of R&D investment, it is mainly only the leading firms that are enjoying a high rate of return on their intangible assets.⁽¹⁰⁸⁾

Indeed, investments in innovation are mostly concentrated in a small group of highly productive firms at the technological frontier while a large number of firms far from this frontier are trapped in a bad mix of low profits and low productivity and therefore are not willing or capable to invest more – as suggested by, for instance, Andrews et al. (2016).⁽¹⁰⁹⁾

Digital investment concentration could support the view that there is little scope for large investment opportunities in developed countries as digital innovation lacks the same revolutionary features of

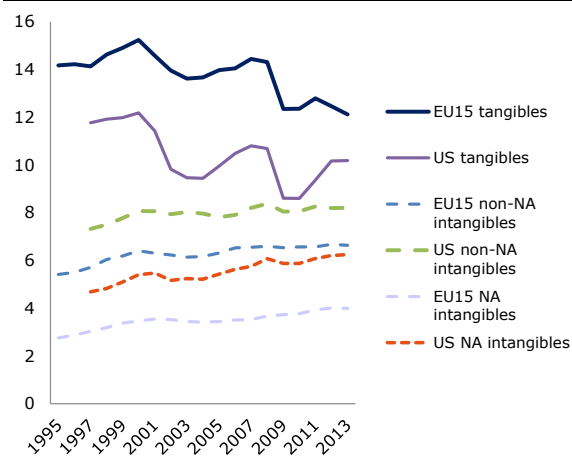
the old waves of technological innovation which gave raise to massive investment in physical capital in the last two centuries.⁽¹¹⁰⁾

Nevertheless, in the medium/long term, when digital technologies will be more mature and enjoy a much broader diffusion a higher rate of digital investment could follow as their adoption would be easier and profitable even for less advanced firms. Therefore, an increase of digital investment as well as its impact on the aggregate investment rate will depend on the speed of diffusion of digital technology in the coming years.

III.3.3. Other macro-economic factors

Other macroeconomic and structural differences may also affect the diffusion of digital technologies. For example, high public and private indebtedness levels, uncertainty over future regulation and economic outlook remain important factors that could hold back investments in digital technologies and their uptake. In turn, if protracted, the low investment levels could have an adverse feedback effect on the diffusion of digital technologies and hence on overall productivity growth and resilience.

Graph III.3: Investment in tangible and intangible assets, Eu 15 vs US



(1) Business sector non-residential GFCF by asset type, (% of business sector GVA).

Source: European commission, European Economy Discussion Paper No. 47.

Public finances may also have an impact on the diffusion of digital technologies. Indeed, while tax

⁽¹⁰⁶⁾ Corrado et al. divide intangibles investment into three broad categories: i) computerised information (software and database); ii) innovative property (scientific R&D, design, financial innovations) and iii) economic competencies (workforce training, improvements in organisational structures, marketing and branding. See Corrado, C A, J Haskel, C Jona-lasinio, and M Iommi (2016), “Intangible Investment in the EU and US Before and Since the Great Recession and Its Contribution to Productivity Growth”, *EIB Working Papers* 2016/08.

⁽¹⁰⁷⁾ Thum-Thysen A., et al. (2017) 'Unlocking Investment in Intangible Assets', *European Economy, Discussion Paper No.47*.

⁽¹⁰⁸⁾ Scalable means that firms can easily increase the return on their intangible without additional new investment. The synergies and spill-overs imply that, as in the case of R&D, most innovative firms benefit more from investment in intangibles than laggards. In addition, leaders might be most effective in assimilating knowledge from intangible investment undertaken by rivals, and in combining intangibles in a way that laggards cannot. For more details, see, for instance, Haskel, J, and S Westlake (2017), *Capitalism Without Capital The Rise of the Intangible Economy*, Princeton University Press.

⁽¹⁰⁹⁾ Andrews, D, Criscuolo, C and P Gal (2016), “Mind the Gap: Productivity Divergence between the Global Frontier and Laggard Firms”, *OECD Productivity Working Papers*.

⁽¹¹⁰⁾ See Cowen, T (2011), *The Great Stagnation: How America Ate All the Low-Hanging Fruit of Modern History, Got Sick, and Will (Eventually) Feel Better*, The Penguin Group.

revenues may suffer from the difficulties of taxing digital activities at the national level, public spending on areas such as education and lifelong learning, innovation, public digital infrastructures and cybersecurity are vital for reaping the full benefits of the digital economy. Hence, improving the overall composition of public finances would help to allow Member States to release more resources for investment in the digital economy. The creation of a fair taxation system that establishes a direct connection between the place where value is created and where taxes are paid and that reflects changes in working conditions could support the objective of securing sustainable public finances.

The demographic structure of a country could also hinder the integration of digital technologies into the production processes, if older workers have a lower propensity to acquire the skills necessary to meet the evolving needs of the labour market. ⁽¹¹¹⁾

Finally, regulations not directly related to the ICT sector, but with a direct impact on the functioning of markets may also act as a barrier to further digital development. For example, empirical research ⁽¹¹²⁾ suggests that overly strict employment protection legislation may deter firms from innovating in risky technologies and from investing in digital equipment (installing PCs, servers and extensions) because of higher costs in shedding workers if the project has to be closed down. ⁽¹¹³⁾

⁽¹¹¹⁾ Older employed persons may have a lower incidence of training for various reasons such as the period for amortisation of the investment in their skills is too short, because they are often perceived as being less adaptable, or because training contents and training forms are not in accordance with their training preferences such as training-on-the-job rather than participation in formal training courses. See, for instance, Thomas Zwick, T. (2015), 'Training older employees: what is effective?', *International Journal of Manpower*, Vol. 36, No. 2, pp.136-150.

⁽¹¹²⁾ See, for instance, DeStefano, T., De Backer, K. and L. Moussiégt (2017), 'Determinants of Digital Technology Use by Companies', *OECD Science, Technology and Innovation Policy Papers* No. 40 and Bartelsman, E., P. Gautier and J. de Wind (2016), 'Employment protection, technology choice, and worker allocation', *International Economic Review*, Vol. 57, No. 3, pp. 747-826.

⁽¹¹³⁾ Nevertheless, such effect may reduce in the future as cloud computing allows firms to access such infrastructure without making the initial costs. For the impact of product market regulation on ICT development, see, for instance, Conway, P., Janod, V. and G. Nicoletti (2006), 'Product Market Regulation in OECD Countries: 1998 to 2003', *OECD Economics Department Working Papers* No. 419.

III.4. Product markets: competition and information

From the first industrial revolution until the early-1990s, the volume of international trade between countries was to a large extent driven by the cost of transporting goods, while its composition reflected countries' comparative advantages. Innovations drove up productivity in developed industrialised economies which consolidated their comparative advantages in capital- and knowledge-intensive products. In this setting the slow and limited flow of knowledge favoured industrial concentration and specialisation across those euro area Member States which industrialised first.

Since the early 1990s, however, ICT innovations have contributed to dramatic changes in trade patterns by accelerating and broadening knowledge flows. In turn, falling communication and transport costs have led to a fragmentation and outsourcing of certain stages of the production process increasing the share of intra-industry trade in total trade better reflecting comparative advantages across countries and locations. Trade flows started to depend less on relative production costs of final goods and services but more on relative productions costs of intermediate goods along the value chain. ⁽¹¹⁴⁾

The ongoing digital revolution is expected to bring further changes in the organisation of production, such as more intense automation and data exchange in manufacturing and stronger service intensity.

These transformations have the potential to affect the existing comparative advantages of countries, including euro area Member States. The less innovative are more vulnerable to changes in international trade flows due to the risk of being cut out from the reshaping of global value chains.

III.4.1. Industry 4.0 and global value chains

Assessing the impact of the ongoing digital revolution on global value chains is not straightforward as it depends on two contrasting factors, i.e. fragmentation and centralisation of the production process.

⁽¹¹⁴⁾ The same factors triggered the development of regional value chains across EU Member States, in particular between old and new euro area Member States.

The convergence of the different technologies underlying the Industry 4.0 revolution⁽¹¹⁵⁾, could make complex and fragmented global value chains more efficient by reducing coordination costs. For example digital technologies allow smart factories to manage more efficiently complex logistic, distribution and production networks, including by widening offshoring opportunities.⁽¹¹⁶⁾

However, global value chains will continue to face other significant costs associated with production fragmentation. Such costs include long lead-time, low flexibility, instability in supply chains, unsatisfactory quality standards of foreign suppliers, cultural differences and communication problems.

In the future, these costs could exceed the benefits of fragmentation which in turn may decrease as emerging technologies, such as machine learning and robotics have the potential to replace or at least bundle together tasks that today are performed by low/medium skilled workers and outsourced across the global value chain. This would lower labour input costs and reduce the gains of locating labour-intensive stages of the production process in low-wage countries, potentially being a driver for significant reshoring.⁽¹¹⁷⁾

In addition, the application of technologies such as the developments of 3D printing could also further reduce production costs and favour small scale fragmented 'microproductions'. Moreover, as the use of 3D printers for certain manufactured goods increases the scope for tailoring the product according to customer preferences, the production of these goods is also likely to move closer to customer markets. This would then provide strong incentives for euro area firms to keep or move back production close to European markets, favouring the expansion of local value chains.⁽¹¹⁸⁾

These developments could favour those Member States already integrated in EU regional value chains, in particular those with relative comparative advantages in knowledge intensive stages of production would likely benefit from such reshoring. At the same time, the growing importance of customer market access and the relatively low factor price differential across euro area Member States could also lead to some concentration of manufacturing activities in fewer regions.⁽¹¹⁹⁾

III.4.2. An increasing share of tradable services

The new ways in which services are produced, distributed and consumed due to the digital revolution is likely to result in a higher share of tradable services in the economy and also impact economic resilience and potential growth, as the following examples illustrate.

New digital technologies tend to further increase the share of the pre- (such as design, R&D, finance, organisation) and post- (such as marketing, post-sales) production services in a product's value added, which blurs the distinction between manufacturing and service operations in the production process. They also open the way to a new form of fragmentation, this time in the service activities of the production process, for instance by means of digital devices such as 'telerobotics' and 'telepresence'.⁽¹²⁰⁾

At the same time, new digital technologies tend to strengthen the ongoing ICT-driven process of knowledge flows from technologically-advanced economies to developing economies that have the necessary network infrastructures and human capital needed for technology adoption.⁽¹²¹⁾ On balance, these ongoing developments exert additional pressure on those euro area Member States which had their comparative advantages in

⁽¹¹⁵⁾ The concept of Industry 4.0 also referred as smart factories or digital industry is about changes in the production process and along the value chain arising from the adoption of different technologies such as cloud computing, internet of things, artificial intelligence, robotics, big data, 3D printing.

⁽¹¹⁶⁾ Christopher, M and M. Holweg (2011) 'Supply Chain 2.0: Managing supply chains in the era of turbulence', *International Journal of Physical Distribution & Logistics Management*, Vol 41, No. 1.

⁽¹¹⁷⁾ Foerstl, K., Kirchoff, J.F. and L. Bals., (2016), 'Reshoring and insourcing: drivers and future research directions', *International Journal of Physical Distribution & Logistics Management*, Vol. 46, No 5.

⁽¹¹⁸⁾ Vyas, N. (2016), 'Disruptive technologies enabling supply chain evolution', *Supply Chain Management Review*, pp. 36-41.

⁽¹¹⁹⁾ As suggested by the New Economic Geography theory. See, for instance, Krugman P. and A. Venables (1990), 'Integration and the Competitiveness of Peripheral Industry', in C. Bliss and G. de Macedo (eds), *Unity with Diversity in the European Community*, Cambridge University Press/Centre for Economic Policy Research, pp. 56–75.

⁽¹²⁰⁾ Such devices allow labour services to be provided by workers without the need for their physical presence. See, for instance, Baldwin, R. (2016), *The Great Convergence: Information Technology and the New Globalization*, Harvard University Press.

⁽¹²¹⁾ Hallward-Driemeier M. and G. Nayyar (2018), 'Trouble in the Making? The Future of Manufacturing-Led Development', The World Bank Group.

the capital and knowledge intensive-stages of production.

Furthermore, digitalisation could also lead to an increase in cross-borders trading of previously non-tradable goods and services, such as certain types of business services, education and health care services. In turn, such developments create opportunities for euro area firms to diversify their sales markets. At the same time they may trigger productivity increases linked to the fact that firms open to international competitions are usually under a stronger pressure to innovate. Both these effects have a strong potential to strengthen the capacity of euro area Member States to absorb and recover from shocks.

Against this background, euro area countries with a more competitive and developed service sector seem better suited to benefit from the large increase in trade opportunities arising from higher tradability of services. While this would be a welcome development, it also runs the risk of strengthening the divergence with lagging euro area Member States.

III.4.3. The geographical location of digital services

New digital technologies that significantly lower fixed costs, such as cloud computing⁽¹²²⁾, and/or the marginal cost of producing and delivering digital products at global scale such as digital platforms, make it easier for small actors to start a "global" business.⁽¹²³⁾ In turn, the lower start-up costs and lower costs of operating a business, beyond increasing opportunities for SMEs, may strengthen an economy's capacity to recover when hit by an adverse shock. Nevertheless the magnitude of the shock can get bigger as small firms and 'start-ups' would be more at risk of exiting the market as they have weaker buffers to absorb shocks.

Several factors such as lower marginal costs in the provision of digital products, the increased share of digital services and strong knowledge flows, could give rise to a larger geographical dispersion of

⁽¹²²⁾ Others are, for example, increasing automatization of certain pre-market services such as consultation and marketing, easier access to financial resources through crowdfunding and venture capital,

⁽¹²³⁾ Lund S. and J.Mankyla (2016), 'How Digital Trade is Transforming Globalisation', McKinsey&C, E15 Expert Group of the Digital Economy, Think Piece.

economic activity. On the other hand, knowledge spillovers are likely to continue playing a key role - and possible even more - in attracting economic activities in highly innovative and concentrated regional clusters and cities. Indeed, smaller firms and individuals carrying out digital businesses and knowledge-intensive activities have stronger incentives to concentrate around regional innovative clusters with a view to benefitting from the innovations produced in the surrounding environment by larger enterprises and public research centres, but also to benefit from interactions with other innovative firms operating in adjacent parts of the value chain.

Overall, an increase in the share of value added concentrated into few innovative and more productive regional clusters and cities can be observed.⁽¹²⁴⁾ In turn, this could lead to larger regional inequalities within and between countries, which would make Member States more vulnerable to shocks, while hindering the convergence process of those Member States lagging behind in digital transformation.

III.4.4. E-commerce

One immediate and very visible aspect related to the impact of ICT technologies on the economy is the rise of e-commerce.⁽¹²⁵⁾

Available data shows that both the share of enterprises having an e-sales department and the turnover related to e-sales is increasing. While the share of turnover from e-sales remains still limited in the euro area⁽¹²⁶⁾, it has doubled from 3% to 6% between 2011 and 2017 (See Graph III.4). In most countries, the majority of e-sales transactions take place between companies.

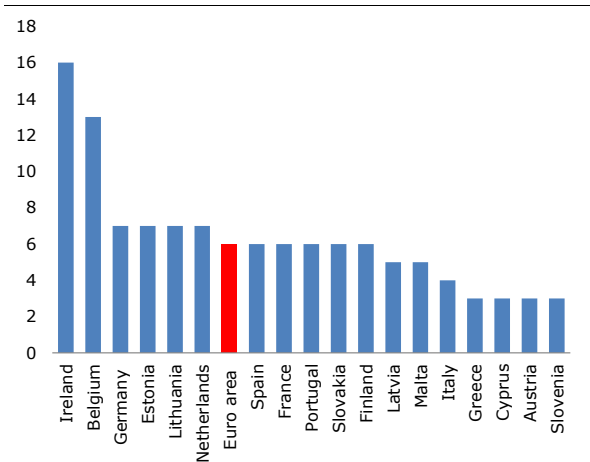
⁽¹²⁴⁾ See for instance Kolko, J (2010), "Urbanization, Agglomeration, and Coagglomeration of Service Industries", in Glaeser, E. L. (editor), *Agglomeration Economics*, The University of Chicago Press, pages 151-180.

⁽¹²⁵⁾ E-commerce can be defined as the sale or purchase of goods or services through electronic transactions conducted via the internet or other computer-mediated networks.

⁽¹²⁶⁾ Mainly due to barriers hindering the well-functioning of the Single Digital Market. A well-functioning Single Digital Market is built on trust between consumers and suppliers, affordable high-quality cross-border parcel delivery, absence of unjustified geo-blocking and limited VAT related burdens when selling across borders. See, for instance, European Commission (2015), 'A Digital Single Market Strategy for Europe', SWD (2015) 100 final; and European Commission (2017), 'A Connected Digital Single Market for All', SWD (2017) 155 final.

E-commerce can have a strong impact on the functioning of the market economy as it provides consumers easier access to a wider range of different products often sold at lower prices than in physical stores. Consumers and firms also profit from the business opportunities arising from the reduction of searching and in general of transaction costs, which allows them to explore markets without the constraint of geographical proximity. In turn, this may make demand for goods and services less vulnerable to idiosyncratic shocks.

Graph III.4: **Enterprises' turnover from web sales (% of total turnover)**



(1) Data for Luxembourg are not available.
Source: Eurostat, E-Commerce Statistics, Dec. 2017.

While the bulk of e-commerce still takes place through firms' own websites or applications, a growing share of transactions is likely to take place via digital platforms in the future, since this allows for further reductions of transactions costs compared to both traditional off-line commerce and on-line bilateral exchanges.

However, as the economy of digital platforms is based on network effects ⁽¹²⁷⁾, their developments could lead to market concentration and market dominance.

In certain sectors where production is concentrated in oligopolistic markets, the direct interaction between large on-line retailers and large producers can lead to a concentration of the producer surplus between these two agents. In addition, while online marketplaces theoretically expand market access

⁽¹²⁷⁾ Network effects imply that the larger the number of users on a platform, the larger the benefits it produces for all users, so that more users are attracted towards the platform.

opportunities for a large set of even small producers, they could also cause sales concentration across a fewer number of firms compared to what occurs with physical marketplaces as filtering criteria can lead to 'superstar effects'. ⁽¹²⁸⁾

As network effects generate positive externalities for users, stronger competition in the platform market would not necessarily be welfare enhancing, in particular for consumers, as this would reduce the network effects and the benefit they generate. ⁽¹²⁹⁾

Large firms and retailers seem to have benefitted most from e-commerce. ⁽¹³⁰⁾ However this may not necessarily be due to the nature of e-commerce per se, but to the more general abilities of large enterprises to profit from digital innovation, at least in a first phase. In this respects, countries where the share of large firms is bigger are in principle more fit to profit from e-commerce - at least in a transitional phase.

The overall macroeconomic impact of e-commerce remains ambiguous and difficult to assess at least in the short to medium run as the following examples illustrate.

⁽¹²⁸⁾ I.e. most popular products benefit from being in the top-ranking and keep attracting a larger share of buyers. However other authors argue that e-commerce, also favour long tail products - i.e. less popular products which attract a limited number of buyers because on-line marketplace can afford keeping such products on-sale while physical store cannot, due to space constraint. The final outcome of these two effects is somehow ambiguous, see, for instance, Brynjolfsson, E., Y. Hu, and M. Smith (2010), 'Long Tails Versus Superstars: The Effect of IT on Product Variety and Sales Concentration Patterns', *Information Systems Research*, Vol. 21, No. 4, pp. 736-747.

⁽¹²⁹⁾ See, for instance, Caillaud, B. and B. Jullien (2003), 'Chicken & egg: Competition about intermediation service providers', *Rand Journal of Economics*, Vol.3 4, No. 2, pp. 309-328. The emergence of the platform economy calls for a new competition policy approach looking at dynamic effects on innovation, market competition, long term consumer welfare, product variety, data portability. See, for instance, Coyle, D. (2018), 'Practical competition policy implications of digital platforms', Bennett Institute for Public Policy working paper no: 01/2018. Moreover, platforms operate under conditions of lively oligopolistic competition as the pace of technological progress has caused a relatively high birth and death rate of leading platforms in the last fifteen years. See for instance Evans P. and A. Gawer (2016), 'The rise of Platform Enterprises, A global survey', *The Emerging Platform Economy Series* No. 1, The Centre for Global Enterprise

⁽¹³⁰⁾ The share of large enterprises with e-sales department accounts is 44% while only 18% of small enterprises have e-sales department. This is also reflected in a larger share of turnover that large enterprises obtain from e-sales. Eurostat: E-commerce statistics December 2017.

First, while e-commerce may change the composition of consumption (e.g. more digital goods and services will be consumed), it also can foster an increase in total consumption, as it reduces trade and distribution costs, allowing all sectors and economic agents to benefit from lower retail prices. ⁽¹³¹⁾

Second, cross-sectorial shocks can materialise giving rise to temporary adjustment costs, which might lead to more persistent distributional effects. In fact, while there is evidence that traditional retailers also can profit from e-commerce opportunities by moving part of their business model on line, the sector could however be confronted with shrinking profit margins and, as a consequence, a number of existing retailers might be pulled out of the market. This may be reinforced by a shift of business opportunities from retailers to producers, as e-commerce lowers the barriers for the latter to operate on retail markets.

In this respect, Member States whose economic structures facilitate a swift reallocation of resources across sectors will be more resilient to absorb these shocks and avoid high transitional unemployment which could reduce on the positive aggregate impact of e-commerce on consumption.

Finally, e-commerce may also have a direct impact on reducing the costs associated with the changing of the prices of goods and service, i.e. so-called menu costs. ⁽¹³²⁾ Although these costs may be small, macroeconomic theory suggests that even small menu costs in an environment characterised by monopolistic competition may give rise to important business cycle fluctuations. ⁽¹³³⁾ As such, a further expansion of e-commerce could contribute to reducing business cycle fluctuations.

Nevertheless, available evidence ⁽¹³⁴⁾ seems to suggest that the impact of lower menu costs via e-commerce on business cycle fluctuations has been insignificant, so far.

III.4.5. Digitalisation, the price level and inflation

Digitalisation affects inflation in a direct way via its impact on the price of ICT goods and services that are part of the HICP basket. But this effect is small. For example, while prices for information processing equipment fell by more than 80% between 2001 and 2017 its weight in the HICP price index is only 0.5%. Furthermore, digitalisation also may pose important challenges for the measurement of inflation, as new goods and services are developed at an intensive pace, the quality of existing goods and services changes, and new types of product outlets emerge, as well as substitution effects from price changes. ⁽¹³⁵⁾

Digitalisation also affects the general price level in an indirect way. First, as e-commerce strengthens competition, the market power of sellers decreases. In addition, digital platforms also reduce transaction costs thereby creating additional room to lower prices. These effects induce a one-off decrease in prices – although as e-commerce is only gradually progressing, these decreases may be dragged out over time giving rise to lower inflation over that period. ⁽¹³⁶⁾

Nevertheless, in markets where sellers have strong market power, the information obtained about consumers (via, for instance, their browsing behaviour) can be used for price discrimination. Therefore, prices would not necessarily decrease. ⁽¹³⁷⁾ In addition, monopoly power on two-sided digital platforms may limit price flexibility if

⁽¹³¹⁾ See, for instance, Cardona M. et al. (2015), 'The Macro-economic impact of e-Commerce in the EU Digital Single Market', *European Commission JRC Technical Reports*.

⁽¹³²⁾ Nevertheless, Blinder (1991), 'Why are Prices Sticky? Preliminary Results from an Interview Study', *The American Economic Review*, Vol. 81, No. 2, pp.89-96 reports that "menu costs" is one of the factors that may trigger price stickiness, along with coordination failures (e.g. firms may be hesitant to be the first to change prices), service (e.g. the service provided such as delivering on time is also an important dimension of competitiveness) and contracts (e.g. firms' room for manoeuvre may be limited by implicit or explicit contracts).

⁽¹³³⁾ See, Mankiw, G. (1985), 'Small Menu Costs and Large Business Cycles: A Macroeconomic Model of Monopoly', *Quarterly Journal of Economics*, 100, pp. 529-537.

⁽¹³⁴⁾ See, for instance, Gorodnichenko, Y., Sheremirov, V. and O. Talavera (2015), 'Price setting in online markets: does IT click?', *Federal Reserve Bank of Boston Working Papers* 15-1.

⁽¹³⁵⁾ See, for instance, Hausman, J. (2003), 'Sources of Bias and Solutions to Bias in the Consumer Price Index', *Journal of Economic Perspectives*, Vol.17, No. 1, pp. 23–44

⁽¹³⁶⁾ Nevertheless, greater ease of price comparison online can already be a sufficient reason for brick-and-mortar retailers to speed up the lowering of their prices i.e., the so-called Amazon effect. See, for instance, Charbonneau et al. (2017), 'Digitalization and Inflation: A Review of the Literature', *Bank of Canada Staff Analytical Note* No. 2017-20.

⁽¹³⁷⁾ See, for instance, Shiller, B. (2014), 'First-Degree Price Discrimination Using Big Data', Department of Economics, Brandeis University.

intermediaries try to capture rents by raising fees for suppliers. ⁽¹³⁸⁾

The digital revolution may also foster stronger cross-border price convergence as it facilitates price arbitrage. ⁽¹³⁹⁾ In addition, global value chains expanding under the impulse of innovations in communication technology may make domestic inflation more responsive to developments in value chain partners. ⁽¹⁴⁰⁾

Digitalisation is also expected to increase productivity, which may lead to price decreases. If, in addition, the productivity gains are associated with employment losses (in the short- to medium turn), decreases in aggregate demand may put additional downward pressure on prices (in the short- to medium turn).

Finally, the effectiveness of monetary policy could also increase if monetary authorities get real time data at their disposal which may be facilitated by a more digital economy. ⁽¹⁴¹⁾ A more credible and effective monetary policy would help reduce the volatility of the economy and hence favour investment and growth.

III.5. Labour markets in the digital age

III.5.1. Employment composition and work organisation: automation and machine learning

Jobs are a coherent bundle of tasks which encompass routine tasks (that can be fully codified) ⁽¹⁴²⁾ as well as non-routine tasks requiring creativity, problem-solving and interpersonal skills. During the first wave of the digital revolution,

computers replaced mainly routine tasks while complementing non-routine tasks. ⁽¹⁴³⁾

Automation of routine tasks is expected to continue, and this is more likely to happen in specific areas. MGI (2017) ⁽¹⁴⁴⁾ estimate that about 5 percent of occupations can be fully automated with currently known technologies. ⁽¹⁴⁵⁾ Examining job profiles in 32 OECD countries, Nedelkoska and Quintini (2018) estimate that 14% of existing jobs have a probability of 70% or more to be automated. This includes primarily jobs requiring a low skill level such as food preparation assistants, assemblers and cleaners. As much as 32% of existing jobs, however, face a lower but still very high probability of automation of between 50 and 70%. This includes mainly jobs performing codifiable tasks in manufacturing such as machine operators and drivers. Instead, jobs requiring a high level of education, in combination with strong social interaction, creativity, problem-solving and personal care are estimated to have less than 30% chance of automation. This concerns about 26% of jobs. ⁽¹⁴⁶⁾

The expected employment impact of machine-algorithms that use big data to infer the tasks to be carried out is more ambiguous. On the one hand, they have the potential to replace non-routine tasks such as driving a car. On the other hand, they have the potential to complement knowledge workers such as the Internet of Things which may give rise to new forms of interaction between workers and machines.

At the same time, increased demand for knowledge workers may generate important local job-multiplier effects. For instance, Goos et al. (2015) estimate that for each high-tech job between 2.5

⁽¹³⁸⁾ The risk of market dominance on two-sided digital platforms could be limited by measures such as promoting the use of common standards. See, for instance, Rochet, J-C and J. Tirole (2006), 'Two-Sided Markets: A Progress Report', *The RAND Journal of Economics*, Vol. 37, No. 3, pp. 645-667

⁽¹³⁹⁾ At least, if barriers such as unjustified geo-blocking get effectively removed. See for instance the Commission's proposal to address unjustified geo-blocking, adopted by the Council in February 2018, at <http://data.consilium.europa.eu/doc/document/PE-64-2017-INIT/en/pdf>

⁽¹⁴⁰⁾ As argued in, for instance, Auer, A., Borio, C. and A Filardo (2017), 'The Globalisation of Inflation: The Growing Importance of Global Value Chains', *CESIFO Working Paper* No. 6387.

⁽¹⁴¹⁾ Nevertheless, this will then call for carefully filtering and analysing large amounts of information. See, for instance, Sinclair (2015), 'What big data could do for economic forecasts', *World Economic Forum*.

⁽¹⁴²⁾ Levy, F. and R. Murnane (2004), *The New Division of Labor: How Computers are Creating the Next Job Market*, Princeton University Press.

⁽¹⁴³⁾ In line with the fall in the price of ICT equipment. See Autor, D. and D. Dorn (2013), 'The Growth of Low-Skill Service Jobs and the Polarization of the US Labor Market', *The American Economic Review*, Vol. 103, No. 5, pp. 1553-1597.

⁽¹⁴⁴⁾ McKinsey Global Institute (2017), 'A Future That Works: Automation, Employment, and Productivity'

⁽¹⁴⁵⁾ Focussing on jobs (rather than tasks), Frey, C. and O. Michael (2017), 'The future of employment: How susceptible are jobs to computerisation?' *Technological Forecasting and Social Change*, Elsevier, Vol. 114(C), pp. 254-280 estimate that about 47 percent of total US employment could be automated over about the next decade or two, whereby especially workers in transportation, logistics, office and administrative support workers, and production are at risk. Nevertheless, occupations labelled as high-risk occupations often still contain a substantial share of tasks that are hard to automate. See, for instance, Arnt et al (2016), op cit.

⁽¹⁴⁶⁾ See, for instance, Nedelkoska, L. and G. Quintini (2018), 'Automation, skills use and training', OECD Social, Employment and Migration Working Papers, No. 202.

and 4.4 jobs are created outside high-tech employment.⁽¹⁴⁷⁾ Such jobs are mainly for workers carrying out low-skilled tasks such as cleaning and gardening, which could in part offset the fall in demand for these jobs as identified by for instance Nedelkoska and Quintini (2018).

In addition, the digital platforms will give rise to new forms of work organisation whereby firms outsource tasks as in the case of the on-demand economy⁽¹⁴⁸⁾ or global value chains⁽¹⁴⁹⁾; while work organisation within firms will become more flexible through the use of digital devices such as virtual work places.⁽¹⁵⁰⁾

Such increased flexibility may then create opportunities for new types of employment which are more flexible, such as independent professionals⁽¹⁵¹⁾, or for other digital innovations such as telerobotics and telepresence that reduce significantly the need for physical presence to perform tasks.⁽¹⁵²⁾

Finally, digitalisation may also affect the composition of labour supply as it provides new opportunities for workers who face difficulties accessing the labour market. For example, digital innovations may enhance the functional capacities of certain people with disabilities, allowing them to perform tasks they otherwise would not be able to carry out. They also may provide parents digital platforms to better combine family and work responsibilities. Cloud-computing may reduce the barriers that the self-employed face to start their

own businesses as they no longer need to make heavy investments in ICT equipment.⁽¹⁵³⁾

These changes in employment composition and work organisation also are likely to impact economic resilience. For example, it is to be expected that a better-skilled labour force and more flexible work arrangements may improve an economy's capacity to absorb and recover from shocks.

Nevertheless, the increased flexibility of work organisation (mediated by digital platforms) may also carry downward risks if it results in an excessive job rotation within as well as between enterprises, which may adversely affect workers' incentives and opportunities to acquire firm-specific skills – and hence may lower productivity and capacity to withstand shocks.

Moreover, the hollowing out of the middle class due to the tasks-biased technological progress carries the risk that it may deprive the economy of a stable source of consumer spending and tax base. Furthermore, if the new organisational methods entail the diffusion of freelance work and this represents the only source of income, employees may be more at risk of income volatility (compared to workers with a standard contract) which may trigger precautionary savings.

Finally, if social security arrangements and taxes are different for employees and freelance workers, unchanged regulations in combination with a strong rise in freelance work may create new rigidities in job changes and pose important fiscal challenges.

III.5.2. Functioning of labour markets: skill mismatches and skill shortages

As discussed above, the digital revolution is expected to change the employment composition significantly and increase the mismatch between current skills and occupations and the new skills and job openings. For example, the European Centre for the Development of Vocational Training projects for the 2015-2025 period a strong growth in the demand for the high-skilled and elementary occupations, and a notable decrease in

⁽¹⁴⁷⁾ See, for instance, Goos, M., Konings, J. and E. Rademakers (2016), 'Employment Growth in Europe: The roles of innovation, local job multipliers and institutions', *KU Leuven VIVES Discussion Paper* No. 50.

⁽¹⁴⁸⁾ On-demand platforms link individuals with contingent or freelance tasks. Employers may have an incentive to engage in such platforms as the labour services resourced via a digital platform constitute a variable cost which makes it easier to maximise profits. In addition, it also facilitates the outsourcing of non-essential tasks (such as cleaning). Employees may participate in such platforms because it provides them more flexibility and opportunity to balance private and working life and this flexibility may be an incentive for some to enter the labour market. It may provide also additional income for those who already have a steady job. See, for instance, Microsoft (2018), 'The Future Computed Artificial Intelligence and its role in society'.

⁽¹⁴⁹⁾ See previous sub-section.

⁽¹⁵⁰⁾ See, for instance, Microsoft (2018), *op cit.*

⁽¹⁵¹⁾ Independent professionals (iPros) are self-employed without employees who are flexible and innovative and operate in high-value, high-knowledge professional sectors. See, for instance, Leighton, P. (2015), 'Future Working: The Rise of Europe's Independent Professionals (iPros)'.

⁽¹⁵²⁾ As discussed in the previous sub-section.

⁽¹⁵³⁾ See, for instance, Abadie, F. et al. (2016), 'The labour market implications of ICT development and digitalisation', Chapter 4 in European Commission (2016), *Employment and Social Developments in Europe report.*

the demand for mid-level skilled occupations. ⁽¹⁵⁴⁾ See Chart III.5. This may then pose important challenges which call for the adaptation of adequate learning and training systems.

At the same time, new digital tools may enhance skill matching. More particularly, digital platforms, such as on-demand and online talent ⁽¹⁵⁵⁾ platforms, lower significantly the cost to match employers with employees, while e-learning facilitates the capacity of employees to acquire and regularly update their skills. ⁽¹⁵⁶⁾

While still limited in size ⁽¹⁵⁷⁾, these digital platforms have a strong potential to strengthen job-matching. This may then also have a feedback on wages. On the one hand, while lower search costs may increase employees' job search intensity, it may also increase their reservation wage, as employees expect to receive more job offers as the cost to post a job vacancy decreases. In turn, a higher reservation wage may make employees more reluctant to accept a job offer and raise wages thereby putting upward pressure on equilibrium unemployment. On the other hand, the lower search cost may increase labour supply that may put downward pressure on wages.

At the same time, the ongoing digital revolution will also increase the ability of employers to monitor employee productivity – especially when

transactions are made on a digital platform. This could bring wages better in line with productivity, thereby lowering equilibrium unemployment and creating better incentives to raise productivity.

III.5.3. Total employment: income and substitution effects

The ongoing digital revolution will affect the demand for and supply of labour via several channels.

The displacement effect. First, the digital revolution is expected to increase productivity so that less labour is required to produce the same output level. ⁽¹⁵⁸⁾

The income effect. At the same time productivity increases may be translated into higher real wages and permanent income. ⁽¹⁵⁹⁾ This may then increase aggregate demand and in turn the demand for labour.

The expectations effect. The income effect may get reinforced if well-functioning financial markets allow agents to bring forward expected future productivity gains.

The labour supply effect. Real wage increases may induce a higher labour supply, limiting the upward pressure on wages.

The reallocation effect. Initially, prices are likely to fall and wages to rise in the sectors experiencing digitalisation but the additional income may be spent on a variety of goods and services raising employment in these sectors. ⁽¹⁶⁰⁾ In turn, this increased demand for goods and services in the other sectors may induce additional investments in these sectors, giving an additional boost to labour demand.

⁽¹⁵⁴⁾ Of course, in these projections the impact of digital revolution is only one of the many factors affecting future labour demand. Other factors include globalisation, demographic change and greening of the economy.

⁽¹⁵⁵⁾ Online talent platforms have the potential to lower search costs for both employers and employees - thereby improving job matching. See, for instance, McKinsey Global Institute (2015), 'A Labor Market that Works: Connecting Talent with Opportunity in the Digital Age'.

⁽¹⁵⁶⁾ In addition, skill matching can be spurred by lifelong-learning strategies and well-functioning labour markets along flexicurity principles in combination with a cross-border recognition of skills that facilitate cross-border mobility of workers, as foreseen in, for instance, in European Commission (2016), 'A New Skills Agenda for Europe. Working together to strengthen human capital, employability and competitiveness', SWD(2016) 195 final.

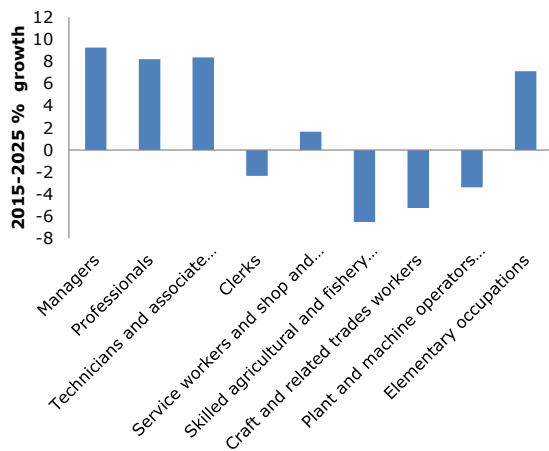
⁽¹⁵⁷⁾ No estimates of full-time equivalent number of jobs employed on the on-demand platforms in the euro area are available. Surveys suggest that it is less than 1% of labour force. See, for instance, Centre for Economic policy Studies (CEPS) and European Economic and Social Committee (EESC) (2017), 'Impact of digitalisation and the on-demand economy on labour markets and the consequences for employment and industrial relations'. Abadie, F. et al. (2016), 'The labour market implications of ICT development and digitalisation', Chapter 4, the European Employment and Social Developments Report state that platform service providers tend to be younger and more highly educated than the general population, work long hours on several platforms, earn below or just above minimum wages, and use the collaborative economy earnings as an income top-up.

⁽¹⁵⁸⁾ Digitalisation is expected to raise productivity via several channels including productivity improvements in the ICT sector, capital deepening in combination with an upgrade of workers' skills as well as network effects. See, for instance, Van Ark, B. (2014), 'Total factor productivity: Lessons from the past and directions for the future', *National Bank of Belgium Working Paper Research*, No. 271.

⁽¹⁵⁹⁾ Either because prices decrease or nominal wages and profits increase. Assuming no changes in bargaining power between labour and capital. Nevertheless, digitalisation may also raise concerns regarding the erosion of labour standards. See, for instance, McKinsey Global Institute (2017), 'Technology, jobs, and the future of work'.

⁽¹⁶⁰⁾ See, for instance, Autor, D. (2015), 'Why Are There Still So Many Jobs? The History and Future of Workplace Automation', *Journal of Economic Perspectives*, Vol. 29, No 3, pp. 3–30.

Graph III.5: **Employment growth by occupational groups**
Cedefop skills demand forecast



Source: European Centre for the Development of Vocational Training (Cedefop)

The uncertainty effect. However, in the absence of adequate labour market institutions and policies to accommodate a swift and smooth labour reallocation⁽¹⁶¹⁾, job uncertainty may increase, which in turn may lead to a rise in precautionary savings that would decrease overall demand and the demand for labour.

The labour income distribution effect. While productivity growth may support aggregate demand via its impact on domestic total income, its net impact also depends on its distribution. Indeed, as digital technologies are expected to complement high-skilled workers and replace the less-educated ones, income gains will flow primarily to the high-skilled. If the marginal propensity to consume of the higher income deciles is lower than that of the lower income deciles, aggregate demand may decrease.

The factor income distribution effect. In addition, downward pressure on the total amount of wages paid could strengthen if labour's bargaining power (compared to capital's bargaining power) would decrease as work organisation becomes more decentralised and less unionised by the use of digital platforms. Moreover, to the extent that

⁽¹⁶¹⁾ Such as the European Commission's New Skills Agenda for Europe. This strategy aims to help people thrive in fast-evolving workplaces; help companies access the talent they need to invest and innovate; ensure that everyone has a solid foundation of basic skills; look ahead to the skills needs of tomorrow; and ensure that skills and qualifications are more transparent and therefore better recognised across borders.

capital becomes more mobile a significant part of the productivity gains may accrue to non-residents who have a lower propensity to spend their income in the country where it was generated.

The international competitiveness effect. In a currency union without internal nominal exchange rates, cost competitiveness may also be affected if differences in productivity growth across Member States are not offset by corresponding differences in nominal wage growth. This could trigger changes in competitiveness between Member States, which in turn could lead to changes in external aggregate demand and subsequently the demand for labour.

The above effects do not all point in the same direction. Based on experience with previous general purpose technologies, it can be expected that in the short run the displacement effect would dominate, whereas in the long run the productivity effect would dominate. This is likely to impact on labour tax bases and revenues, which are a significant source of tax revenue in the euro area. However, the quality of framework conditions - including labour market institutions - is likely to affect the strength of the impact and the speed of adjustment.

III.6. Financial markets: FinTech's impact

Digital technological innovations including artificial intelligence, network computers, big data and distributed ledger technologies (blockchain) may give rise to the development of new financial products and services as well as new business models - provided barriers get removed or at least lowered.⁽¹⁶²⁾

FinTech innovations that could support economic resilience and potential growth include digital payment systems facilitating trade across borders, as well as a more diversified supply of credit at a lower cost. Nevertheless, in this respect, it remains crucial to make the financial sector more cyber resilient by ensuring that financial services are delivered effectively and smoothly across the EU, and that consumer and market trust and confidence are preserved - as is one of the

⁽¹⁶²⁾ See, for instance, European Commission (2018), 'FinTech Action plan: For a more competitive and innovative European financial sector', COM(2018) 109/2, which identifies as an important barrier a lack of common approaches between national regulators and supervisors.

objectives of the European Commission's FinTech Action Plan.

Finally, FinTech innovations may also carry important risks in terms of overall financial stability; while the added value of virtual currency schemes to the well-functioning of financial markets can be regarded as non-existent.

III.6.1. Lowering barriers

With the aim of lowering barriers and help the financial industry make use of the rapid advances in technology such as blockchain and other IT applications and strengthen cyber resilience, the European Commission launched the FinTech Action Plan in March 2018. The Action Plan has three main objectives: i) to support innovative business models to scale up across the single market; ii) to encourage the uptake of new technologies in the financial sector; and to iii) increase cybersecurity and the integrity of the financial system. ⁽¹⁶³⁾

Clear and consistent licensing requirements are a foundational requirement for supporting the scaling up of innovative business models across the single market. This applies to both new business models such as crowdfunding platforms for which the European Commission presented a new legal framework, or the emergence of crypto-assets and Initial Coin Offerings, as well as the use of flexibility and proportionality in existing regulatory frameworks governing activities such as banking, investment firms, payment services, e-money services, etc. Technology based solutions are also highly dependent on standards, interoperability and open application programming interfaces. Scaling up digital financial services across the EU requires a determined effort in this respect. Also the use of innovative and alternative methods of supervision through innovation facilitators, hubs and sandboxes has an important role to play in scaling up activity, both from the perspective of market participants and for regulators and supervisors as a means to acquaint themselves with new technologies and business models.

Digitalisation of finance across the EU also requires new technologies to be implemented in

the financial sector across all Member States. Regulatory and supervisory hesitations and lack of familiarity with new technologies may hinder the take-up of innovations, especially where financial institutions require approval, endorsement or at least non-opposition from their supervisors for implementing innovations in their operations or product and service offerings.

Finally, further digitalisation also requires a reviewing for existing rules and requirements for unjustified obstacles to financial innovation as a result of regulation acting as an enforced standard that reflects or requires dominant designs and business models or product features that have emerged in previous innovation cycles. This applies for example to the use of cloud computing service providers by financial institutions or the promotion and application of distribution ledger technology and blockchain based solutions in the financial sector. Financial regulators and supervisors therefore also need to build the required skills and expertise that go beyond familiarity with traditional economic or financial risks such as credit, market or liquidity risk, and that also cover technology governance and the risks and opportunities inherent in the advanced use of technology and data.

Digitalisation of finance raises increased concerns and interest in cybersecurity as an essential pre-condition for technology and data based financial services provision to develop across the EU. Building on horizontal and cross-sector cybersecurity policies, attention should also be given to the special role of the financial sector as both among the most mature but also the most attacked sectors. Advanced threat intelligence sharing, a detailed review of ICT security and governance requirements and associated supervisory practices and the development of a coherent cyber resilience testing framework for financial institutions and infrastructures all play an important role here.

III.6.2. Digital payment systems

Traditional cross-border payments, especially those crossing euro area borders, involve high transaction costs and inefficiencies. ⁽¹⁶⁴⁾ These high costs

⁽¹⁶³⁾ For more details on the Action Plan, see https://ec.europa.eu/info/publications/180308-action-plan-fintech_en

⁽¹⁶⁴⁾ Cross-border payments involve mainly large correspondent banks facing significant variable and fixed costs (IMF Staff Team (2017)). These costs include building the capacity to take on credit risks, maintain liquidity in foreign accounts as well as carry fixed

reduce competitiveness in retail markets, especially for SME's. Furthermore, inefficiencies create, among other problems, uncertainty over settlement timing and associated foreign exchange risks, which are major barriers especially for large enterprises. ⁽¹⁶⁵⁾

Well-functioning digital payment systems, which link the payer and the online merchant via the payer's online banking module (like PayPal), may contribute to a more integrated and efficient European payments market. ⁽¹⁶⁶⁾ In turn, better functioning payment schemes increase consumer choice not only with respect to the type of goods and services, but also with respect to the location of the provider. Hence, as FinTech payment systems are expected to lower these transaction costs, small and large businesses will gain the opportunity to further diversify their sales markets, and, in that way also strengthen the economy's capacity to withstand idiosyncratic shocks.

Nevertheless, digital payment platforms may also be subject to systematic risks such as an external shock that triggers a crisis of confidence or failure of a major participant. ⁽¹⁶⁷⁾ Addressing such challenges calls for a number of measures including enhanced cooperation and information exchange between national authorities in the context of authorisation and supervision of payment institutions, ⁽¹⁶⁸⁾ and a better understanding of the vulnerabilities of emerging payment systems. ⁽¹⁶⁹⁾

III.6.3. FinTech Credit

While in 2018 the size of FinTech credit is still small compared to traditional banking credit ⁽¹⁷⁰⁾, FinTech is expected to give rise to faster, cheaper and more efficient business processes ⁽¹⁷¹⁾ that in turn may strengthen economic resilience.

For example, FinTech technologies make it easier to enter the market which increases competition and lowers monopoly rents. At the same time, the application of FinTech technologies, by using of big data algorithms, might help provide small-scale loans at a lower fixed-cost than traditional banks, ⁽¹⁷²⁾ thereby not only potentially lowering the cost of finance but also broadening credit supply and promoting social inclusiveness. ⁽¹⁷³⁾

By using big data analytics to assess creditworthiness, FinTech firms can provide credit at a lower cost. However, no firm evidence that such tools are more effective is yet available.

Crowd-funding has the potential to act as a catalyst in a recovery phase by facilitating, for instance, the entry of new firms that need start-up capital or complementing firms' other forms of traditional financing, bringing in new sources of funding that might otherwise remain outside the usual financial market channels. ⁽¹⁷⁴⁾

Nevertheless, while digital financial services rely on volume, economies of scale and network effects, possible differences in national regulation across euro area Member States remain an important barrier to fully realise this potential. ⁽¹⁷⁵⁾

Moreover, FinTech credit may also pose risks in terms of the stability of the financial system ⁽¹⁷⁶⁾ – notwithstanding that such risks could also be associated with traditional credit provision. For example, a pro-cyclical credit provision could arise if lending standards would weaken during an economic boom. This risk is especially strong if FinTech credit provision were to occur outside of

costs in back-office operations. See, for instance, IMF Staff Team (2017), op cit.

⁽¹⁶⁵⁾ See, Committee on Payments and Market Infrastructures (CPMI) (2018), Cross-border retail payments.

⁽¹⁶⁶⁾ As, for example, foreseen in Directive (EU) 2015/2366 of the European Parliament and of the Council of 25 November 2015, on payment services in the internal market.

⁽¹⁶⁷⁾ See, for instance, Pauget, G. (2016), 'Systemic risk in payment', in Banque de France, *Financial Stability Review*, No. 20.

⁽¹⁶⁸⁾ See, for instance, Payment services Directive 2015/2366.

⁽¹⁶⁹⁾ See, for instance, Pauget, G. (2016), op cit.

⁽¹⁷⁰⁾ As surveyed in, for example, FSB and BIS (2017), op cit.

⁽¹⁷¹⁾ Draghi, M. (2017), 'Into the future: Europe's digital integrated market', Opening remarks by Mario Draghi, President of the ECB, at the Joint ECB and European Commission Conference.

⁽¹⁷²⁾ See, for instance, FSB and BIS (2017), op cit.

⁽¹⁷³⁾ Because of lower transaction and information costs FinTech makes financial services more accessible for people with low-income. See, for instance, FSB (2017). The lack of access to financial services reinforces the risk of social exclusion as it prevents people from getting a job, creating a business and accessing to other services. See European Commission (2010), 'The European Platform against Poverty and Social Exclusion: A European framework for social and territorial cohesion'.

⁽¹⁷⁴⁾ Nevertheless, still in its initial phase several issues still need to be addressed to get crowd-funding reach its full potential, including protection of intellectual property, combatting fraud, addressing consumer protection concerns and issues of legal uncertainty. European Commission (2014), 'Unleashing the potential of Crowdfunding in the European Union', COM(2014) 172 final.

⁽¹⁷⁵⁾ See, for instance, European Commission (2018), op cit.

⁽¹⁷⁶⁾ See, for instance, Financial Stability Board (FSB) and Bank for International Settlements (BIS) (2017), 'FinTech credit. Market structure, business models and financial stability implications'; and IMF Staff Team (2017), 'Fintech and Financial Services: Initial Considerations', IMF Staff Discussion Note, SDN/17/05.

the purview of financial regulation and supervision that is not tailored to the specific characteristics of FinTech firms. ⁽¹⁷⁷⁾

These risks may be reinforced by the digitalisation process itself, if overly optimistic expectations about future productivity gains brought by the new technologies were to lead to an excessive accumulation of debt - partly fuelled by less regulated and supervised FinTech firms.

III.6.4. Virtual currency schemes

Distributed ledger technologies have also given rise to virtual currency schemes. ⁽¹⁷⁸⁾ However, so far such schemes have proven to be volatile, risky and energy intensive which makes them unsuitable as investment, savings or retirement planning products. ⁽¹⁷⁹⁾

This is mainly because virtual currency schemes lack an authority (or private issuer) that guarantees their stability. ⁽¹⁸⁰⁾ The legal status of virtual currency schemes remains unsettled. The applicability or not of existing EU legislation and regulation requires a careful and case-by-case assessment of the precise facts and circumstances surrounding each virtual currency scheme and the legal and natural persons providing the virtual currency related services. In addition to legal uncertainty on rights and obligations associated with specific virtual currencies, service providers in this field still face severe operational problems affecting the transparency and integrity of the price formation process, the security of the system or its availability to users who due to operational and cyber incidents and limitations have found themselves unable to access their assets and buy or sell virtual currencies. Information made available to consumers is in most cases incomplete, difficult to understand, or does not properly disclose the risks. ⁽¹⁸¹⁾

Furthermore, as its supply is fixed (or growing at a constant rate) no lender of last resort support is available in times of a liquidity crisis - which undermines its long-term credibility. ⁽¹⁸²⁾

Virtual currencies saw a dramatic price increase in the course of 2017, reaching a peak of global market capitalisation estimated to be in the 800 bn US\$ range, before deflating and settling in the 300 bn US \$ range in the year 2018 to date. At this size, and given the relative isolation between traditional financial markets and virtual currency markets with an absence so far of significant transmission channels, virtual currency markets at this stage do not present a financial stability risk, as confirmed by the Financial Stability Board. ⁽¹⁸³⁾ This situation may, however, change, especially as financial institutions and institutional investors start engaging in the market for example through the development of synthetic crypto-assets and crypto-asset derivatives. For example, crypto-assets may be used as collateral or strongly leveraged so that when their volatile price drops significantly it could trigger instability as margin calls intensify and wealth losses adversely affect agents' solvability. ⁽¹⁸⁴⁾ It was the risks to investors that motivated the European Commission to request the European Supervisory Authorities to issue warnings about the speculative market environment and other risks associated with crypto-assets. ⁽¹⁸⁵⁾

⁽¹⁷⁷⁾ See, for instance, FSB and BIS (2017), op cit.

⁽¹⁷⁸⁾ I.e. "a digital representation of value, not issued by a central bank, credit institution or e-money institution" as defined in ECB (2015), 'Virtual currency schemes – a further analysis'.

⁽¹⁷⁹⁾ See the European Supervisory Authorities for securities (ESMA), banking (EBA), and insurance and pensions (EIOPA) pan-EU warning about the great risks of virtual currencies at <https://www.eba.europa.eu/documents/10180/2139750/Joint+ESAs+Warning+on+Virtual+Currencies.pdf>

⁽¹⁸⁰⁾ Mersch, Y. (2018), 'Virtual or virtueless? The evolution of money in the digital age', lecture delivered at the Official Monetary and Financial Institutions Forum, London.

⁽¹⁸¹⁾ See, ESMA, EBA and EIOPA op cit.

⁽¹⁸²⁾ De Grauwe, P. (2018), 'Bitcoin is not The Currency Of The Future', *Social Europa* (January 2018)

⁽¹⁸³⁾ For more details, see <http://www.fsb.org/2018/06/fsb-assesses-financial-vulnerabilities-and-takes-stock-of-actions-under-its-2018-workplan/>

⁽¹⁸⁴⁾ See, for instance, Merch (2018), op cit.

⁽¹⁸⁵⁾ Warning to consumers on Virtual Currencies. EBA/WRG/2013/01

<https://eba.europa.eu/documents/10180/598344/EBA+Warning+on+Virtual+Currencies.pdf>; EBA Opinion on Virtual Currencies – EBA/Op/2014/08

<https://www.eba.europa.eu/documents/10180/657547/EBA-Op-2014-08+Opinion+on+Virtual+Currencies.pdf>;

ESMA alerts investors to the high risks of Initial Coin Offerings – ESMA50-157-829

https://www.esma.europa.eu/sites/default/files/library/esma50-157-829_ico_statement_investors.pdf;

ESMA alerts firms involved in Initial Coin Offerings (ICOs) to the need to meet relevant regulatory requirements – ESMA50-157-828

https://www.esma.europa.eu/sites/default/files/library/esma50-157-828_ico_statement_firms.pdf;

ESMA, EBA and EIOPA warn consumers on the risks of Virtual Currencies – 12 February 2018

<https://www.eba.europa.eu/documents/10180/2120596/Joint+ESAs+Warning+on+Virtual+Currencies.pdf>

III.7. Conclusion

A general finding of this section is that the macro-economic effects of the ongoing digital revolution go in different directions and that digital structural reforms can affect macro-economic outcomes, including on Member States' economic resilience, growth potential and relative convergence.

The impact of the revolution will manifest itself through cyclical and permanent effects that may well be different across Member States, potentially leading to divergent outcomes. To avoid this, and rather build on the opportunities provided by the digital revolution, it seems crucial to continue efforts to reinforce convergence towards resilient economic structures across the euro area.

First, it is important to quickly overcome the uneven distribution of the legacy of the crisis across the euro area, as this could hinder the smooth transition towards the digital economy. Several factors, such as high indebtedness and a sustained lack of investments, may limit Member States' capacity to adjust and innovate and fully benefit from the opportunities of the digital revolution.

In addition, as the ability to absorb shocks during the crisis differed significantly among countries, the temporary effects linked to digital transformation could crystallise into larger structural differences across Member States.

An important risk in this regard could emerge if the speed at which the diffusion of digital technologies leads to great differences in the speed at which economies transit to the digital economy.

Hence, improving the regulatory framework and completing the Digital Single Market remain pressing policy challenges to foster access to online activities under conditions of fair competition.

Furthermore, the digitalisation process also has the potential to transform existing comparative advantages worldwide and to affect potential growth and convergence. As such, not only lagging euro area Member States will have to catch-up with the leading ones, but the leaders will have to transform with a view to maximising the opportunities created by knowledge-intensive activities. This calls for policies aimed at promoting wide-reaching innovation and investment and tackling remaining structural rigidities.

The ongoing digitalisation process calls also for a strengthening of labour markets to support smoother transitions into the new job opportunities, as well as building up skills and expertise on the part of financial regulators and supervisors that will see the nature of the firms and activities they supervise undergo substantial change, with the role of technology and data in the financial value chain and risk and opportunities mix becoming substantially more outspoken. Importantly, Member States, businesses and individuals will need to invest more in training in digital skills across the whole spectrum of education and training so that machine-learning complements the tasks of skilled workers rather than displace them, while mitigating at the same time the risk of further labour market segmentation.

Finally, the available evidence suggests that FinTech has the potential to both strengthen the economic resilience of euro area economies, and to trigger new macro-economic risks. A key challenge is therefore to create a regulatory framework that enables the euro area's financial sector to take full advantage of these digital technologies while keeping a hold on these risks.

IV. Second-round effects of income tax reforms

Fiscal policy measures have complex economic effects. Businesses and consumers may respond by changing their behaviour and these responses can themselves have further economic effects by changing the supply, demand and prices of goods and services. Quantitative assessments of these second-round budgetary effects are those with the highest degree of uncertainty and therefore often at the centre of political and public debates. Conventional budget analysis relying on static scoring assumes that GDP remains the same when the government changes taxes or spending. Although this assumption is simple and transparent, economic theory and empirical research confirm that fiscal policy influences the path of the economy. For example, if a tax cut stimulates growth, the revenue loss will be less than its estimate, assuming unaffected GDP. The macroeconomic feedback effect may not be large enough to make tax cuts pay for themselves, but it can make tax cuts partially self-financing.

This section builds on a recent paper, Barrios et al. (2017), in which the authors develop a dynamic scoring framework for analysing tax and benefit reforms in European countries.⁽¹⁸⁶⁾ The framework combines EUROMOD, a static microsimulation model, with QUEST, the European Commission's dynamic general equilibrium model. While the microsimulation model allows for the precise translation of actual tax reform proposals into policy shocks, it cannot account for the economy-wide effects of the reforms. On the other hand, dynamic general equilibrium models can consistently capture the macroeconomic feedback effects. This section shows that accounting for the macroeconomic feedback effects is important for the comprehensive evaluation of tax reforms, including their distributional impact. ⁽¹⁸⁷⁾

Quantifying the impact of tax-cuts on the fiscal balance is a difficult task because tax-cuts can affect the tax base over time. For example, cutting capital income taxes reduces the tax revenue on impact but it can also increase the tax base over time if the tax cut stimulates the economy through higher investment. Accounting for the second-round feedback effects of tax reforms on the tax base is important from a fiscal sustainability point of view because these effects can make the tax-cut partially self-financing. Dynamic scoring methods can estimate the revenue effects of tax reforms using dynamic macroeconomic models. The literature suggests that the second-round effects can be sizable, e.g., in case of capital taxes, more than 70 percent of the tax cut can be self-financing.⁽¹⁸⁸⁾

This section elaborates on Barrios et al. (2017) which develops a dynamic scoring framework for analysing tax and benefit reforms in European countries. The framework combines EUROMOD,

the static microsimulation model for all European Union Member States, with QUEST, the European Commission's dynamic general equilibrium model used for the analysis of fiscal and structural reforms.

EUROMOD on its own can only be used to calculate the direct, 'overnight' effect of reforms on the taxes paid and benefits received by households, assuming that their pre-tax income and employment status remain unaffected after the policy shock. The combined use of EUROMOD and QUEST has three main advantages.

- First, the microsimulation model allows for a precise translation of actual tax reform measures into policy shocks that is not possible using macroeconomic models alone.
- Second, the policy shocks can be fed into the macroeconomic model in order to capture the macroeconomic feedback effects. Static microsimulation models ignore how tax reforms endogenously affect wages, employment, prices and other monetary and fiscal variables in the economy that can lead to non-negligible feedback effects on tax-revenues. These effects can be consistently modelled in dynamic general equilibrium models.
- Third, in addition to the analysis of the macroeconomic and fiscal effects, the results

⁽¹⁸⁶⁾ Barrios, S, Dolls, M., Maftci, A., Peichl, A., Riscado, S., Varga, J., and C. Wittneben (2017), 'Dynamic Scoring of Tax Reforms in the European Union.' ZEW Discussion Paper No. 17-017. This study was developed in collaboration with the Joint Research Centre in the context of the ECFIN-JRC Administrative Agreement to provide support to fiscal and tax policy recommendations with the EUROMOD model.

⁽¹⁸⁷⁾ This section was prepared by Janos Varga. The author wishes to thank Savina Princen, Eric Meyermans, Valeska Gronert, Werner Roeger and Jan in 't Veld for useful comments.

⁽¹⁸⁸⁾ Trabandt, M. and H. Uhlig (2011), 'The Laffer curve revisited.' *Journal of Monetary Economics*, Vol. 58, pp. 305-327.

can be fed back into the microsimulation model to analyse the distributional effects of the reforms. This is the novel approach taken in the current dynamic scoring practice.

The results of this exercise indicate that accounting for the macroeconomic feedback effects is important for a comprehensive evaluation of tax reforms, including their distributional impact. This section gives a short introduction to this framework.

Why to use EUROMOD and QUEST for the dynamic scoring of tax-revenue estimates?

Similar to other microsimulation models, EUROMOD is a static tax and benefit calculator that makes use of the representative microdata from the Statistics on Income and Living Conditions (national and EU-SILC). As a microsimulation model, it allows for the translation of actual tax and benefit reform measures into policy shocks, something which is not possible using macroeconomic models alone. ⁽¹⁸⁹⁾ The extensive micro database in EUROMOD includes information on personal and household characteristics (e.g. education), several types of income (e.g. market income, pensions or social transfers), certain expenditures (e.g., housing costs or life insurance payments), and other variables related to living conditions. ⁽¹⁹⁰⁾ Since EUROMOD covers only households/individuals without connecting them to the rest of the economy, it cannot account for the impact of tax reforms on wages, employment, and other variables in the economy that can lead to non-negligible feedback effects on tax-revenues.

Therefore, EUROMOD can only be used to calculate the direct, ‘overnight’ effect of reforms on the taxes paid and benefits received by households, assuming that their pre-tax income and employment status remain unaffected after the policy shock. On the other hand, micro-founded dynamic general equilibrium models, like the

QUEST model, can consistently capture the missing feedback effects. ⁽¹⁹¹⁾ These general equilibrium models can simulate the behavioural response of firms, households, fiscal and monetary authorities to policy shocks.

The idea of combining micro- and macroeconomic simulation models is not new but the approaches and techniques are still under development (see Peichl, 2016). ⁽¹⁹²⁾ By linking these two model types, fiscal policy analysts benefit from the complementary advantages of the models. Researchers have been using linked microsimulation and computable general equilibrium (CGE) models to examine the distributional effect of policy shocks. Although these layered CGE-microsimulation models can account for some of the macroeconomic feedback effects, a serious drawback of this approach is the lack of explicit dynamic structure in the CGE model parts. ⁽¹⁹³⁾ Static CGE models can provide the long-run, steady state feedback effects but they are silent on the short- to medium-run transition path of the simulated policy shocks. Fully dynamic macroeconomic models can provide complete impulse responses from the short run to the new, long-run steady state. Moreover, tax and benefit reforms can also affect growth; e.g. through influencing saving and investment, incentives for innovating or adopting new technologies. As opposed to traditional CGE models, these impacts

⁽¹⁸⁹⁾ See Sutherland (2001) and Sutherland and Figari (2013) for a description of the EUROMOD microsimulation model. Sutherland, H. (2001). EUROMOD: An integrated European benefit-tax model (No. EM9/01). EUROMOD Working Paper Series. Sutherland, H., & Figari, F. (2013). EUROMOD: The European Union tax-benefit microsimulation model (No. EM8/13). EUROMOD Working Paper.

⁽¹⁹⁰⁾ EUROMOD integrates taxes, social contributions and benefits based on a common framework code of the policy systems for the EU-28, see <https://www.euromod.ac.uk>.

⁽¹⁹¹⁾ QUEST is a fully dynamic structural macro-model with microeconomic foundations derived from intertemporal utility and profit optimisation. The different model variants have been extensively used for macroeconomic policy analysis and research, e.g. analysing the impact of fiscal and structural reforms and assessing the impact of Cohesion Policies. See Ratto, M., Roeger, W., & in 't Veld, J. (2009). QUEST III: An estimated open-economy DSGE model of the euro area with fiscal and monetary policy. *Economic Modelling*, 26(1), 222-233., Varga, J., Roeger W. and in 't Veld, J. “Growth effects of structural reforms in Southern Europe: the case of Greece, Italy, Spain and Portugal” *Empirica*, 2014, vol. 41, issue 2, 323-363.

⁽¹⁹²⁾ Peichl (2016) distinguishes two main strategies for linking the models: a.) completely integrate both models, and b.) combine two separated models via interfaces (so-called layered approach). The second approach can be differentiated into top-down and bottom-up approaches. The top-down approach computes the macroeconomic variables as inputs for the micro model to adjust its exogenous macro aggregates. The bottom-up approach works in the opposite order: variables from the micro model help to calibrate aggregates in the macro model (See Peichl, A. (2016), ‘Linking Microsimulation and CGE models’, *International Journal of Microsimulation*, Vol. 9(1), pp. 164-176.) Barrios et al. (2017) combines the bottom-up and top-down approaches.

⁽¹⁹³⁾ See Davies, J. (2004), ‘Microsimulation, CGE and Macro Modelling for Transition and Developing Economies’, Mimeo, University of Western Ontario.

can be analysed with forward-looking growth models like the QUEST model. ⁽¹⁹⁴⁾

IV.1. Revenue estimates of tax reforms: dynamic scoring vs. static scoring

Dynamic scoring is an American term referring to a budgetary analysis which accounts for the full macroeconomic effects of policies when estimating their budgetary effects (Mankiw and Weinzierl, 2006).⁽¹⁹⁵⁾ Traditional revenue estimation, called static scoring, on the other hand, assumes no behavioural feedback effects at the macro level when producing the budgetary estimate of policies. Dynamic scoring is a well-established exercise for budgetary estimations in the U.S., where the Joint Committee on Taxation (JCT) is legally required to provide a macroeconomic impact analysis for bills that are expected to have large fiscal effects.⁽¹⁹⁶⁾ Barrios et al. (2017) develop a dynamic scoring framework for modelling and analysing tax and benefit reforms for all EU countries.

Advocates of dynamic scoring argue that traditional scoring techniques undermine the case for tax cuts because the feedback effects of tax cuts, with reinforced incentives, are not taken into account. Laffer-curves can easily illustrate this argument. The stylised Laffer-curves of Graph IV.1 show the collected revenues from two different types of taxes (A and B). The dashed lines represent the static scoring exercise that would correspond to a standard microsimulation estimate. In this case, by cutting the tax-rates from their starting levels (TA,0 and TB,0), the corresponding tax revenues decrease proportionally if one does not take into account the macroeconomic feedback effects (from R0 to R-stat). Dynamic scoring estimates, which account for these feedback effects, would produce higher revenue estimates (R-dyn). The difference between the static and

dynamic scoring estimates captures the so-called revenue feedback effect (R-dyn – R-stat). By missing the feedback from the behavioural response of economic agents, the static scoring overestimates the revenue loss after the tax-cut and biases the analysis against the proposed policy measure.

Graph IV.1 also demonstrates that the magnitude of the revenue feedback effect depends:

- on the magnitude of the tax-change: for larger cuts one would expect stronger behaviour effects while for smaller changes the difference may be negligible;
- on the type of the tax which is captured by the shape of the corresponding Laffer-curve in our graphs. For example, cutting more ‘growth distortionary’ taxes tend to generate larger self-financing effects (Tax A vs. Tax B).

Finally, note that the Laffer-curves above correspond to the final steady states. Concerning the transition dynamics towards the new equilibrium, Mankiw and Weinzierl (2006) show that the difference between the static and dynamic scoring revenue estimates is smaller in the beginning but it is gradually increasing over time after the introduction of the tax reforms. ⁽¹⁹⁷⁾

⁽¹⁹⁴⁾ See Roeger, W., J. Varga and J. in ‘t Veld (2009), ‘Structural Reforms in the EU: A simulation-based analysis using the QUEST model with endogenous growth’, European Economy. Economic Papers 351.

⁽¹⁹⁵⁾ Mankiw, N. G., and M. Weinzierl (2006), ‘Dynamic scoring: a back-of-the-envelope guide’, *Journal of Public Economics*, Vol. 90(8), pp. 1415-1433. See also Auerbach, A. J. (2005), ‘Dynamic scoring: An introduction to the issues.’ *American Economic Review*, Vol. 95, pp. 421-425.

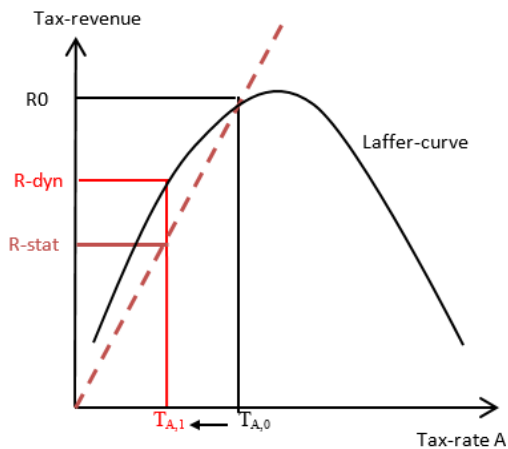
⁽¹⁹⁶⁾ The current rules require the Joint Committee on Taxation (JCT) to develop dynamic scoring estimates for any official conventional revenue score that exceeds 0.25 percent of U.S. GDP for any given year. The rules also require qualitative analysis for 20 years after the budget window. (See JCT. 2017. ‘Overview of the Joint Committee Revenue Estimating Process’,

<https://www.jct.gov/publications.html?func=startdown&id=4969>)

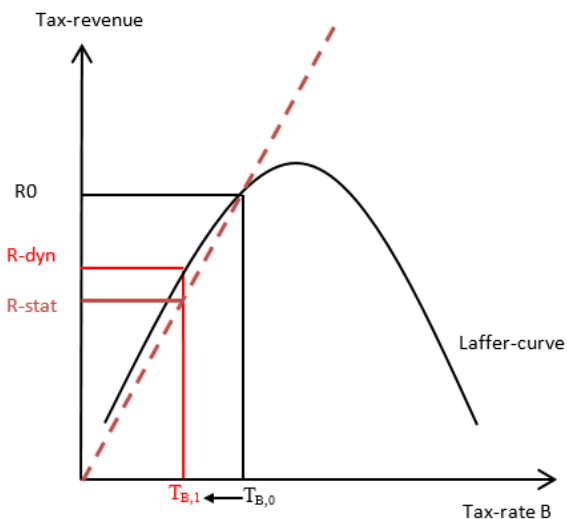
⁽¹⁹⁷⁾ Exploring the shape and the revenue maximising tax-rate of the Laffer curve has been the subject of intense academic research. For a comprehensive U.S. and EU wide analysis, see Trabandt and Uhlig (2012). Vogel (2012) uses a QUEST model variant with home production to map the Laffer curves in an economy with informal sector. Trabandt M. and H. Uhlig, 2012. ‘How Do Laffer Curves Differ across Countries?’, NBER Chapters, in: Fiscal Policy after the Financial Crisis, pages 211-249 National Bureau of Economic Research, Inc., Vogel, L. (2012) ‘Tax avoidance and fiscal limits: Laffer curves in an economy with informal sector,’ European Economy. Economic Papers 448.

Graph IV.1: **Static vs. dynamic scoring**

Laffer curve – Tax A



Laffer curve – Tax B



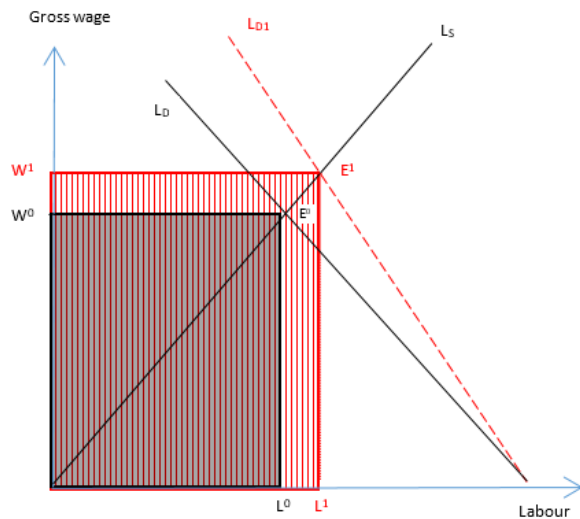
(1) R_0 =pre-reform tax revenue, R_{-dyn} =tax-revenue estimate with dynamic scoring, R_{-stat} = tax-revenue estimate with static scoring

Source: Illustration based on Adam and Bozio (2009) Dynamic scoring, OECD Journal on Budgeting, Vol. 9(2), 107.

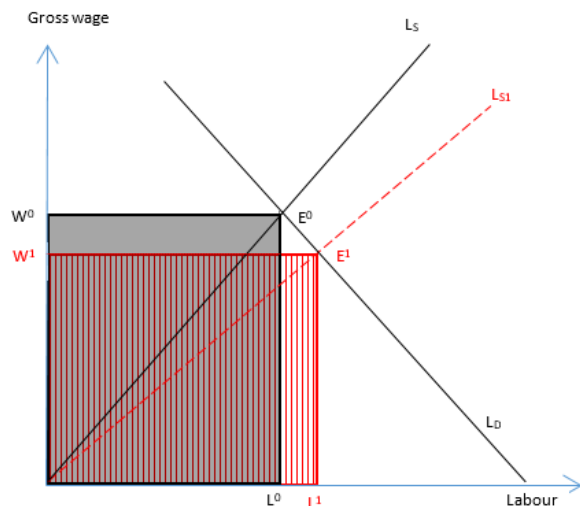
Section IV.3 gives examples for both types of taxes (A and B-type) with different feedback effects and it also confirms the increasing gap between the static and dynamic scoring estimates over time. We will show that even two types of labour tax-reforms on employee- vs. employer-paid taxes can have different short-run feedback effects. The partial equilibrium analysis of Graph IV.2. can illustrate this point:

Graph IV.2: **Short-run feedback effect of labour tax-cuts**

Reduction of employer-paid taxes



Reduction of employee-paid taxes



(1) The rectangle of $OL^0E^0W^0$ is the pre-reform tax-base while $OL^1E^1W^1$ is the new tax-base after the corresponding tax-cut. L_D denotes labour demand and L_S is labour supply.

Source: Author's illustration.

- When employer-paid labour taxes decrease, firms are willing to hire more labour services at all levels of the gross wage and L_D rotates up to L_{D1} . In the new equilibrium, gross wages are higher and firms are willing to hire more labour at the new wage rate. As both wages and employment increase the tax-cut unambiguously increases the tax-base (from the shaded $OL^0E^0W^0$ rectangle to the $OL^1E^1W^1$ rectangle with stripes). Notice, that a static scoring framework with exogenous, constant wages and employment would completely miss

this effect: this is an example of type-A tax from Graph IV.1.

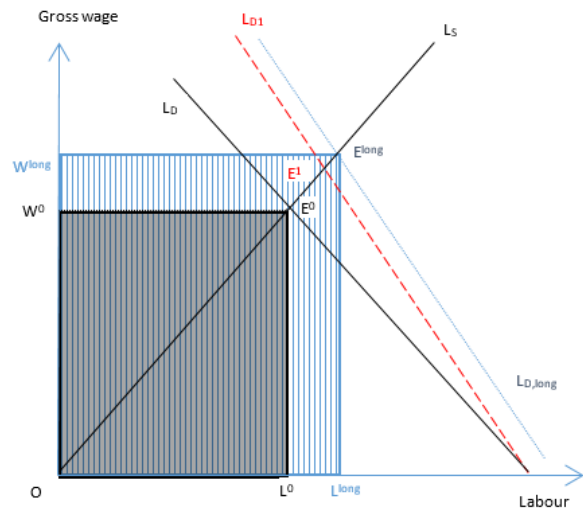
- When employee-paid labour taxes decrease, workers are willing to offer more labour services at all levels of the gross wage, and LS rotates down to the right to LS1. In this case, the tax-cut has two opposing effects on the tax-base: in the new equilibrium, gross wages are lower and firms are willing to hire more labour. The tax-base transforms from the shaded $OL^0E^0W^0$ rectangle to the $OL^1E^1W^1$ rectangle with stripes. Due to the two opposing effects, the tax-base may not even change significantly in the short-run. Scoring exercises with or without endogenous wage and labour response might give similar results: this is an example of type-B tax in Graph IV.1.

In the long-run, the capital stock will gradually increase to its new steady-state level, which will lead to higher labour demand (LD, long on Graph IV.3), increased wages, and larger tax-base. Consequently, along the transition path, the difference between the static and dynamic scoring revenue estimates will increase.

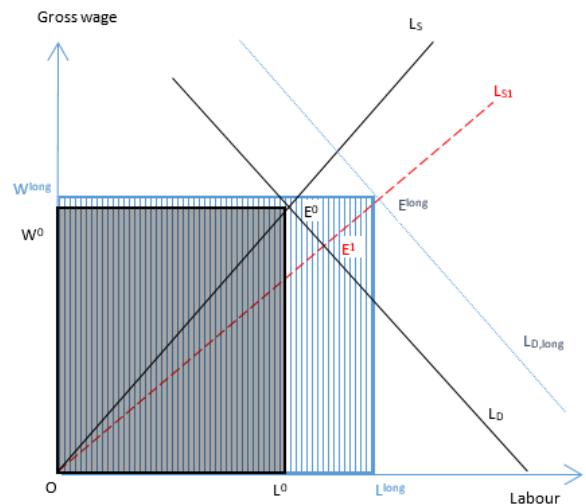
Graphs IV.2 and IV.3 can only provide a simplified, partial equilibrium insight into how labour-tax cuts affect the tax-base under the two scoring exercises. Model-based dynamic scoring exercises can capture the complex general equilibrium linkages (e.g. interaction with other fiscal revenue components), which have further impact on these estimates.

Graph IV.3: **Long-run feedback effects of labour tax-cuts**

Reduction of employer-paid taxes – long-run



Reduction of employee-paid taxes – long-run



(1) The rectangle of $OL^0E^0W^0$ is the pre-reform tax-base while $OL^1E^1W^1$ is the new tax-base after the corresponding tax-cut. LD denotes labour demand, LS is labour supply

Source: Author's illustration

IV.2. Empirical estimates of the revenue feedback effects

Turning to the quantified magnitude of the feedback effects, the literature suggests that the steady state feedback effect can be surprisingly large. The seminal article of Mankiw and Weinzierl (2006) calculates the revenue feedback effect of labour and capital taxes in a standard neoclassical framework. Their model-based dynamic scoring exercise places the self-financing effect of employee-paid labour taxes between 17 percent and 38 percent. In other words, growth pays for up to 38 percent of a labour income tax cut in the steady state. The self-financing effect is even higher for the more distortionary capital taxes, between 39 percent and 74 percent, depending on the model parametrisation. Following Mankiw and Weinzierl (2006), Trabandt and Uhlig (2011) also pursue a dynamic scoring exercise in a richer neoclassical growth model.⁽¹⁹⁸⁾ The authors derive Laffer curves for the U.S., and 14 EU Member States. The paper finds that for the U.S.-calibrated model 32 percent of an employee-paid labour tax cut and 51 percent of a capital tax cut are self-financing in the steady state. In case of the EU aggregate economy, 54 percent of a labour tax cut and 79 percent of a capital tax cut are self-financing in the model. Interestingly, Trabandt and Uhlig (2011) suggests that the higher self-financing rates of several EU countries compared to the US can be explained by being closer to the revenue maximising tax-rate.

Dynamic scoring studies based on general equilibrium models can also shed light on the role of alternative financing regimes when estimating the revenue effect of tax-reforms.⁽¹⁹⁹⁾ These studies suggest that revenue losses from capital and labour income tax cuts are higher when the tax cuts are financed from decreasing productive spending or from raising more growth-distortionary taxes and lower when lump-sum taxes or transfer payment cuts are used to finance them. Openness to trade can further increase the revenue feedback effects. For example, Choi and Kim (2016) finds that the revenue feedback effect from an income

tax cut on labour or capital becomes substantially larger in a small open economy when agents can access international financial markets compared to the case of a closed economy without this possibility.⁽²⁰⁰⁾

Revenue scoring exercises by the Joint Committee on Taxation (JCT) in the U.S. focus on the short-to medium-run dynamic feedback effects of actual tax-reforms. The JCT relies on several models for revenue scoring. First, corporate and individual microsimulation models help to obtain the conventional, static estimate of actual tax reforms without behavioural effects.⁽²⁰¹⁾ In the next step, three macroeconomic models can provide estimates on the dynamic, behavioural effects of reforms – a macroeconomic growth (MEG) model, an overlapping generations (OLG) model and a dynamic stochastic general equilibrium (DSGE) model.⁽²⁰²⁾ The estimated revenue feedback effects show large variation depending on the type of the tax reform and the model parametrisation. For example, in JCT (2005) the feedback effect of labour and corporate tax cuts ranges from about 3 percent to 18 percent in the first five years, and from 6 percent to 23 percent over the 10-year budget period.⁽²⁰³⁾ The most recent macroeconomic analysis of the ‘Tax Cuts and Jobs Act’ estimates that the complex package of individual income tax reform would generate a substantial increase in GDP. The model-based simulations show that this output gain would finance up to 26.5 percent of the revenue loss estimated by conventional, static scoring.⁽²⁰⁴⁾

IV.3. Dynamic scoring in practice

To illustrate the advantages of linking the two models, two hypothetical Belgian tax-reforms are simulated: an approximately eight percent cut in labour tax-rates paid by employees and employers

⁽¹⁹⁸⁾ Trabandt, M. and H. Uhlig (2011), ‘The Laffer curve revisited.’ *Journal of Monetary Economics*, Vol. 58, pp. 305-327.

⁽¹⁹⁹⁾ See Leeper, E. and S-Ch. S., Young (2008), ‘Dynamic scoring: Alternative financing schemes’, *Journal of Public Economics*, Vol. 92, pp. 159-182. and Ergete, F. (2008), ‘Dynamic Scoring in the Ramsey Growth Model,’ *The B.E. Journal of Economic Analysis & Policy*, Vol. 8(1), pp. 1-27.

⁽²⁰⁰⁾ Choi, Y., and S. Kim (2016), ‘Dynamic scoring of tax reforms in a small open economy model’, *Economic Modelling*, Vol. 58. pp. 182-193.

⁽²⁰¹⁾ See JCT (2015), ‘Estimating Changes in the Federal Individual Income Tax: Description of The Individual Tax Model,’ <https://www.jct.gov/publications.html?func=startdown&id=4776>.

⁽²⁰²⁾ Butz, A. (2017), ‘The Role of Revenue Estimating and Dynamic Scoring in the Tax Reform Debate.’ Daily Tax Report, 146 DTR J-1, 8/1/17. The Bureau of National Affairs

⁽²⁰³⁾ JCT (2005), ‘Macroeconomic Analysis of Various Proposals to Provide \$500 Billion In Tax Relief,’ JCX-4-05.

⁽²⁰⁴⁾ JCT (2017), Macroeconomic Analysis of the Conference Agreement for HR. 1. The “Tax Cuts and Jobs Act.” JCX-69-17. <https://www.jct.gov/publications.html?func=startdown&id=5055>

respectively. In the first step, the QUEST model is calibrated to mirror EUROMOD and EU-SILC in terms of labour supply and labour taxation statistics at the aggregate, macro-level. ⁽²⁰⁵⁾ This step makes sure that both models start from the same baseline. Being a macro model, the QUEST model cannot integrate all the underlying micro level data of EUROMOD. In order to bring the granularity of the labour force in the QUEST model closer to EUROMOD, the labour force is disaggregated into three-skill groups: low-, medium-, and high-skilled based on the standard ISCED classification. ⁽²⁰⁶⁾ Participation, employment and unemployment rates, wages and labour supply elasticities in the QUEST model are calibrated to match the EUROMOD counterparts for the three skill groups. At this stage, labour supply elasticities by skill-groups are estimated with the help of a satellite labour supply discrete choice model. ⁽²⁰⁷⁾ These estimates serve to calibrate the skill-specific Frisch elasticity of labour supply in the QUEST model.

After aligning the labour supply and labour taxation parameters between the two models, the tax shocks are introduced into the EUROMOD microsimulation model in order to calculate the corresponding ‘overnight’ change in the effective labour tax rates (note, that these changes do not include any behavioural responses from the side of employees or employers). The aggregated changes in the effective labour taxes by skill-groups serve as the relevant policy shocks for the QUEST model simulations. In order to account for the ‘clean’ macroeconomic feedback effects of the shock on tax revenues, the debt-stabilisation rule remains idle for the first 15 years. By doing so, one can account for the direct budgetary effect of the shocks in the short- to medium-run. ⁽²⁰⁸⁾

⁽²⁰⁵⁾ Barrios et al. (2017) used the “G3.0+” version of EUROMOD together with the latest available datasets in EU-SILC. For the simulation of the tax reforms, they chose the 2013 tax-benefit rules as the baseline.

⁽²⁰⁶⁾ The share of population with up to lower secondary education (ISCED 0-2) are low-skilled, with up to upper secondary, non-tertiary education (ISCED 3-4) are medium skilled and the rest of the population is considered high-skilled.

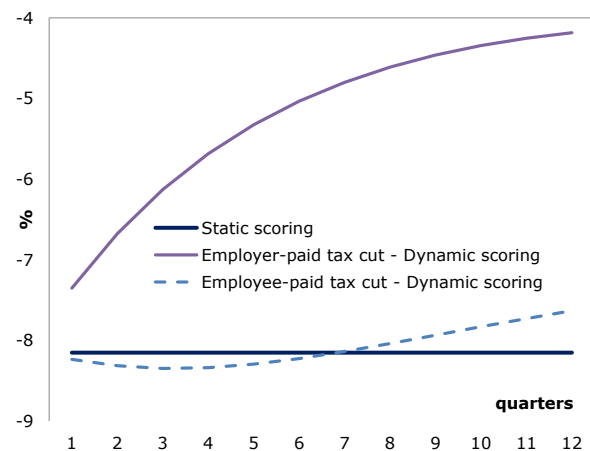
⁽²⁰⁷⁾ A labour supply discrete choice model was set up to estimate the skill-specific labour supply elasticities following the standard methodology in Bargain et al. (2014). Bargain, O., Orsini, K., and A. Peichl, (2014), ‘Comparing labor supply elasticities in Europe and the United States, new results’ *Journal of Human Resources*, Vol. 49(3), pp. 723-838. For more details, see the Appendix B of Barrios et al. (2017).

⁽²⁰⁸⁾ In the long-run, personal income taxes ensure budgetary neutrality. As previous research shows (e.g. Leeper and Young

Graph IV.4 compares the percent change in total labour tax revenues from the static estimates and the dynamic scoring revenue estimates simulated by the QUEST model. We can make the following observations from these results:

- Without wage and employment feedbacks, a static scoring exercise would give the same percent decline in revenues for both cases (solid dark blue line) because the tax rates fall by the same magnitude while the tax-base does not change.
- In line with Graph IV.2, cutting employee-paid taxes has two opposing effects on the tax base: employment increases and wages decline. As the tax base may not change at all, the static and dynamic scoring estimates could be very close to each other, especially in the short run. Notice, however, that the gap between the two scoring estimates starts increasing overtime. This result is also in line with Mankiw and Weinzierl (2006).

Graph IV.4: **Static and dynamic revenue estimates of labour tax cuts**



(1) Percent deviations from baseline. QUEST simulations.

Source: Barrios et al. (2017)

- As explained in the previous section, cutting employer-paid taxes will give much larger difference between the dynamic and static scoring results. The behavioural responses increase the tax-base with higher wages and

(2008), there are various alternative ways to tackle the government deficit generated by the reforms. The different financing may have very different second-round effects on the tax-revenues. Choi and Kim (2016) show examples when the tax-cut can be completely self-financing.

employment (see Graph IV.2) and the tax-cut becomes partly self-financing. The transition dynamics is again in line with Mankiw and Wenzierl (2006), as the revenue feedback effect is gradually increasing. After three years, the dynamic scoring estimate is almost half of the static scoring results.

Graph IV.4 only shows the difference between static and dynamic scoring with respect to labour tax revenues. Self-financing effects reported in the literature typically correspond to total tax revenues, not only to the labour tax burden. The panels in Table IV.1 also show how the main tax revenue components change under dynamic scoring compared to static scoring after five years. The table also reports the revenue feedback or self-financing effect. The feedback effect is the percentage difference of the revenue effect produced by the macroeconomic model relative to the static revenue estimate. This index allows us to quantify the extent to which the reforms are self-financing through economic growth.

Table IV.1: Revenue scores and self-financing

	Static scoring	Dynamic scoring	Self-financing rate
Employer tax cut:			
effect on tax revenues			
- labour tax	-8.2	-4.1	50.2
- consumption tax	0.0	0.9	n/a
- corporate tax	7.5	0.8	n/a
- total tax-revenues	-2.5	-1.7	32.1
Employee tax cut:			
effect on tax revenues			
- labour tax	-8.2	-7.1	13.3
- consumption tax	0.0	1.9	n/a
- corporate tax	0.0	1.8	n/a
- total tax-revenues	-3.7	-2.8	25.2

(1) Static and dynamic scoring revenue effects are in percent deviations from baseline. n/a - not applicable.

Source: QUEST simulations.

Focusing on the first column of the table, we can see that under static scoring, labour tax revenue decreases in both reform scenarios, while consumption tax revenue stays unchanged. Notice that corporate tax revenues remain unaffected when cutting employee-paid taxes but they significantly increase when employer paid taxes are cut due to the widening of the tax base (income from sales, less employee compensation).

The second column shows that under dynamic scoring all three tax revenue components change. Since employment, wages, consumption and

output all react to the tax reform, static scoring can under or overestimate the expected tax revenues.

As shown on Graph IV.4, static scoring overestimates the direct revenue loss from labour tax revenues. Additional revenues from consumption taxes also stay undetected in static scoring because the method does not account for the increase in household disposable income. As households benefit more from the direct tax-cut on their wages, the feedback effect on tax revenues from increased consumption is higher for an employee-paid than for an employer-paid tax reduction (1.9 vs. 0.9 percent). Finally, static scoring predicts significantly larger corporate tax revenues from lowering employer-paid taxes compared to the dynamic scoring counterpart (7.5 percent vs. 0.8 percent). That is because in this case, the static approach only accounts for the declining tax rate without the growth in gross wages and employment. (See Graphs IV.2 and IV.3). The dynamic feedback effects reduce the fall in employee compensation, therefore, the increase in profits and corporate tax revenues becomes smaller. Furthermore, static scoring also misses the expansion of domestic demand from easing the burden of taxation on employees, which leads to an increase in firms' output and turnover. The dynamic scoring results show that around 1.8 percent rise in corporate tax revenue remains undetected in the static scoring exercise in this case.

The aggregate revenue effects from all tax components are in the range of estimates in the literature. In the case of an employer (employee) tax reduction, the total tax revenue under dynamic scoring decreases by 1.7 (2.8) percent from the baseline, compared to 2.5 (3.7) percent under static scoring. This suggests that static scoring overestimates the revenue loss from a tax cut by a significant amount: the self-financing rate is about 32 and 25 percent respectively.

It is important to stress that these results do not violate the Invariance of Incidence Proposition (IIP) in the QUEST model: a shift of taxation from employers to employees, which leaves overall labour tax revenues constant, or only changes the composition of the tax-wedge but not its size, would not affect employment and GDP in the long-run (see Box IV.1 at the end of the section).

IV.4. Distributional impacts of tax reforms

In addition to providing a dynamic scoring estimate of labour tax-reforms, one can also use the EUROMOD-QUEST link to explore the distributional effects of the reform scenarios.

Feeding the macrosimulation results back into the microsimulation model in order to analyse the distributional impact of policies is not a common practice in the dynamic scoring literature. Although researchers have been linking microsimulation and large-scale macroeconomic models to examine the distributional effect of policy shocks, the applied macroeconomic models were static computable general equilibrium models without proper dynamics, and therefore, inappropriate to analyse the short- to medium-run effect of policies (see Verikios and Zhang 2015, Clauss and Schubert, 2009, Labandeira et al. 2009).⁽²⁰⁹⁾ Fully forward looking general equilibrium models, like the QUEST model, are better suited to provide the dynamic macroeconomic effects as inputs into microsimulation models for distributional analysis.

In order to assess the effect of the labour tax reforms on the disposable income of households by income deciles, the QUEST simulated macroeconomic trajectories for employment, gross real wages and the consumer price index can be fed into EUROMOD. In practice, this step first requires an increase in the weighting of employed persons in EUROMOD according to the simulation results. At the same time, the weighting of unemployed persons decreases in order to keep the total population constant for each skill groups.⁽²¹⁰⁾ Second, the macroeconomic feedback effects on the consumer price index and the skill-specific gross wages feed into EUROMOD by adjusting the corresponding uprating factors. Finally, the microsimulation model is used to

quantify the distributional effects of the two reforms by income deciles.⁽²¹¹⁾

One can also compare the scenarios obtained from linking the two models with the static counterparts, i.e. without accounting for the macroeconomic feedback effects. This comparison allows for the benefits of this approach for distributional analysis to be sustained.⁽²¹²⁾

The result of this exercise (see Graphs IV.5 and IV.6 below) mirrors the previous analysis on the static and dynamic scoring profiles of Graph IV.4. Reducing the labour tax burden on employers has no direct first-order distributive effects when using EUROMOD alone because employers are not part of the microsimulation model. Without modelling the impact of employer-paid taxes on firms, EUROMOD alone cannot account for the feedback effect of this reform on household income. The reform of employer-paid taxes raises household disposable income only when behavioural responses are included. When the feedback effects obtained from the QUEST model simulations are channelled into EUROMOD, one can see that household disposable income rises across most deciles, with the exception of the first decile (Graph IV.5). The rise in disposable income is due to increased labour demand which leads to higher wages and employment (see Graph IV.2). This effect is regressive: top deciles benefit more from the reform while the first decile faces a loss in disposable income because of lower benefit payments following the wage and employment increase.

On the other hand, reducing the labour tax burden on employees has a similar effect on the total disposable income of households either with or without interacting the two models, QUEST and EUROMOD (Graph IV.6). As discussed earlier, the opposing move in wages and employment can leave the tax base almost unaffected in the short-

⁽²⁰⁹⁾ Verikios, G. and X-G, Zhang (2015), 'Reform of Australian urban transport: A CGE-microsimulation analysis of the effects on income distribution,' *Economic Modelling*, Vol. 44(C), pp. 7-17. Clauss, M. and S. Schubert (2009), 'The ZEW combined microsimulation-CGE model: innovative tool for applied policy analysis,' ZEW Discussion Papers 09-062. Labandeira, X., J. M. Labeaga, and M. Rodríguez, 2009. 'An integrated economic and distributional analysis of energy policies,' *Energy Policy*, Vol. 37(12), pp. 5776-5786. For a review, see Feltenstein A., L. Lopes, J. Porras-Mendoza and S. Wallace (2014), 'Modeling tax reform in developing countries,' in: *Taxation and Development: The Weakest Link?*, Chapter 3, pp 69-102. Edward Elgar Publishing.

⁽²¹⁰⁾ This means that in EUROMOD the authors implement the employment effects from QUEST simulations at the extensive margin.

⁽²¹¹⁾ Note, that QUEST also provides impulse responses on other components of the functional income distribution, e.g. income from profits, financial assets. These effects are not implemented yet in Barrios et al. (2017).

⁽²¹²⁾ The analysis focuses on the short-run effects of the reform and temporarily deactivates the debt-stabilisation rule. The long run, 'steady state' distributional effect of the tax-reform depends on which budgetary item will compensate for the missing tax revenues. The QUEST model offers a wide range of fiscal closure rules, which could be based on revenue or spending items in the government's budget constraint. Exploring the long-run implications of these various alternative fiscal closure rules goes beyond the scope of the analysis.

Graph IV.5: **Impact of employer-paid tax reform on disposable income by income decile**



(1) percent deviation from baseline

Source: Barrios et al. 2017

run (see Graph IV.2), therefore, the static and dynamic scoring estimates remain very close.

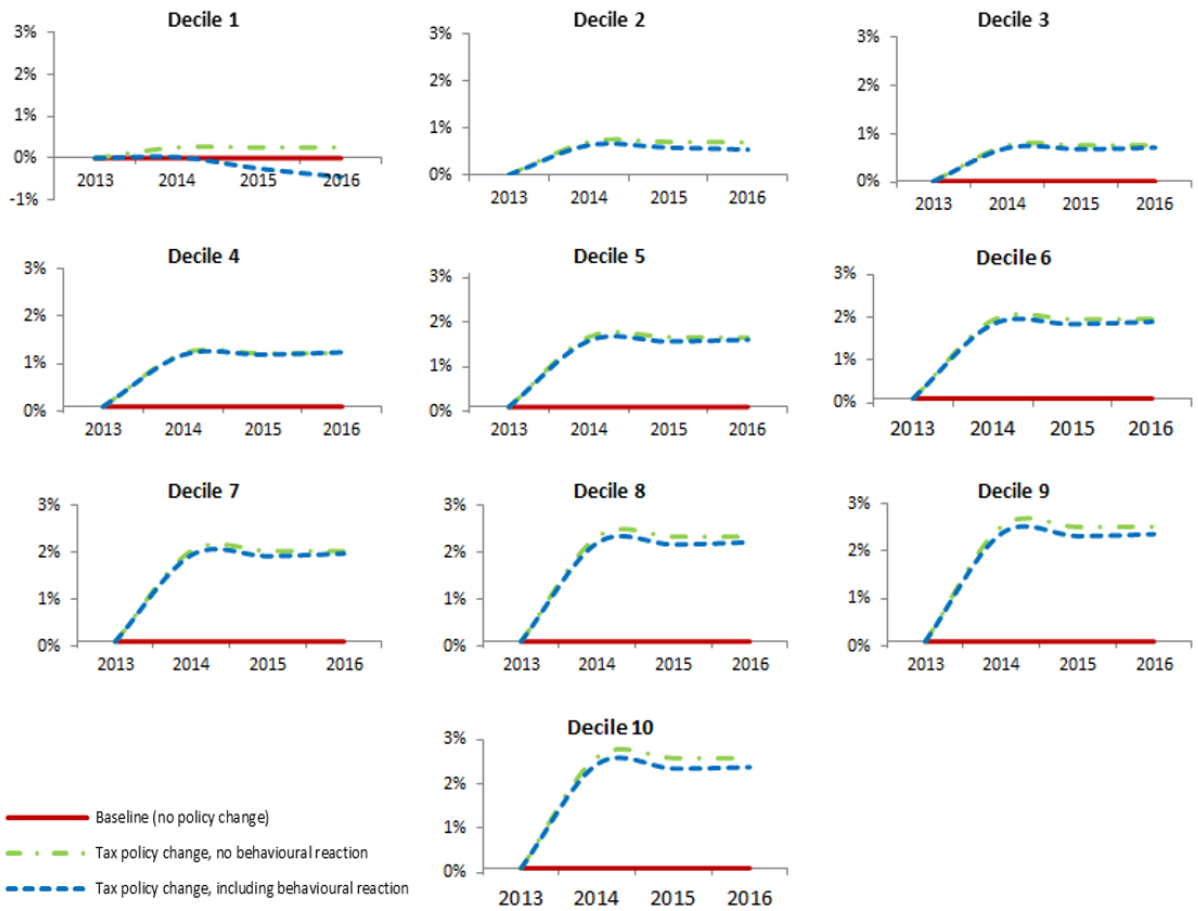
This highlights that second-round dynamic effects can also be crucial for assessing the impact of tax reforms on income inequality. Ignoring these dynamic effects could lead to wrong conclusions on the distributional impacts of tax reforms.

IV.5. Conclusion

The purpose of this section is to demonstrate that behavioural responses and macroeconomic feedback effects are essential for a comprehensive evaluation of tax reforms. The dynamic scoring exercise of Barrios et al. (2017) accounts for the macroeconomic effects of actual tax reforms when estimating their budgetary effects. Their approach combines the first-order fiscal and distributional effects of tax reforms using the EUROMOD microsimulation model and the second-round general equilibrium effects derived from the

QUEST macroeconomic model. The authors find that the direct self-financing effect of reducing employer-paid taxes is roughly 50 percent while the aggregate self-financing effect on total tax revenues is around 32 percent in the case of Belgium. The self-financing effect is smaller, around 13 and 25 percent, in case of a similar reduction in employee-paid taxes. Standard microsimulation methods focus only on the household-side and do not take into account the macroeconomic interaction with the rest of the economy. Accounting for the general equilibrium feedbacks from the rest of the economy, particularly from firms, fiscal and monetary authorities gives a more complete and comprehensive budgetary and income distribution estimate.

Graph IV.6: **Impact of employee-paid tax reform on disposable income by income decile**



(1) percent deviation from baseline

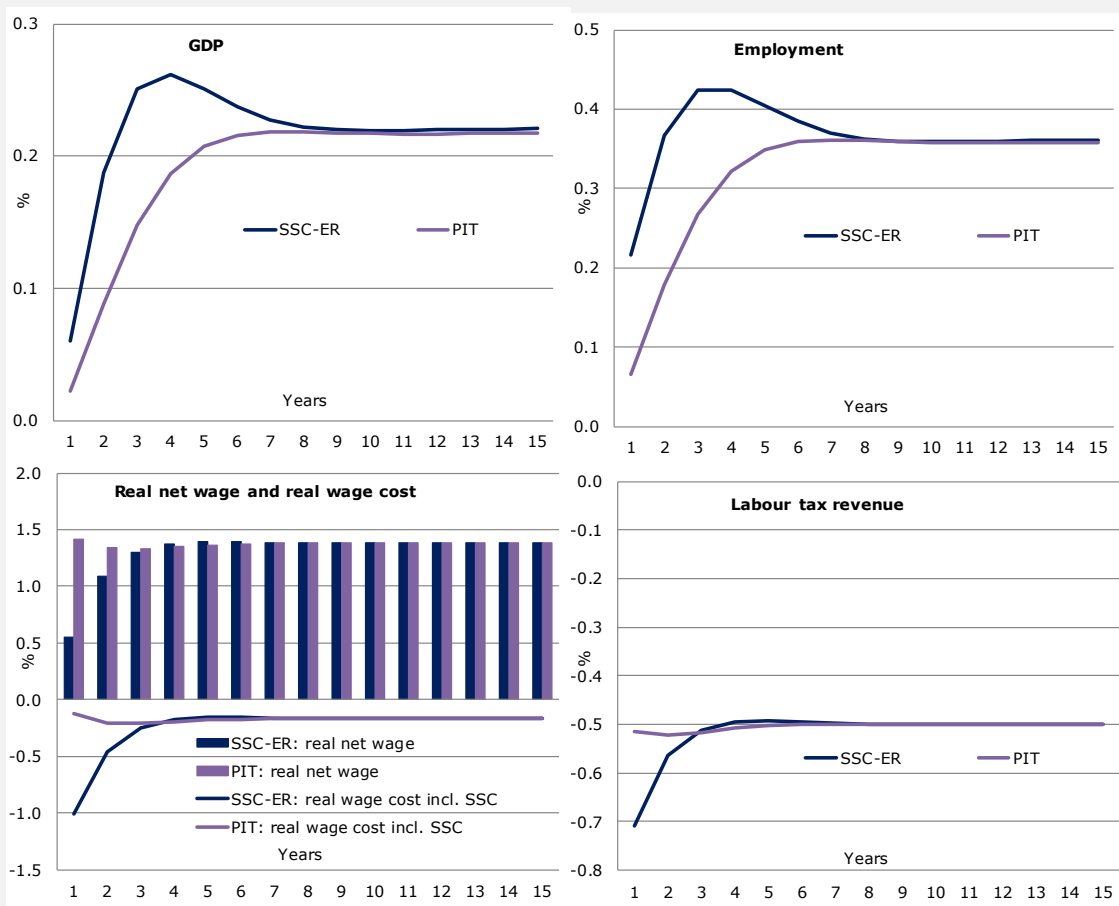
Source: Barrios et al. (2017)

Box IV.1: Invariance of Incidence Proposition

The Invariance of Incidence Proposition (IIP) holds in the QUEST model over the medium to long-run: a shift of taxation from employers to employees, which leaves overall labour tax revenues constant, or only changes the composition of the tax-wedge but not its size, does not affect employment and GDP (see Stiglitz, 1988, OECD, 1990 and Goerke, 2002). ⁽¹⁾ This can be illustrated by the following two simulation scenarios which show the decrease of employee paid personal income tax (PIT) and employer paid social security contributions (SSC-ER) in the order of 0.5 percent of GDP. Graph B IV.1 presents the corresponding impulse responses on GDP, employment, real wages and labour tax revenues.

Graph B IV.1: Invariance of Incidence Proposition

Employer vs. employee paid labour tax cuts



Note: percent deviation from baseline. The simulations show the effect of a permanent decrease in PIT and SSC respectively in a model calibrated for Belgium. In the long-run, lump-sum taxes are used to balance the government budget.

Source: QUEST simulations.

⁽¹⁾ Stiglitz, J. E. (1988), *Economics of the Public Sector*, 2nd ed., New York and London: W. W. Norton. Goerke, L. (2002) *Taxes and Unemployment. Collective Bargaining and Efficiency Wage Models*. Springer. OECD (1990). *Employer versus employee taxation: the impact on employment*, in OECD *Employment Outlook 1990* (pp. 153–177).

(Continued on the next page)

Box (continued)

The equivalence of labour taxes paid by employers and employees implies that our output and employment effects converge to the same percent deviations w.r.t. the baseline in the medium to long-run. Note that on the short-run, the differences between the scenarios are due to the nominal and real wage rigidities. After five years, real wage costs (including social security contributions) and net real wages converge to the same level effects, independently of whether the employers or employees' tax burden decreased. Ten years after the shock GDP and employment is up by around 0.2 percent and 0.35 percent respectively in both scenarios.

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