



European
Commission

JRC TECHNICAL REPORT

The third pillar of the Investment Plan for Europe: an impact assessment using the RHOMOLO model

JRC Working Papers on
Territorial Modelling and Analysis
No 02/2018



Authors:
Christensen, M.,
Conte, A.,
Di Pietro, F.,
Lecca, P.,
Mandras, G.,
Salotti, S.

2018

Joint
Research
Centre

This publication is a Technical report by the Joint Research Centre (JRC), the European Commission's science and knowledge service. It aims to provide evidence-based scientific support to the European policymaking process. The scientific output expressed does not imply a policy position of the European Commission. Neither the European Commission nor any person acting on behalf of the Commission is responsible for the use that might be made of this publication. For information on the methodology and quality underlying the data used in this publication for which the source is neither Eurostat nor other Commission services, users should contact the referenced source. The designations employed and the presentation of material on the maps do not imply the expression of any opinion whatsoever on the part of the European Union concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.

Contact information

Name: Simone Salotti

Address: Edificio Expo, C/Inca Garcilaso 3, 41092 Sevilla (Spain)

Email: simone.salotti@ec.europa.eu

Tel.: +34 954488250

EU Science Hub

<https://ec.europa.eu/jrc>

JRC113746

Seville: European Commission, 2018

© European Union, 2018



The reuse policy of the European Commission is implemented by the Commission Decision 2011/833/EU of 12 December 2011 on the reuse of Commission documents (OJ L 330, 14.12.2011, p. 39). Except otherwise noted, the reuse of this document is authorised under the Creative Commons Attribution 4.0 International (CC BY 4.0) licence (<https://creativecommons.org/licenses/by/4.0/>). This means that reuse is allowed provided appropriate credit is given and any changes are indicated. For any use or reproduction of photos or other material that is not owned by the EU, permission must be sought directly from the copyright holders.

All content © European Union, 2018 (unless otherwise specified)

How to cite this report: Christensen, M., Conte, A., Di Pietro, F., Lecca, P., Mandras, G., and Salotti, S. (2018). The third pillar of the Investment Plan for Europe: an impact assessment using the RHOMOLO model. JRC Working Papers on Territorial Modelling and Analysis No. 02/2018, European Commission, Seville, JRC113746.

The **JRC Working Papers on Territorial Modelling and Analysis** are published under the supervision of Simone Salotti and Andrea Conte of JRC Seville, European Commission. This series mainly addresses the economic analysis related to the regional and territorial policies carried out in the European Union. The Working Papers of the series are mainly targeted to policy analysts and to the academic community and are to be considered as early-stage scientific papers containing relevant policy implications. They are meant to communicate to a broad audience preliminary research findings and to generate a debate and attract feedback for further improvements.

Acknowledgments

The authors would like to thank Florentine Hopmeier (Cabinet Katainen), Maria Nedelcheva, and Patrick Van Bruggen (Secretariat General) for their coordination efforts; Marie-Agnes Deléglise and Adrien Rorive (JRC A2) for their support; Fabrizia Benini, Luigi Giamboni, Guillermo Hernandez, Silvia Merisio and Alexander Riedl (DG CNECT) for their useful inputs on the analysis on the Digital Single Market; Oana Bogza, Tomas Brannstorm, Francisco Caballero Sanz, Martine Diss, Eike Klapper, Katharina Knapton-Vierlich, Borut Lozar, Josefina Monteagudo, and Frank Siebern-Thomas (DG GROW) for their useful inputs on the analysis on the Single Market Strategy; Jung-Duk Lichtenberger, Tomas Vaclavicek, Diego Valiante, and Geert Van Campenhout (DG FISMA) for their useful inputs on the analysis on the Capital Markets Union; Luis Rey Los Santos and Kimon Keramidas (JRC C6) for their useful inputs on the analysis on the Energy Union.

Abstract

We evaluate the macroeconomic impact of the legislative proposals contained in the third pillar of the Investment Plan for Europe using the RHOMOLO modelling framework. In particular, we study a number of proposals related to the Capital Markets Union, the Single Market Strategy, the Digital Single Market, and the Energy Union. The likely economic effects of the removal of cross-country barriers to investment related to these four initiatives are positive and quantified to be on average equal to an increase of 1.5% of EU GDP by 2030. Such an impact would also entail the creation of about 1 million jobs.

The third pillar of the Investment Plan for Europe: An impact assessment using the RHOMOLO model

Martin Christensen, Andrea Conte, Filippo Di Pietro, Patrizio Lecca, Giovanni Mandras, and Simone Salotti

European Commission, Joint Research Centre

1 Introduction

One of the main priorities of the European Commission during the 2014-2020 programming period has been to sustain economic growth following the financial and economic crisis that started in 2008. At the end of 2014 the Investment Plan for Europe was launched, consisting of a combination of public and private investments with the initial objective to reach a total direct monetary injection of €315 billion. The initiative was structured along three pillars: i) the European Fund for Strategic Investments (EFSI), providing an EU guarantee to mobilise private investment; ii) technical assistance and visibility for investment opportunities through the European Investment Advisory Hub and the European Investment Project Portal; iii) the removal of regulatory barriers to investment both nationally and at the EU level.

The impact evaluation of policy interventions has now become a common practice to improve the transparency and effectiveness of public policy. Also, it is important to understand the economic effects of policies which explicitly target economic growth and investment in order to understand, and possibly improve, their effectiveness and efficacy. The macroeconomic impact of the first pillar of the Investment Plan is routinely carried out jointly by the European Investment Bank (EIB) and the European Commission's Joint Research Centre (JRC). The dynamic spatial Computable General Equilibrium (CGE) model RHOMOLO, parametrized on 267 NUTS2 regions of the EU and developed by the JRC for territorial impact assessment (Lecca et al. 2018), is used in this context (see EIB 2018).

While it is hard to imagine an economic evaluation of the second pillar of the Investment Plan for Europe, this Technical Report evaluates the macroeconomic impact of the initiatives related to the third pillar across the EU using the RHOMOLO simulation modelling framework. We believe that employing the same modelling framework used to evaluate the EFSI strengthens the analysis and permits a straightforward comparison of the possible effects on the economy of the investment policies carried out by the European Commission.

The RHOMOLO model is regularly used for impact assessments and provides sector-, region- and time-specific results to support EU policy making and investments (see, for instance, Sakkas 2018). The current version of RHOMOLO covers all the 267 EU NUTS2 regions, each regional economy being disaggregated into ten economic sectors. Spatial interactions between regional economies are captured through trade of goods and services, income flows, and factor mobility, making RHOMOLO well suited for simulating human capital, transport infrastructure, and R&D and innovation policies. The model captures the macroeconomic impacts of EU policies on regional economies and notably on variables such as GDP, employment, income and wages, consumption, investment, and savings.

The third pillar of the Investment Plan encompasses four main areas: the Capital Markets Union (CMU), the Single Market Strategy (SMS), the Digital Single Market (DSM), and the Energy Union. We separately evaluate the system-wide economic impact of each initiative identifying for each case an appropriate transmission channel, that is the process through which the policy initiatives are expected to directly affect the behaviour of economic agents. The operational mechanisms underlying each policy initiative are of crucial importance for our analysis.¹ The Third Pillar of the Investment Plan for Europe is based on a set of regulatory proposals that do not directly involve a monetary injection into the economy. Rather, it is designed to lower barriers to investment and to improve the management of resources and the system-wide efficiency in the economic and financial systems by modifying the regulatory frameworks of each area of intervention accordingly.

This report is structured as follows. In Section 2 we present an overview of the building blocks of the RHOMOLO model and its theoretical foundation. Sections 3, 4, 5, 6, and 7 present the analysis related to the CMU, the SMS (first the Start-up and Scale-up initiative and then the procurement package), the DSM, and the Energy Union, respectively. Finally, policy conclusions and further steps are discussed in Section 8.

2 Building blocks of the RHOMOLO model

In this section we present an overview of the RHOMOLO-V3 model. A full model exposition can be found in Lecca et al. (2018). The theoretical structure of the model is common to other numerical general equilibrium model, with its key distinguishing feature being its geographical granularity. The economy consists of a set of 267 EU NUTS2 regions plus one single exogenous region representing the rest of the World.

¹ These have been discussed and agreed with the competent European Commission services in advance.

The model has a set of different economic sectors (also called industries), with a subset of these operating under monopolistic competition à la Dixit and Stiglitz (1977). In each region and sector, identical firms produce a differentiated variety, which is considered as an imperfect substitute for the varieties produced within the same region and elsewhere. The number of varieties in the sectors is endogenous and determined from the zero-profit equilibrium condition (according to which profits must be equal to fixed costs). In turn, this means that, in equilibrium, prices equal average costs. In the rest of the sectors, firms operate under perfect competition. Currently, RHOMOLO is disaggregated into 267 EU regions and 10 NACE rev.2 economic sectors: A, B-E, C, F, G-I, J, K-L, M-N, O-Q, and R-U (see Table 2.1). Typically, we assume the following sectors under perfectly competitive market structure: A, O-Q, and R-U. The rest are treated as imperfectly competitive sectors.

Final goods are consumed by households and government (in the form of private and public capital goods), whilst firms consume intermediate inputs. Regional goods are produced by combining value added (labour and capital) with domestic and imported intermediates, creating vertical linkages between firms. This means that the spatial configuration of the system of regions has a direct impact on the competitiveness of regions because firms located in more accessible regions can source their intermediate inputs at lower prices and thus gain larger market shares in local markets.

Trade both between and within regions is costly, implying that the shipping of goods entails transport costs assumed to be of the iceberg type as in Krugman (1991). Transport costs are identical across varieties but specific to sectors and trading partners (region pairs).

Regarding the labour market setup, the model distinguishes three different labour categories which correspond to the level of skill or education: low, medium, and high. For each labour type, the default wage setting relationship is represented by a wage curve (Blanchflower and Oswald 1995), whose implication is that lower levels of unemployment increase the workers' bargaining power, thereby increasing real wages.

Government expenditure includes current consumption on goods and services, capital expenditures dedicated to public infrastructure, and net transfers to households. Revenues are generated by labour and capital income taxes on household income and indirect taxes on production. In the simulations reported here, government spending is typically considered an exogenous policy variable. If the government runs a balanced budget, and therefore the government deficit is fixed, either part of government

spending or any of the income tax rates have to adjust endogenously in order to satisfy the government budget constraint.

Last, the model is recursively dynamic with myopic expectations, and it is solved sequentially with stocks being upgraded at the beginning of each year.

The RHOMOLO model briefly described here is used to evaluate all the policy initiatives related to the CMU, the SMS, and the DSM. However, for the case of Energy Union we adopt a modified version of RHOMOLO where all supply constraints are removed and direct input substitution effects are neglected. The model is thus transformed in a conventional Inter-Regional Input-Output (RHOMOLO-IO) model where the price elasticity of supply is infinite and the price elasticity of demand is zero.

Table 2.1: Sectoral classification used in RHOMOLO

CODE NACE REV 2	Sectors' description
A	Agriculture, Forestry and Fishing
B-D-E	Mining and Quarrying + Electricity, Gas, Steam and Air Conditioning Supply + Water Supply; Sewerage, Waste Management and Remediation Activities
C	Manufacturing
F	Construction
G-I	Wholesale and Retail Trade; Repair of Motor Vehicles and Motorcycles + Transportation and Storage + Accommodation and Food Service Activities
J	Information and Communication
K-L	Financial and Insurance Activities + Real Estate Activities
M_N	Professional, Scientific and Technical Activities + Administrative and Support Service Activities
O-Q	Public Administration and Defence; Compulsory Social Security + Education + Human Health and Social Work Activities
R-U	Arts, Entertainment and Recreation + Other Service Activities + Activities of Households As Employers; Undifferentiated Goods- and Services-Producing Activities of Households for Own Use + Activities of Extraterritorial Organisations and Bodies

3 CMU analysis

The development of the CMU is based on a number of proposals whose macroeconomic impact cannot in principle be routinely and explicitly analysed in standard general equilibrium models. For instance, some of the legislative proposals imply strengthening and expanding the role of the European Securities and Markets Authority (ESMA); others (European Commission 2015a, 2015b, 2017, and 2018a) entail distinctive regulatory legislations such as Regulation (EU) 2017/1129 amending the former regime for securitisation, and Regulation (EU) 2017/1991 creating a new regime for European venture capital funds and establishing the European Social Entrepreneurship Funds.

In this section we evaluate the macroeconomic impact of removing national regulatory barriers to facilitate cross-border activity and investment within the EU capital market using the RHOMOLO modelling framework and taking advantage of the current macroeconomic and financial economic literature. In particular, we hereby concentrate on the evaluation of the following proposals:

- i. the proposal for a Regulation on crowdfunding (and a corresponding amendment to Directive 2014/65/EU on the Markets in Financial Instruments MiFID II);
- ii. the proposal to facilitate cross-border distribution of investment funds;
- iii. the proposal on the assignment of financial claims and a guidance on third party effects of securities to improve legal security for cross-border investment.

The broad idea behind such a proposed regulatory framework is to create the necessary incentives to improve the market-based financial system as a complement of bank-based finance of investments (Veron and Wolff 2015; Quaglia et al. 2016; Sapir et al. 2018; ESRB 2014). This should improve the efficiency of the whole EU financial market and reduce the price of capital, as postulated by most of the theoretical constructions adopted in the current economic literature on the deepening and integration of the EU capital market though the decrease in the cost of capital is rather modest according to Bekaert and Harvey (2000). Essentially, standard neoclassical theory predicts positive growth effects from more integrated financial markets based on the reduction of capital cost driven by capital flows moving from capital-abundant regions towards capital-scarce ones. However, the existing empirical evidence does not unambiguously confirm this theoretical finding and tends to conclude that there are only limited effects at best. For instance, Bekaert et al. (2005) and Quinn and Toyoda (2008) find positive growth effects, but Rodrik (1998) and Edison et al. (2002) only find mixed effects. On the contrary, Bhagwati (1998), Neumann et al. (2009), Stiglitz (2004), and Levchenko et al. (2009) find negative effects of financial integration on growth through the reduction of the cost of capital.

An alternative transmission channel has been identified by Gehinger (2013) who, in the European context, finds financial openness to be able to generate a strong positive impact on economic growth and factor productivity. Other studies affirm that financial openness directly affects factor productivity by stimulating financial development (see, among others, Raian and Zingales 2003). According to Gourinchas and Jeanne (2006), analysing the effects of international financial integration on productivity is more important than examining its investment growth effects. Typically, financial openness is expected to have a positive impact on productivity via a better and more efficient allocation of resources (Kose et al. 2009; Mishkin 2006), as well as due to easier access

to investment opportunities (Giannetti et al. 2002). Furthermore, financial openness may result in less capital constraints, permitting the economy to engage in more productive investments (Acemoglu et al. 2006; Acemoglu and Zilibotti 1997). In addition, capital account openness may spur financial development (Baltagi et al. 2009; Klein and Olivei 1999). According to Hsu et al. (2014), innovation companies need a developed financial equity market to attract more funds for more innovative projects with higher risk and expected returns. In fact, a well-developed financial system would also ensure the availability of more funds for innovative companies that are more productive and ensure long term growth. More freedom in financial transactions contributes to a better risk diversification and encourages foreign investors to shift at least part of their investments from safe and low-yield to risky but more profitable locations (Obstfeld 1994; Sandri 2010).

In line with the economic literature summarised above, productivity shocks appear to be the most appropriate transmission channel to evaluate the potential impact of more integrated capital markets in the European Union. Thus, we frame our simulation strategy in accordance to this approach within RHOMOLO. In particular, we aim at capturing the system-wide impact of greater financial openness within the EU through changes in TFP.

3.1 Simulation setup

We assess the potential economic impact of proposals i, ii, and iii reported in the previous section by implementing a permanent TFP shock in the RHOMOLO model. Such a shock is based on Gehinger (2013) who estimates the impact of financial openness on TFP growth, that is the TFP elasticity to financial openness. To the best of our knowledge, this study is the most up-to-date analysis measuring such elasticity in relationship with the EU capital market. The estimated elasticity is equal to 0.043 with a standard error of 0.012 (Gehinger 2013, Table 2). Applying such elasticity to the time series index of financial openness by Chinn-Ito (2008) and data on TFP levels for the 28 Member States (MS) from 1996 to 2017 (AMECO database), we are able to reconstruct the evolution of TFP up to 2017 for each of the 28 EU MS solely driven by financial integration.

We simulate three alternative scenarios, Low, Central, and High, based on the uncertainty attached to the estimated TFP elasticity to financial openness quantified via the standard deviation associated to the point estimate by Gehinger (2013). Namely, for the construction of the Central scenario we use the point estimate of 0.043, while the Low and High scenarios use the point estimate \pm two standard deviations, respectively.

The three newly created TFP series (one for each scenario) are thus taken as benchmark to include the TFP shocks in the model.

The idea behind our simulation is the following: we assume that the further development of the capital markets union associated to the regulatory proposals on cross-border activities may exert effects comparable to those observed during the 3 years either before the adoption of the euro (for the old EU MS) or before the entrance into the EU (for newer MS). Thus, we proceed as follows: for the MS that adopted the euro in 1999, the TFP shock is defined as the period by period percentage changes computed during the period 1997-1999 with respect to the 1996 TFP level (bear in mind that such changes are solely due to financial openness by construction, as explained above). The third and last period's TFP change is then kept as a permanent shock in the model. We use the same approach for the MS such as Denmark, Sweden and UK that have negotiated the right to opt-out from participation to the Eurozone. For the MS that joined the EU at a later stage, and are therefore still in the adjustment phase, the TFP shock is created using a different reference period which is the three years preceding the entrance in the EU. For instance, Romania is an EU MS since 2007, it is currently outside the Eurozone, but committed to the adoption of the euro once it fulfils the necessary conditions. In this case, the reference period is 2005-2007.

3.2 Results

The immediate effect of a positive TFP shock is a fall in the price of both capital and labour. Lower production costs cause an increase in the demand of labour and capital increasing therefore production in real terms. The lower cost of the primary factors of production drives a general reduction in the price of commodities producing positive terms of trade effects particularly towards the rest of the World (ROW) and improving the competitiveness of EU regions through positive changes in exports, stimulating economic growth even further.

The adjustment mechanisms described above are reflected in the numbers reported in Table 3.1 showing the percentage deviations from the initial steady-state of some key economic variables for the following years: 2020, 2025, and 2030.² We observe a sharp increase in GDP and employment by period 2020, two years after the implementation of the policy, in all three scenarios. In the other periods we estimate even bigger changes in GDP and employment, meaning that the economy expands further period by period through capital accumulation. Not surprisingly, the magnitude of the impact is different depending on the adopted scenario. In 2030, the GDP is likely to increase by between

² The variables are the following: Gross Domestic Product (GDP), employment, household consumption, exports to the ROW, and the consumer price index (CPI).

0.21% and 0.75%, with the central estimates being equal to +0.48% with respect to the initial steady-state. As for employment, our modelling simulations suggest a minimum impact of +0.07% and a maximum impact of +0.26% from the initial steady-state (corresponding to 147 and 547 thousand FTEs respectively), with the central estimate being equal to +0.17 (equivalent to 353 thousand FTEs).

Table 3.1: Macroeconomic impact on key economic variables (percentage changes from initial steady-state) - Low, Central, and High scenarios

	Low Scenario			Central Scenario			High Scenario		
	2020	2025	2030	2020	2025	2030	2020	2025	2030
<i>GDP</i>	0.15	0.19	0.21	0.35	0.44	0.48	0.54	0.68	0.75
<i>Employment</i>	0.03	0.06	0.07	0.08	0.14	0.17	0.12	0.21	0.26
<i>Household consumption</i>	0.09	0.13	0.15	0.20	0.29	0.33	0.32	0.46	0.52
<i>Export to the ROW</i>	0.29	0.34	0.37	0.66	0.76	0.83	1.03	1.19	1.30
<i>CPI</i>	-0.09	-0.10	-0.10	-0.21	-0.22	-0.23	-0.33	-0.34	-0.36

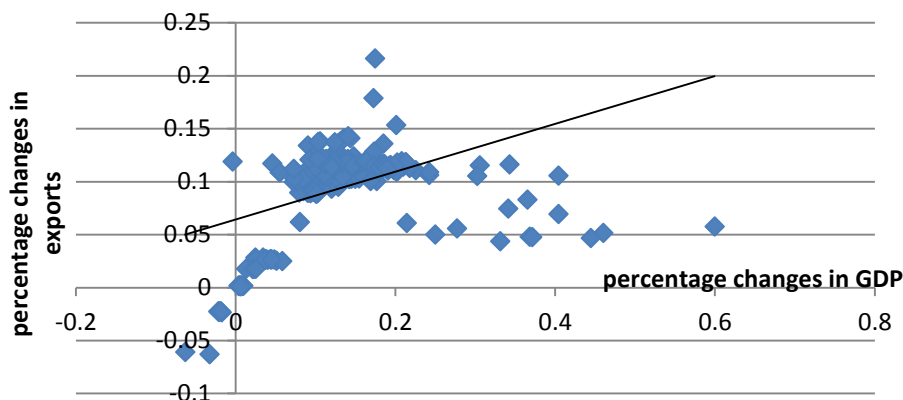
Interestingly, the employment changes are lower than those of GDP, meaning that capital is increasing proportionally more than GDP. This reflects substitution effects in favour of capital generated by a relatively greater reduction of the price of capital compared to the price of labour, both measured in efficiency units.

Our results also suggest that household consumption benefits from the policy shock. The fall in prices generates an increase in real income that can be used by consumers. The price reduction also provides an additional stimulus to exports. The EU economy thus becomes more competitive, increasing its exports to the ROW by 0.37%, 0.83% and 1.3% under the Low, Central and High scenario, respectively.

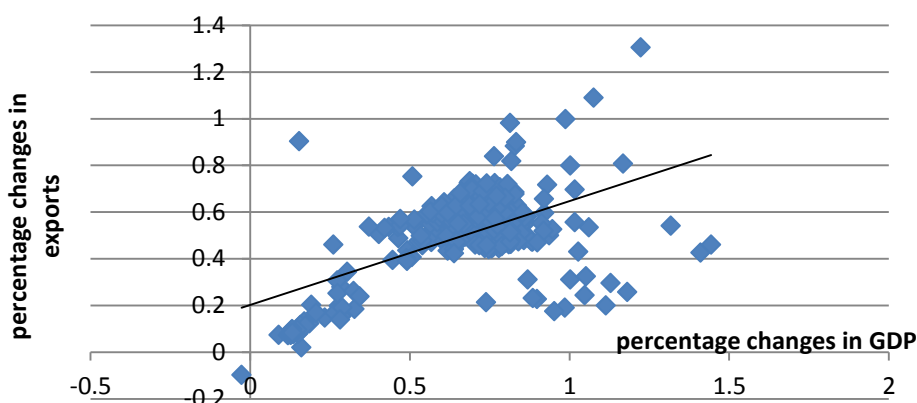
With the aim of identifying the sources of the increased competitiveness at the regional level, in Figure 3.1 we plot changes in the regional GDP (horizontal axes) against changes in exports (vertical axes) obtained under the Central scenario. In almost all regions, in the short run (Panel a) positive GDP changes are correlated to positive changes in total export. Both in the short-run (panel a) and in the long-run (panel b) we observe a positive correlation between changes in the GDP and exports, with the correlation being weaker in the short-run as supply constraints are in place to mimic adjustment delays of firms. As explained above, the fall in the price of primary factors generates a fall in commodity prices boosting regional competitiveness particularly with the ROW. It is worth noticing that the regions above the fitting lines are those benefiting the most from such improved competitiveness effects, while the rest of the regions experience smaller changes in export.

Figure 3.1: Impact on the relative competitiveness of regions: short-run and long-run - Central scenario

Panel a) Short-run



Panel b) Long-run



To summarise, we have reported the expected macroeconomic impact of a number of proposals by the European Commission aimed at further developing the CMU by facilitating cross-border activity and investment and diversifying the sources of funding across the EU. Our results suggest that such measures might have in the long-run extensive positive effects in terms of GDP, employment, and competitiveness gains.

Our simulation strategy starts from an empirically-based transmission channel suggesting that improved accessibility and diversification of the financial system is strongly linked with the factors' productivity. The source of such an effect lies in a more efficient allocation of resources that is likely to arise under a more open/integrated financial system.

We made a number of assumptions in the preparation of our simulation scenarios. In particular, we assumed that the further development of the CMU may have effects comparable to those observed during the 3 years either before the adoption of the euro

(for the old EU MS) or before the entrance into the EU (for newer MS). We believe this assumption to be reasonable in the context of the current economic evidence and given data availability constraints. Besides, we manage the uncertainty related to the assumptions we made by providing a range of estimates by using different values for the key TFP elasticity. We are therefore confident that the sign, direction, and magnitude of the impact are likely to fall in the ranges reported above.

4 SMS analysis - Start-up and Scale-up initiative

The Start-up and Scale-up EU initiative aims to create a favourable environment to innovation, entrepreneurship, and competitiveness (European Commission 2016a and 2016b). With this initiative, the European Commission is determined to eliminate the administrative and regulatory barriers currently existing in the fragmented EU Single Market that may particularly constraint start-up and scale-up companies in their growth potential. The initiative brings together a number of new actions that complement existing EU funding instruments such as the EFSI and regulatory frameworks such as the SMS, the DSM, and the CMU. In particular, the Start-up and Scale-up EU initiative addresses the following issues:

- i. improved access to finance. The European Commission, as part of the CMU Action Plan, together with the EIB Group, has launched a Pan-European Venture Capital Fund of Funds to attract private funding from institutional investors into the EU venture capital asset with the aim to help innovative start-up to scale up, create sustainable jobs, and increase the value of firms in the market. The EU provided an initial investment of €400 million which is expected to trigger around €1.6bn in venture capital funding over the period 2018-2020 (European Commission 2018b);
- ii. second chance for entrepreneurs. The Commission intends to help firms in financial difficulties through a legislative proposal on insolvency law;
- iii. simpler tax filings. The Commission is committed to modernise and simplify the Value Added Tax (VAT) system reducing complexity and fragmentation at the EU level. It will reduce tax compliance costs making cross border trade more attractive to start-ups.

In this section we only focus on the macroeconomic impact of improved access to finance for start-ups (i). The remaining two actions (ii and iii) are still under discussion, and there are not enough details to allow us to set up an analysis capable of quantifying the direct economic impact of these initiatives.

We simulate an improved access to finance for start-up companies using the spatial economic model RHOMOLO. The increased access to finance for start-up companies should increase direct investments and help these companies to scale-up, generating in turn additional positive impacts in the whole economy. We identify in the change of the model's calibrated risk premium (RP) the more appropriate transmission channel to evaluate the potential economic impact of greater accessibility to finance for small and innovative companies.

The RP is a parameter calibrated as the difference between the market return and the risk free rate.³ By reducing this gap, we immediately impose a fall in the user cost of capital which increases the profitability of the latter. The direct impact therefore entails a less expensive capital that stimulates investments, capital accumulation and raises the capital/labour ratio in regional economies.

Given the features of the RHOMOLO model, the immediate positive incentive on investment produces both direct demand- and supply-side effects. However, in order to reflect delays in agents' response, in the first period of the simulations we impose short-run capacity constraints, meaning that accumulation of capital stock is prevented in this time frame. This means that in the first period of simulation the economy responds to the shock as if it was in operation a conventional demand-side shock with no direct supply-side response. In the next periods, the demand-side effect of the shock is also accompanied by direct supply-side effects through increased capital stock. The reader should bear in mind that this combination of demand- and supply-side shocks has two conflicting effects on commodity prices. The demand-induced type of shock puts initial upward pressure on prices, but then capital accumulation puts downward pressure on prices of goods. The final impact is naturally a generalised fall in all prices.

4.1 Simulation setup

The European Commission believes that the initial contribution of €400 million to the Pan-European Venture Capital Fund-of-Funds programme can generate an additional €1.6 billion of venture capital assets from private sources over the period 2018-2020 (European Commission 2018b). The Fund-of-Funds is then expected to trigger in the future an estimated €6.5 billion of new investment in breakthrough innovation projects by start-ups with potential to grow across Europe (European Commission 2016a). We therefore translate a potential availability of funds of around €500 million per year into a fall in the actual price of capital through a reduction in the market RP. We then run the

³ Although in the calibration each regions start with the same risk free return, the market return is different across regions in order to accommodate capital terminal conditions. Therefore, each region has a different level of RP in the initial steady-state.

shock forward up to year 2030 implicitly assuming a total cumulative investment shock of €6.5 billion.

It has been estimated that only few start-ups survive beyond the critical phase of 3 years (European Commission 2016b). In order to reflect the current and potential survival rates we build the following Low, Central and High scenarios. In the High scenario we assume that all firms will be able to survive and scale-up. This is a very ambitious objective and, correspondingly, a fairly generous assumption. However, we base our hypothesis on the fact that the Start-up and Scale-up Initiative is only one of a number of existing actions (such as the CMU, the SMS, and the DSM) that the European Commission is determined to implement to allow start-ups to grow and do business across Europe. Under the Central scenario we instead assume that, after 3 years, 25% of start-up companies will face bankruptcy and will dissipate all the accumulated assets. Under the Low scenario, we assume that there would be an additional 25% of start-ups unable to survive beyond the 6th year.

4.2 Results

Figure 4.1 plots the percentage changes of EU GDP from the initial steady-state obtained under the three scenarios. According to our simulation exercise, we observe a permanent economic expansion in all three scenarios, with the GDP increase expected to lie between 0.02% and 0.036% from base year values in year 2030 (corresponding to €2.8 and €4.7 billion added to EU GDP, respectively). Furthermore, as depicted in Figure 4.2, our modelling experiment suggests a sharp increase in employment by period 2020, two years after the implementation of the policy, in all three scenarios. In the other periods, we estimate even bigger changes in employment, meaning that the economy expands further period by period through capital accumulation. Not surprisingly, the magnitude of the impact is different depending on the adopted scenario. In 2030, employment is likely to increase by between 30 and 50 thousands FTEs with the central estimates being equal to 40 thousands FTEs with respect to the initial steady-state.

Figure 4.1: Macroeconomic impact on GDP (Percentage changes from initial steady state) - Low, Central, and High scenarios

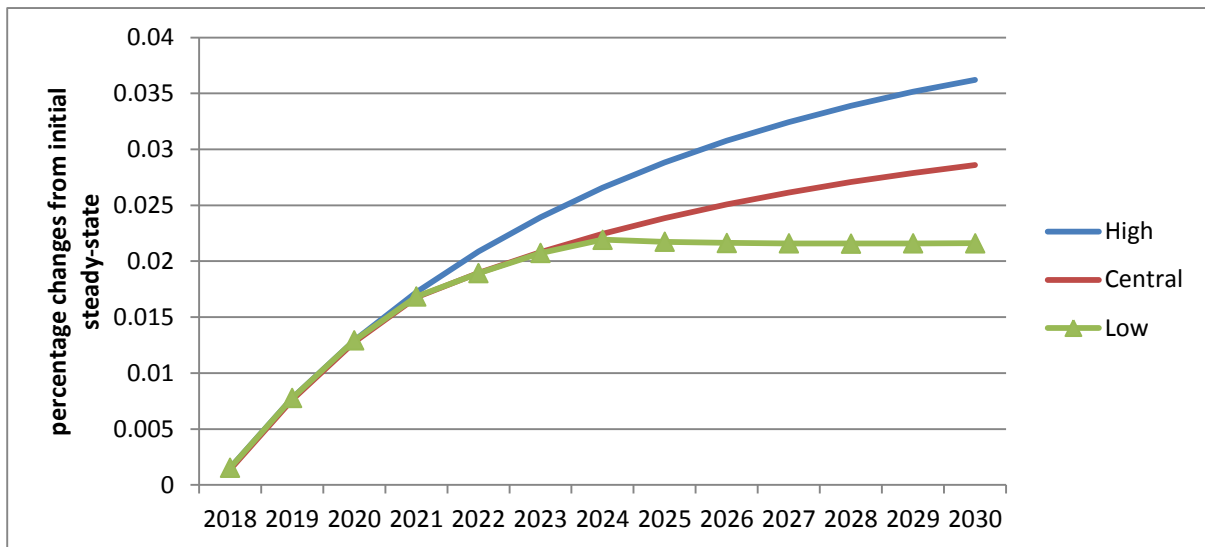
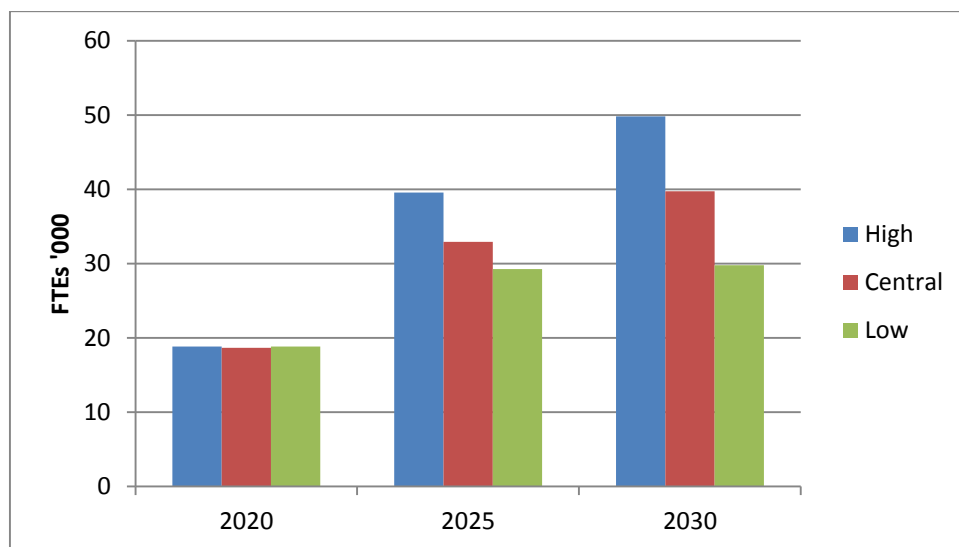


Figure 4.2: Macroeconomic impact on employment (thousands of FTEs) - Low, Central, and High scenarios

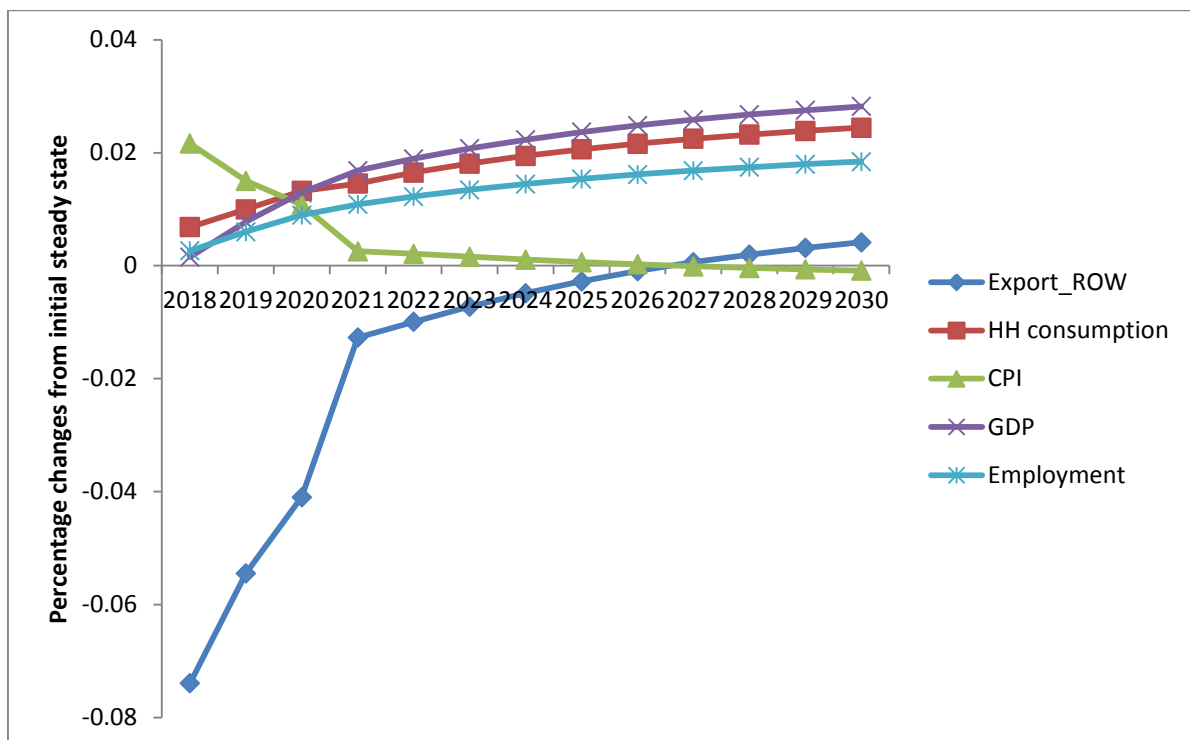


To allow the reader to better understand the adjustment mechanisms underlying the model, in Figure 4.3, we plot the percentage changes from the initial steady-state of selected variables for the EU as a whole obtained under the Central scenario. We can see that GDP, employment and household consumption all increase period by period eventually settling to a new steady-state where all variables grow at a constant rate. We observe that in the first period the change in GDP is slightly lower than that of employment. However, from period 2 onwards, the opposite is true. In the first period, the supply of capital is fixed: thus, the additional demand of capital is fully offset by an increase in the rate of return to capital making labour the only alternative. From period 2 onwards, constraints on capital are relaxed and substitution away from labour becomes

effective and driven by a fall in the price of capital. This also means that, as soon as capital accumulates, the capital labour ratio increases over time.

Exports to the ROW are below base year values until 2026. We indeed observe a loss in competitiveness as a result of an increase in prices, as shown in figure 4.3 by the CPI curve. After 2026, prices fall below their base year values and positive competitiveness effects come into play, in turn rising exports to the ROW. The fall in prices also generates an increase in real income that makes available additional resources to consumers. Indeed, household consumption is increasing over time until settling in 2030 at 0.018% from base year values. It is worth noticing that consumption and export increase less than the GDP. The corresponding curves expressed in percentage deviations from steady-state are below the GDP curve. Given that government expenditure in this run has been exogenously fixed, the GDP increase is dominated by a massive rise in investments.

Figure 4.3: Macroeconomic impact on selected key variables (percentage changes from initial steady state) - Central scenario



To summarise, we have reported the expected macroeconomic impact of the Pan-European Venture Capital Fund of Funds launched by the European Commission in cooperation with the EIB and the European Investment Fund (EIF) on November 22nd 2016 in the context of the 'the Start-up and Scale-up initiative'. Our results are based on the expectation that the Venture Capital Fund of Funds will be able to generate and allocate €6.5 billion of investments by 2030. Our modelling strategy assumes €500

million of allocated investments each year until 2030. The estimated GDP effects by 2030 are in the range of €2.8-4.7 billion, while the number of new jobs created could be up to 50 thousand. As for any modelling simulation scenario analysis, a number of assumptions have been made and therefore these results should be regarded with caution.

5 SMS analysis - Procurement package

With the aim to develop and reinforce the SMS (European Commission 2015c), the European Commission is promoting a number of initiatives with the purpose of removing obstacles to investments within the Single Market. The objective of one of these initiatives is to help national governments and local authorities in managing large procurement projects (European Commission 2017b) by assisting them in the phases of initial procurement procedures, projects' evaluation, and applications of best practices to handle major cross-border projects. The aim of this ex-ante mechanism is to improve both the effectiveness and the attractiveness of public spending of MS. The implementation and application of this initiative has the potential of generating substantial benefits in terms of growth and jobs driven by efficiency improvements in the public sector that are expected to spread to all the other sectors of the economy. According to the economic literature (see, among others, Aschauer 1985 and 1988), the productivity of public investment has a powerful impact on the productivity of the whole economic system.

This section explains how we evaluate the economy-wide impact of the ex-ante mechanism in public procurement by using the RHOMOLO model. Note that we only focus on public capital expenditures, given that the policy mentioned above aims at improving procurement procedures for cross-border and large public infrastructure projects.

5.1 Simulation setup

We initially run a baseline scenario that consists of a permanent increase in public capital expenditures. In such baseline, the efficiency of public capital, defined as the output elasticity of public capital, is set to its default model value of 0.1.⁴ We then compare the baseline with a set of counterfactual scenarios involving an increase in efficiency of public capital that is assumed to be due to the policy introduced above and whose magnitude is based on the potential efficiency gains in public investments estimated in IMF (2015) and on the cost saving estimates of public procurement made by Europe

⁴ Estimates of the output elasticity of public capital are taken from Bom and Ligthart (2014).

Economics (2006) and Vogel (2009). Our objective is to evaluate and explore the effects of the increase in public sector productivity by manipulating the output elasticity of public capital in the production function. Higher values of this elasticity generate positive output and income effects, thereby increasing the attractiveness of public investments. Results will be presented in terms of additional GDP and jobs with respect to the baseline scenario.

We construct three alternative scenarios, Low, Central, and High, depending on the assumed changes in efficiency of public capital. Our hypotheses are based on estimated potential efficiency gains in public investments and costs savings in public procurements. In an assessment of the quality of public investment management practices, the IMF (2015) finds that the average efficiency gap in public investment efficiency for the EU28 countries is 15%. Hence, the average EU28 country is 15% from an estimated public investment efficiency frontier.⁵ In its analysis, the IMF suggests that up to two-thirds of the efficiency gap could be closed by strengthening the public investment management institutions. A survey-based analysis contained in Europe Economics (2006) estimates that costs savings related to transparency and competition in public procurement can range between 2.5%-10%.⁶

We translate the estimated efficiency gains and cost savings into changes in public capital efficiency by taking into account two additional measures: the country-specific share of large cross-border procurement projects over total public procurement, and a country index of administrative performance. This means that the efficiency improvement η that we assume in the simulation scenarios, that is the change that we apply to the output elasticity of public capital, is defined by equation (5.1) as follows:

$$\eta = \rho\alpha q \tag{5.1}$$

where ρ is the efficiency improvement that we expect with the fully operative new regulation on public procurement; α is the share of the value of the procurement projects over total procurement that may benefit by the ex-ante mechanism; and q is a parameter employed to allow for larger positive effects to countries currently characterised by relatively worse administrative performances, and lower positive effects to well-performing countries which are therefore already close to the efficiency frontier.

⁵ Estimates of the public investment efficiency index and the efficiency gap for the EU28 MS based on IMF (2015) were kindly provided by Gerd Schwartz and Geneviève Verdier from the IMF.

⁶ These estimates are based on 2002 contract values (Europe Economics 2006).

Table 5.1: Data used in the construction of the scenarios and estimated changes in the output elasticity of public capital

	Indirect cross-border share of value of awards	Direct cross-border share of value of awards	Index of admin. performance	Scenarios: Changes in output elasticity %		
				Low	Central	High
Austria	19.8	5.2	1.2	0.8	1.2	1.5
Belgium	36.1	5.1	0.7	2.9	4.5	5.8
Bulgaria	15.4	4.5	0.8	1.4	2.2	2.8
Croatia	17.4	4.7	0.8	1.3	2.1	2.7
Cyprus	5.9	13.8	1.3	0.6	0.9	1.2
Czech R	30.2	3.0	1.1	1.7	2.6	3.3
Denmark	16.7	4.8	1.2	0.9	1.3	1.7
Estonia	22.3	7.4	1.3	0.9	1.4	1.8
Finland	24.0	2.9	1.3	0.8	1.3	1.6
France	12.2	1.8	0.7	1.0	1.5	2.0
Germany	16.0	2.1	1.0	0.9	1.4	1.8
Greece	11.5	3.4	1.0	0.9	1.4	1.8
Hungary	22.5	3.6	1.1	1.3	2.0	2.6
Ireland	20.8	10.0	1.2	1.2	1.9	2.5
Italy	24.2	2.6	0.5	1.9	2.9	3.8
Latvia	16.0	3.2	1.0	1.0	1.5	1.9
Lithuania	20.9	7.1	1.0	1.7	2.6	3.4
Luxembourg	18.7	13.3	1.1	1.6	2.5	3.2
Malta	6.0	19.6	1.1	1.0	1.6	2.0
Netherlands	17.5	2.8	1.2	0.8	1.3	1.6
Poland	23.2	1.9	0.9	1.5	2.3	3.0
Portugal	25.9	6.8	1.1	1.3	2.0	2.6
Romania	24.0	7.1	0.6	2.2	3.4	4.4
Slovakia	24.4	6.4	1.0	1.8	2.9	3.7
Slovenia	17.4	7.8	1.1	1.3	2.0	2.5
Spain	27.0	1.2	0.8	2.0	3.1	3.9
Sweden	20.4	3.4	1.2	1.0	1.5	1.9
UK	22.3	2.5	1.0	1.5	2.3	3.0

To the best of our knowledge, there are no estimates on the numbers and values of the large procurement projects that are expected to be directly impacted by the policy. For this reason, α is proxied with the direct and indirect cross-border procurement projects' shares of the total value of contracts awarded between 2009 and 2015. We report such numbers (found in European Commission 2017c) in the first two columns of Table 5.1.

The parameter q is derived from an index of country administrative performances. The numbers reported in the third column of Table 5.1 are taken from Afonso et al. (2005) for the older EU MS and from Afonso et al. (2010) for the newer MS. We create cut-off

points for the distribution of the performance index across regions by splitting the sample into quintiles. We then assign the following values to q : 0.6 to the 1st quintile (good performers, that is associated with the highest values of the index), 0.8 to the 2nd quintile, 1.0 to the 3rd quintile, 1.2 to the 4th quintile and 1.4 to the 5th quintile (bad performers, that is associated with the lowest values of the index). This allows public investment to be more attractive in countries where public sector efficiency is relatively lower. Essentially, we expect larger marginal benefits in those MS which currently are relatively bad performers.

In the construction of the three simulation scenarios, the parameters α and q remain fixed while the efficiency improvement ρ varies as follows: 0.05 in the Low scenario, 0.075 in the Central scenario, and 0.10 in the High scenario, reflecting alternative hypotheses on the expected efficiency increase related to the implementation of the policy (with 10% being the maximum expected increase). The full changes implemented in our model simulations can be found in the last three columns of Table 5.1.

It is interesting to quantify the cost saving implied by our scenarios, that is the amount of money saved thanks to fully functioning better public procurement procedures. Given the estimates reported in Table 5.1 and applying the shares of expected public investments directly affected by the ex-ante mechanism on the calibrated public investments in RHOMOLO, the cost saving associated to the policy analysed here amounts to €4 billion under $\rho = 0.1$ (High scenario), to €3 billion under $\rho = 0.075$ (central scenario), and to €2 billion under $\rho = 0.05$ (Low scenario). These numbers are consistent with the estimates made by European Commission (2015d), from which we quote the following: "Public procurement uncertainties contribute to the general cost overruns. Considering that 9 out of 10 big transport infrastructure projects run over budget on average by 28%, the overall cost increase of projects above €700 million registered in TED could amount up to €4 billion per year. Although the factors leading to overruns are many, improving this situation even marginally, due to better public procurement procedures, can imply large savings for taxpayers."

Our scenarios are built specifically for the 28 MS. However, the RHOMOLO model is disaggregated into 267 NUTS 2 regions, therefore all the regions belonging to the same country received the same country-specific shock.

5.2 Results

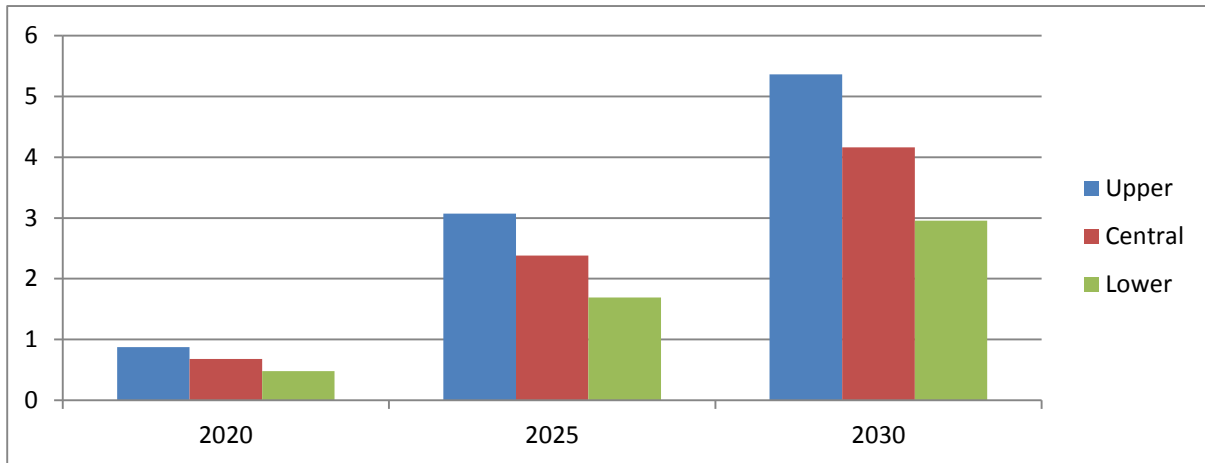
Table 5.2 contains the results of the three scenarios expressed in terms of percentage changes from the initial steady-state for GDP and employment for the years 2020, 2025, and 2030.

Table 5.2: Macroeconomic impact on GDP and employment (percentage changes from initial steady state) - High, Central, and Low scenarios

	2020	2025	2030
High			
<i>GDP</i>	0.0017	0.0047	0.0074
<i>Employment</i>	0.0004	0.0015	0.0025
Central			
<i>GDP</i>	0.0013	0.0037	0.0057
<i>Employment</i>	0.0003	0.0011	0.0020
Low			
<i>GDP</i>	0.0010	0.0026	0.0041
<i>Employment</i>	0.0002	0.0008	0.0014

Our simulations suggest that, under the Central scenario, improvements in public procurement procedures could result in a GDP rise of 0.0057% by 2030 from its base year values, with a potential range lying between +0.0041% and +0.0074%. Furthermore, we show that augmenting public sector efficiency is effective and able to generate a significant amount of additional jobs. By 2030, employment is expected to increase by an amount ranging between +0.0014% and +0.0025%, with the middle point estimate being around 0.002%. Figure 5.1 shows that the number of additional jobs increases constantly period by period. Under the Central scenario, the system-wide impact on jobs yields 4.2 thousand FTEs by 2030. In the same year, the estimated interval is in the range of 3.0-5.4 thousand FTEs depending on the assumed intensity of the efficiency improvement.

Figure 5.1: Additional FTEs (thousand) with respect to the steady state - High, Central and Low scenarios



As for the sectoral impact of the policy shock, the Primary (A and B_E) and the Manufacturing sectors appear to benefit relatively more than the service sectors as suggested by Figure 5.2 plotting the percentage changes from the steady state for the three scenarios and for the years 2020, 2025, and 2030.

According to our analysis, EU households are likely to benefit from the ex-ante mechanism for public procurement. Figure 5.3 shows the gains in household consumption stemming from general equilibrium efficiency improvements. This result is not unexpected, since efficiency improvement in the public sector is likely to spread through the economy thanks to the fall in commodities prices that makes real wages and real income of households increase.

Figure 5.2: Sectoral output effects (percentage changes from initial steady-state) - Central scenario

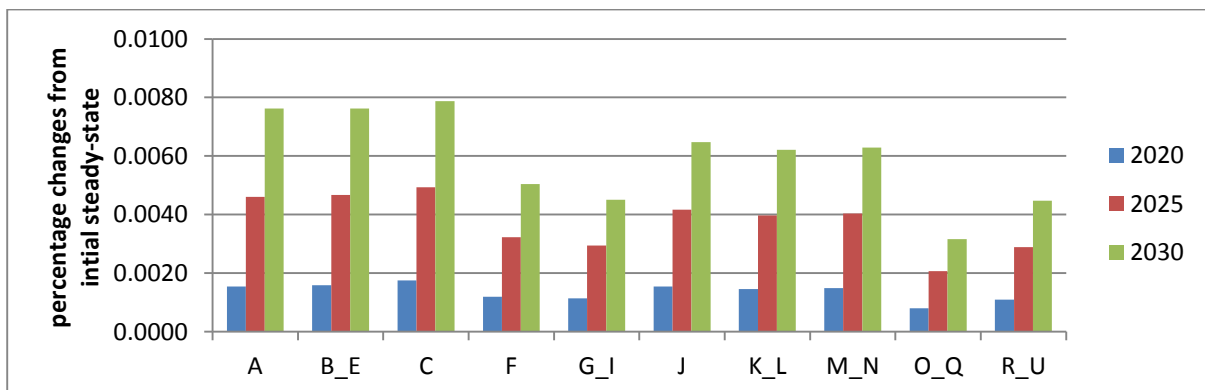
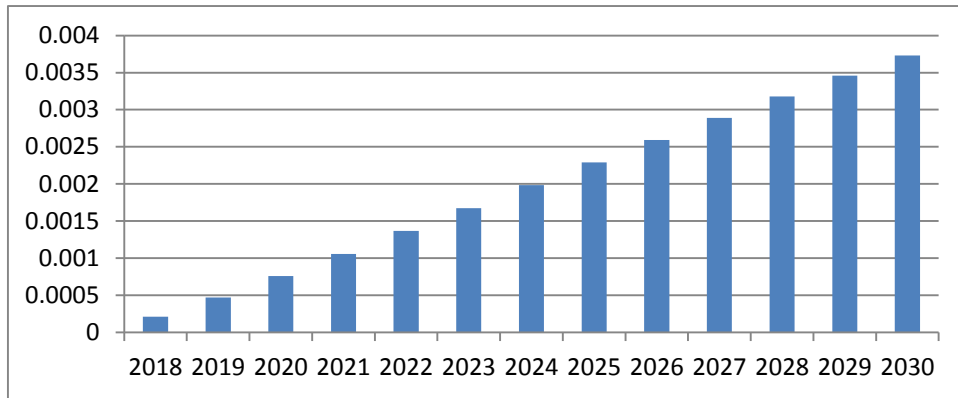
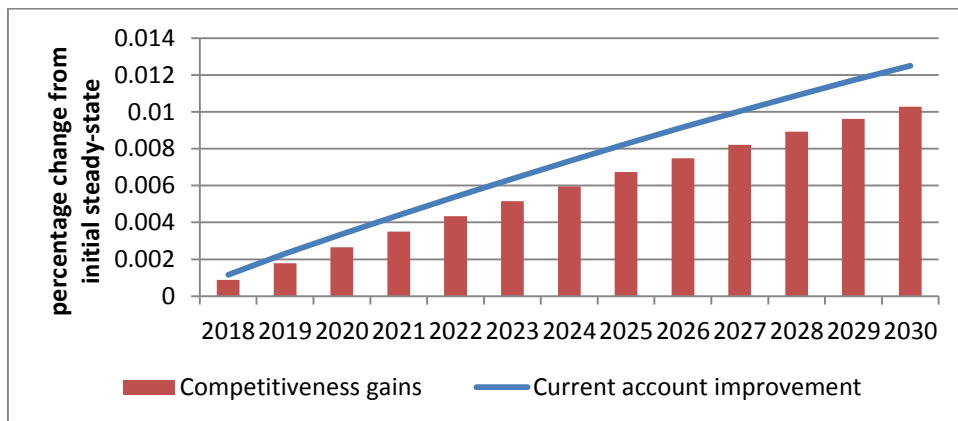


Figure 5.3: Impact on household consumption (percentage changes with respect to the steady state) - Central scenario



As already mentioned above, the increase in public capital efficiency is expected to generate system-wide efficiency gains. This means that the economy becomes more competitive through positive terms of trade effects. In Figure 5.4 we plot the competitiveness effects and the potential improvement in the current account generated by the implementation of the EU initiative on public procurement with positive effects on public sector efficiency. The bars represent the percentage deviations from the baseline in the exports to the rest of the world following the assumed improvement in public sector efficiency. The blue line represents the related current account improvements. Thus, our modelling experiment suggests that the EU as whole could gain quite significant benefits from an efficiency improvement in the public sector in terms of competitiveness and current account surplus. Positive competitiveness effects boost the economy even further by increasing the GDP multipliers and the potential for additional jobs.

Figure 5.4: Competitive gains and current account improvements (percentage changes from initial steady state) - Central scenario



To summarise, we have reported the expected macroeconomic impact of the ex-ante mechanism proposed by the European Commission in order to improve public procurement procedures of the EU MS, an initiative developed to remove obstacles to

investments within the SMS. The estimated macroeconomic impact is based on robust empirical evidence found in the literature. In particular, in order to set up our policy simulation we start with existing estimates of cost savings in public procurement brought about by more transparency, better discipline, and the adoption of best practice in the selection and evaluation of major cross-border infrastructure projects. We believe that the cost saving estimates reported by Europe Economics (2006) are a good match for what can be reasonably expected should the ex-ante mechanism envisaged by the European Commission become fully operational in the context of the Single Market. Based on RHOMOLO calibrated data, the cost savings associated with that policy would range from a minimum of €2 billion to a maximum of €4 billion. Translating these numbers in terms of further system-wide economic effects through model simulations, this results in an estimated increase in GDP by 2030 of 0.0074% in the High scenario (corresponding to 966 million), and of 0.0041% in the Low scenario (corresponding to 532 million). As far as employment is concerned, our simulations suggest an increase of jobs of 4.2 thousand FTEs by 2030 in the Central scenario, with a Low-High range between 3.0 thousand and 5.4 thousand FTEs.

Some caveats are required. In the absence of precise information of the cost savings expected by the implementation of the policy, we approximate the efficiency gains measure with estimates found in previous works. To keep the uncertainty at the minimum, we provide three scenario outcomes reflecting three levels of achievable efficiency gains. However, we believe that the estimates used are in line and consistent with the first approximations contained in European Commission (2015d). Moreover, this evaluation focuses only on one potential channel of public sectors efficiency gains. Potentially, there could be a number of distinctive channels, though minor, that might be appropriate to consider in future works.

6 DSM analysis

The Digital Single Market (DSM) strategy put forward by the EU Commission in 2015 (European Commission 2015e) has the objective to improve the digitalization of the economy by reinforcing the Information and Communication Technology (ICT) sector through a set of rules and proposals that create the incentives for strengthening and advancing cross-border digital activities for consumers and businesses. It has been estimated that EU consumers could save €11.7 billion (European Commission 2015e) each year if they could choose from a full range of EU goods and services when shopping online. The overall and additional annual impact on GDP is expected to amount to €415 billion (Boston Consulting Group 2016). The estimated impact is derived from a study by the European Parliamentary Research Service (2017) and is based on a combination of

existing research conducted by Copenhagen Economics (2010) and GHK Consulting Ltd. (2014).

This estimate represents only the direct impact of a fully functioning DSM. In this note we complement such economic evaluation by focusing on the indirect economy-wide structural effects of changing the regulation for cross border digital activities. Thus, we do not evaluate separately all the regulatory measures proposed under the DSM strategy of the European Commission. Rather, we use a general approach by making assumptions on the link between the economy and the DSM-related initiatives such as the Artificial Intelligence communication adopted in April 2018 (European Commission 2018c), the proposal for a regulation on a European electronic communication code (European Commission 2016c), and the data proposals such as the regulation on the free flow of non-personal data (European Commission 2017d) and the re-use of public sector information (European Commission 2018d).

We carry out our economic analysis by using the RHOMOLO model, which is particularly suitable for this type of analysis as it allows capturing both demand- and supply-side effects of the DSM as well as the geographical spillover effects associated to improved cross-border digital activities within the EU. We identify two potential transmission channels through which a fully operational DSM could impact the EU economy. Firstly, it would reduce non-tariff trade barriers and improve allocative efficiency for cross border digital activities, leading to a cost reduction for firms and final consumers when purchasing digital services. Secondly, it can potentially spur efficiency gains in the use and provision of digital services. The latter are in our analysis captured by a TFP shock to the overall economy. Consequently, we expect substantial and wide competitiveness effects as a result of the DSM strategy mainly driven by a fall in domestic prices (not only in the ICT sector).

6.1 Simulation setup

The estimated reduction in cost from a fully functioning DSM is converted into a reduction in non-tariff trade barriers both for transactions within EU MS and for trade between EU MS. In RHOMOLO this is done by reducing the iceberg type trade costs such that the total reduction in trade costs within and between EU MS corresponds to the expected cost reduction from DSM. This causes a fall in prices which benefits firms in all business sectors as well as final consumers in the economy.

Furthermore, it is assumed that the DSM leads to an improvement in TFP. The change in TFP is introduced into the model by using a simple accounting approach according to which the pre-identified direct impact of DSM is assumed to directly augmenting the

value added in the economy. The period by period TFP improvement is then calculated as follows:

$$\dot{A} = \frac{\delta}{Y} Z \quad (6.1)$$

where \dot{A} represents the change in TFP; Y is total value added; Z is the regionalised direct impact of DSM; and δ is the output elasticity derived from Kanacs and Siliverstovs (2016) adjusted for ICT intensity. We furthermore assume that the gains from the DSM are split across the 267 NUTS 2 regions represented in the model proportionally to their shares of regional GDP to overall EU GDP.⁷ We also assume that all sectors of the economy will be affected equally from a change in TFP. Although this could be seen as a strong hypothesis, in fact it is expected that improved efficiency in digital services is likely to be beneficial for all business sectors and economic activities.

We conduct the impact assessment using three scenarios covering a high, a central and a low estimate of the impact of DSM. The High and Low scenarios are based on upper and lower bound estimates which are respectively 30% higher and lower than the mid-point estimate of €415 billion. To be precise, we simulate the high and low direct impact of the DSM to be equal to €290 billion and €540 billion, respectively, corresponding to the range of the estimates found in GHK Consulting Ltd. (2014).

6.2 Results

The aim of this simulation is to add additional insights on the economic evaluation of the DSM strategy. We focus on the indirect structural effects of the DSM abstracting from the direct demand effects resulting from public support to ICT investment provided by other EU policy initiatives. Our analysis supplements the direct impact estimated in EPRS (2015) and European Commission (2015f).

Table 6.1 shows the effects of changing the regulation for cross border digital activities under the DSM strategy on GDP and employment for the EU as a whole. The higher allocative efficiency and the rise in TFP following the implementation of the DSM lead to a rise in GDP and employment. Our results suggest that the difference in GDP in 2030 with respect to its base year value will range between 0.44% and 0.82%. The changes in

⁷ Alternatively, we could assume that the gains are higher in the more digitised regions. Operationally we observe a high correlation between potential gains from DSM allocated using the share of regional GDP over EU GDP and different measures of digitalisation. Data of digitalisation only partially covers EU regions at the Nuts 2 level. However, comparing the allocations of policy gains for NUTS 2 regions where data is available yields a correlation between allocation based on internet access and GDP shares of 0.92 and between internet use and GDP shares of 0.93. Data on digitalisation at the NUTS 1 level covers most EU MS. Considering data available at the Nuts 1 level yields a correlation between allocation based on internet access and GDP shares of 0.91 and between internet use and GDP shares of 0.92. Hence, allocating potential gains from DSM using a measure of digitalisation would not dramatically affect results.

employment are lower than that of GDP both in the short-run and in the long-run. In 2030, EU employment increases with respect to the base year by between 0.15% and 0.27%. This indicates that capital is increasing more than GDP, signalling higher substitution effects in favour of the former. In turn, this means that the capital-labour ratio is increasing over time.

Table 6.1: Macroeconomic impact on EU key economic variables (percentage changes from initial steady state) - High, Central, and Low scenarios

	2020	2025	2030
High			
<i>GDP</i>	0.63	0.76	0.82
<i>Employment</i>	0.16	0.23	0.27
<i>Export to ROW</i>	0.96	1.22	1.34
<i>Import from ROW</i>	-0.08	-0.13	-0.15
<i>Household consumption</i>	0.44	0.54	0.59
<i>CPI</i>	-0.23	-0.27	-0.29
Central			
<i>GDP</i>	0.48	0.59	0.63
<i>Employment</i>	0.13	0.18	0.21
<i>Export to ROW</i>	0.74	0.94	1.03
<i>Import from ROW</i>	-0.06	-0.10	-0.11
<i>Household consumption</i>	0.34	0.42	0.45
<i>CPI</i>	-0.17	-0.21	-0.23
Low			
<i>GDP</i>	0.34	0.41	0.44
<i>Employment</i>	0.09	0.13	0.15
<i>Export to ROW</i>	0.52	0.66	0.72
<i>Import from ROW</i>	-0.04	-0.07	-0.08
<i>Household consumption</i>	0.24	0.29	0.32
<i>CPI</i>	-0.12	-0.15	-0.16

Table 6.2 shows the change in EU employment measured in thousands of FTEs. Our results suggest that implementing the DSM strategy could increase long-term EU employment by between 307 thousand and 561 thousand FTEs. In the short-term, EU employment could rise by between 186 thousand and 342 thousand FTEs.

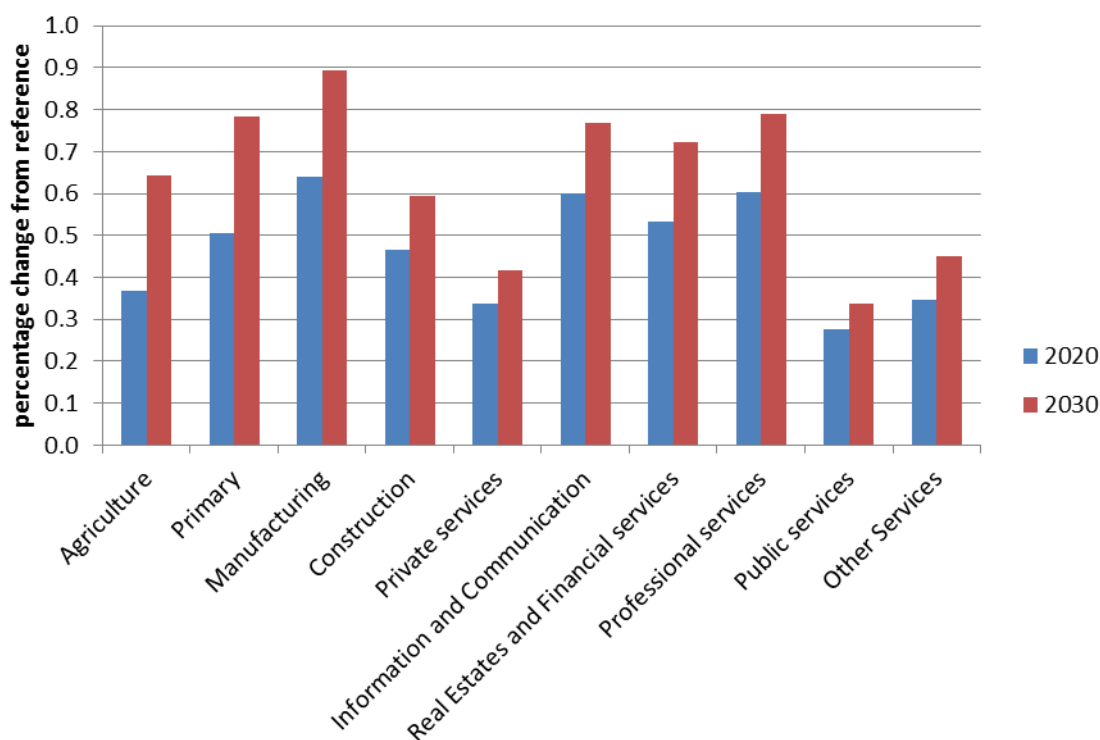
Table 6.2: Impact on employment (thousands of FTEs) - High, Central, and Low scenarios

	2020	2025	2030
Employment			
High	342	490	561
Central	265	380	435
Low	186	268	307

The change in TFP lowers the price of capital and labour in efficiency unit. This is then translated in lower commodities prices, making the overall economy more competitive with respect to the ROW and thus increasing export, reducing imports and boosting the economy even further as shown in Table 6.1. Consumers will enjoy higher real income thanks to the fall in prices freeing up additional resources for consumption.

Turning to the sectoral disaggregation, in Figure 6.1 we illustrates the impact on sectoral output as a result of the operationalization of the DSM. All sectors enjoy substantial benefits from the DSM. However, we detect larger profitability in Manufacturing, Primary, Professional services and ICT. The sectors benefitting less are Public services, Private services and Other services such as recreational activities, art and entertainment (all belonging to Other Services in Figure 6.1).

Figure 6.1: Macroeconomic impact on sectoral output (percentage changes from initial steady state) - Central scenario



To sum up, we have used a simple accounting method to translate the estimated direct effect of DSM into improvements in allocative efficiency and TFP. Some assumptions have been made to carry out the analysis, thus caution should be used when using these results. For example, the share of ICT in total output and the elasticity of ICT in equation (1) are proxied with R&D intensity and the elasticity of R&D from Kancs and Siliverstovs (2016). Furthermore, all sectors of the economy are assumed to be affected equally by the change in TFP generated by the DSM.

The direct impact in the form of cost savings and increased use of digital services has been estimated to €415 billion (Boston Consulting Group 2016). In this study we have examined the impact stemming from an increase in allocative efficiency and TFP. In the analysis we have taken into account the indirect structural effects from the policy without including any direct demand effects arising from public support to investments in ICT. These are left out to avoid double counting of public investment support given through other EU programmes (such as HorizonEurope, EFSI or InvestEU)⁸.

Our results suggest that increased efficiency from DSM is likely to achieve a long-run rise in GDP of around €60-110 billion per year. Typically, the magnitude of the structural changes depends on the extent to which economic agents believe the full realisation of the policy a credible outcome. We implicitly assume that the policy will be implemented correctly, uncertainties will be minimized, and MS will implement the digitalization strategy so to strengthen the reliability of the DSM. Such assumptions are crucial in order to choose the parameters in equation 6.1 to convert the direct impact into structural change effects.

Furthermore, in this analysis we have considered two possible transmission channels. That is to say, the structural effects of digitalization are transferred into the model through changes in non-tariff trade barriers and through primary factors productivity. However, alternative channels can be operationalized and added to the analysis. Additionally, the indirect effects can be decomposed in a number of alternative inputs into the model. For instance, it is conceivable that cross-border digital activities might specifically reduce other costs of trading across countries and regions. In our simulations we are capturing it indirectly, given that the TFP shock is able to generate substantial favourable term of trade effects with respect to the rest of the world and intensified trade activities within the EU.

⁸ For an ex ante impact assessment of HorizonEurope see European Commission (2018e). For an ex ante impact assessment of EFSI see European Investment Bank (2018).

7 Energy Union

The Energy Union strategy has been identified as a clear European priority project by the European Commission. It is made up of five pillars (European Commission 2017e): energy security and cooperation, an integrated energy market, decarbonising the economy, research and innovation in low carbon and clean energy technology, and energy efficiency. The latter is a key element of the Energy Union (European Commission 2016d) and it is regarded as the most effective way to support the transition to a low carbon economy and to sustain growth and creation of new jobs. The Energy Union strategy is built around an energy efficiency target of 30% to be achieved by 2030 (European Commission 2016d, 2016e, and 2017e). According to the Energy Efficiency Directive updated on November 30th 2016, the target is expected to be met through a 1.5% increase per year in energy savings by energy suppliers and distributors.

This section illustrates the system-wide economic impact of reaching the 30% reduction in the consumption of energy for the whole EU. We quantify the impact in terms of additional GDP growth and number of jobs created by means of the RHOMOLO-IO model, a variant of the RHOMOLO modelling framework. While the IO system is fully incorporated into RHOMOLO, it is in fact a standalone simulation framework whose assumptions make it a distinctive modelling tool. Similarly to the RHOMOLO model used in the preceding analysis, the RHOMOLO-IO model is based on a full set of bilateral trade flows in intermediate and final demand goods among 267 EU NUTS2 regions over 10 economic sectors. However, for the purpose of evaluating energy efficiency policies we had to make the energy sectors explicit in our analysis and therefore we adapted the sectoral classification of the RHOMOLO-IO model by modifying the one used in RHOMOLO (shown in Table 2.1). In particular, we disaggregated the B-D-E composite sector into three distinctive sectors (B, D, and E) and we took out from the Manufacturing sector the C19 sector which identifies the Manufacture of coke and refined petroleum products. Furthermore, we aggregated sectors O-Q and R-U into one composite sector (O-U).

The construction of the energy scenarios that are used to generate the exogenous demand shock to the RHOMOLO-IO model are based on the energy partial equilibrium model PRIMES developed by the National Technical University of Athens. The PRIMES projections have been used by the European Commission to define the overall energy efficiency package that forms part of a full set of the 2016 proposals for climate and energy policy under the Energy Union (European Commission 2017e).

Our methodology is similar to that used in the impact assessment carried out by the European Commission (European Commission 2016e and 2016f) where two distinctive macroeconomic models were used: the E3ME and GEM-E3 models. Likewise, our analysis on the macroeconomic economic impacts is based on a multi-sectoral macro-modelling framework. To some degrees, our model is directly comparable with the E3ME model, while the GEM-E3 model is more sophisticated as far as the dynamic structure is concerned and incorporates further complexities on the supply-side of the economy.

However, what distinguishes our analysis from the former impact assessments is the specific focus on energy efficiency as a result of the behavioural changes of economic agents mainly driven by the policy framework developed in the Energy Union. The assumption is that the European Commission's proposals aimed at improving energy efficiency are able to create a set of incentives that would positively modify the attitude of consumers towards low-carbon and more sustainable consumption patterns. This means that we abstract from all the monetary incentives that the European Commission is making available for energy efficiency measures such as the EFSI and the European Structural and Investment Funds (ESIF) that are typically the most important financing stream of energy efficiency policies.

7.1 Methodology

The RHOMOLO-IO framework uses data organised in IO tables which are defined as a set of sectoral disaggregated regional economic accounts. The IO tables represent a snapshot of the flows of products and services produced and consumed within the economy in a single year. The basic principle of the IO tables is to identify and disaggregate all the monetary flows between industries (inter-industry expenditure flows), consumers and supplies of factors in the economy.

Under a number of assumptions, IO tables can be used as the basis for an economic model where exogenous final demands drives total output (Leontief 1986; Miller and Blair 2009). Supply is infinitely elastic and the determination of inputs is based on fixed technical coefficients. The transmission mechanisms linking changes in exogenous demands to changes in aggregate and sectoral activities are called multipliers. These represent the knock-on effects throughout the economy, generated by the change in final demand. In other words, IO multipliers allow us to measure to what extent an increase/decrease in final demand of one sector, entail expansionary/contractionary effects in the output of all sectors, the perturbed sector included. The activity generated by each sector resulting from the initial demand disturbance is known as the indirect

effect. In computational terms the multiplier effect is thus given by the direct plus indirect effects divided by direct effect.

Formally, the IO model is operationalised by assuming that industry inputs are characterised by fixed coefficients that represent the available technology. In matrix notation, the key equation is the following:

$$Y = [I - A]X \quad (7.1)$$

Where X is the vector of outputs, Y the vector of final demands, A is the matrix of input coefficients, and I is the identity matrix. Pre-multiplying both sides by $[I - A]^{-1}$ gives:

$$X = [I - A]^{-1}Y \quad (7.2)$$

$[I - A]^{-1}$ is called the Leontief Inverse or the multipliers matrix. Notice that IO multipliers are to be interpreted as average effects and do not account for economies of scale, nor for unused capacity or technological change. Thus, IO multipliers can be used to quantify the economic impact derived from a demand-side shock assuming that the average relationships in the IO table apply at the margin.

Finally, the two key assumptions in IO are: (a) the supply-side of the economy is entirely passive and, (b) the production technology for all sectors is represented by fixed coefficients (i.e. an increase in the production of any one sector's output means a proportional increase in that sector's input requirements). This means that inputs substitutability is neglected.

7.2 Simulation strategy

Our simulations are based on the impact of energy consumption as predicted by PRIMES and reported in the impact assessment of the energy system in European Commission (2016e). According to the European Council reference baseline 2016 projection (EUCO-Ref-2016) which only takes into account the current policy framework, the gross energy consumption should equate to 1554 Mtoe by 2030. An alternative target of 27% energy efficiency (EUCO-27) results in a gross energy consumption of 1486 Mtoe, while with the more ambitious 30% target (EUCO-30), consumption of energy should be equal to 1321 Mtoe in 2030. Rebasng these energy consumption targets into changes in the use of energy from 2015 values, the expected increase in energy savings is equal to 6.9% under the EUCO-Ref-2016, 10.8% under the EUCO-27, and 13.7% for the EUCO-30 scenario. In order to be in line with the rest of the analyses carried out to evaluate the third pillar of the Investment Plan, we refer to three alternative scenarios. We consider

the EUCO-Ref-2016 as our Low scenario, the EUCO-27 as the Central scenario, and EUCO-30 as the High (most ambitious) scenario. Targets and related scenarios are reported in Table 7.2 below.

Table 7.2: Energy efficiency targets under the PRIMES projections and final use of energy targets adopted in RHOMOLO-IO

		EUCO-Ref-2016	EUCO-27	EUCO-30
		Low scenario	Central scenario	High scenario
2030	PRIMES	1554 Mtoe	1486 Mtoe	1321 Mtoe
energy efficiency projections				
IO model	energy saving targets	6.9%	10.8%	13.7%

Given the above targets on the overall consumption of energy for the all EU, we increase energy savings in the production of capital energy-type goods, as well as in the household and government sectors. In all three scenarios, the corresponding amount of energy savings is redistributed to the consumption of other goods and services other than energy, maintaining income fixed (for a similar analysis, see Lecca et al. 2014). The idea behind this simulation is to allow consumers and other institutions to use the resources saved through well implemented energy efficiency policy in the consumption of non-energy goods and services. We assume therefore that, for example, households reallocate the full amount of less expensive energy bills to consumption and not to savings. We furthermore assume that final users keep preferences unchanged. This means that reallocation of resources is performed using the initial calibrated consumption shares.

7.3 Results

Our consumption switching exercise is expected to return positive output effects as long as non-energy-intermediate sectors have higher backward linkages than the energy supply sectors. Table 7.3 shows the impact on GDP for selected years under the Low, Central and High scenarios. In all three scenarios, the GDP increases over time, however in each period, we observe larger impacts under the High energy scenario whilst lower economic impacts are associated to less ambitious and more conservative energy targets.

Table 7.3: GDP impact (percentage change from base year values) - Low, Central, and High scenarios

	2020	2025	2030
Low	0.060	0.160	0.250
Central	0.091	0.243	0.380
High	0.115	0.307	0.480

The additional jobs created are shown in Figure 7.1. We estimate for the EU as whole 225, 178, 118 thousand jobs under the High, Central, and Low scenarios, respectively. Our results also suggest greater variation response across economic sectors. As depicted in Figure 7.2, where only the outcomes for Central scenario are reported, the energy sectors (B, D and C19) experience a great reduction in Output and Employment. However this is more than compensated by the growth registered in the other sectors.

Finally, Figure 7.3 plots the percentage deviations from base year values of the GDP and employment obtained for all the 267 NUTS2 regions under the Central scenario. Almost all regions experience positive growth in GDP and increase in number of jobs created. However, we register few regions where output and employment are crowded out. In these regions the energy supply sectors are typically more labour intensive. The fall in employment and output in these energy sectors is excessively large to be fully offset by positive changes in the other sectors of the economy.

Figure 7.1: Impact on EU employment (thousands of FTEs) - High, Central, and Low scenarios

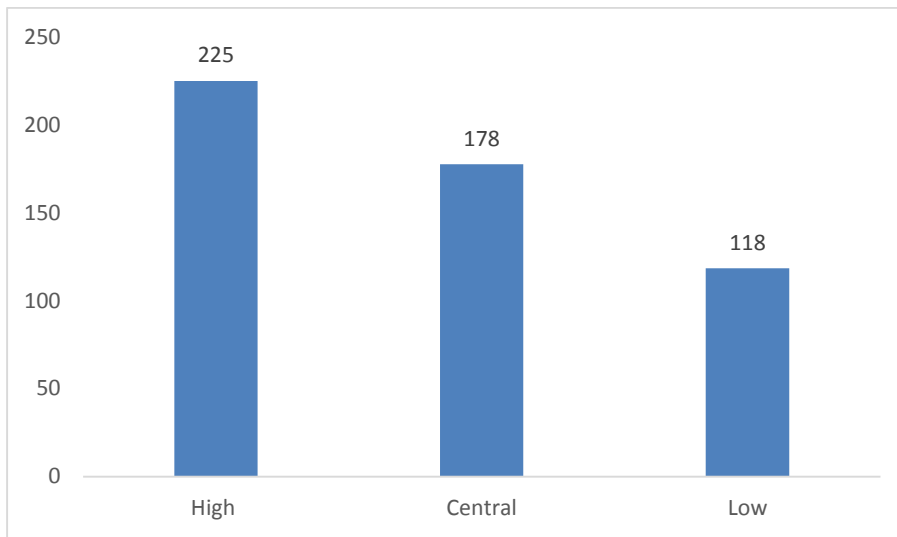


Figure 7.2: Impact at the sectoral level on GDP and employment – Central scenario

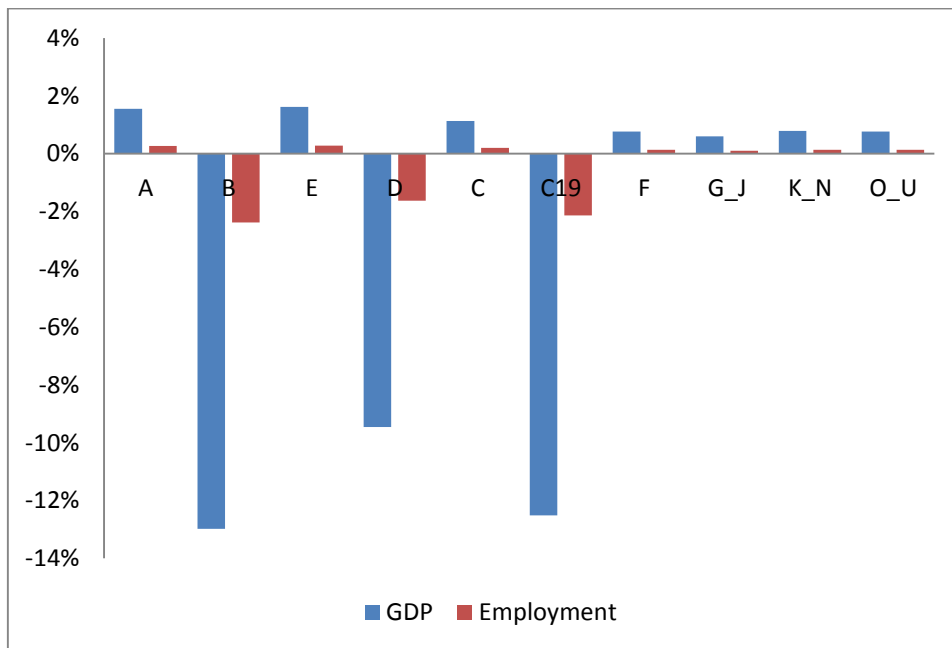
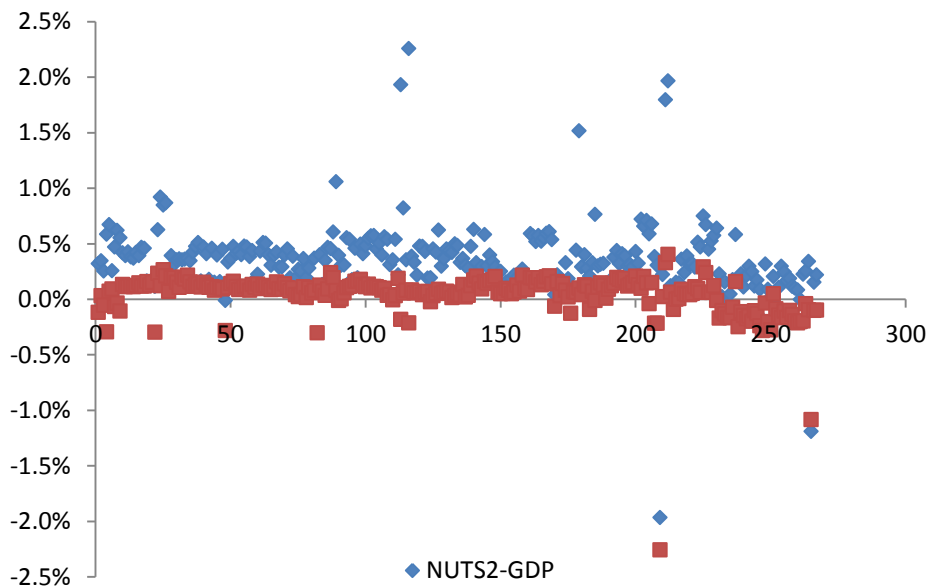


Figure 7.3: Impact at Regional (NUTS2 EU regions) level on GDP and employment – Central scenario



To summarise, we have reported the expected macroeconomic impact of the measures contained in the Energy Union package specifically designed to improve energy efficiency. The European Commission recently updated the Energy Efficiency Directive (Directive 2012/27/EU) in order to set a new 30% reduction target (therefore changing the previous 20% target) in energy sales to the final consumers by 2030 (European Commission 2017e). We use the RHOMOLO-IO modelling framework to quantify the macroeconomic impact of increased energy savings induced by energy efficiency policy measures by simulating three different scenarios. Our model simulations suggest that in all three scenarios, GDP and employment are positively affected by the energy efficiency shock. The output of the energy sectors fall substantially, but this is not enough to fully offset the positive impact in registered in the rest of the sectors.

8 Conclusions

The purpose of this paper is to report the potential macroeconomic impact of some of the measures contained under the third pillar of the Investment Plan for Europe aimed at removing barriers to investment under initiatives such as the CMU, the SMS, the DSM, and the Energy Union. The estimated impact reported here has to be read as additional to the impact of the first pillar of the same Plan, that is the EFSI, whose latest available estimate amount to an increase in EU GDP of 1.3% by 2020.⁹

The total macroeconomic impact of the measures analysed in this paper using the RHOMOLO and the RHOMOLO-IO modelling frameworks amount to an increase of EU GDP of 1.5% by 2030 (according to the Central scenario), and potentially getting up to a 2.1% increase by the same year. These two numbers translate to a potential increase of about one million jobs and almost 1.4 million jobs, respectively, as shown in Table 8.1.

Table 8.1: GDP and employment changes associated with the third pillar of the Investment Plan for Europe

	GDP percentage changes			Employment changes (thousands of FTEs)		
	Low	Central	High	Low	Central	High
CMU	0.21	0.48	0.75	147	353	547
SMS (Start-up)	0.0041	0.0057	0.0074	2.95	4.16	5.36
SMS (Procurement)	0.020	0.028	0.036	30	40	50
DSM	0.44	0.63	0.82	307	435	561
Energy Union	0.25	0.38	0.48	118	178	225
TOTAL	0.92	1.52	2.09	605	1010	1388

These results suggest that removing barriers to investment such as red-tape and regulatory bottlenecks can be beneficial for the EU economy, and strengthens the necessity for MS to address the existing investment barriers at the national level.

⁹ See the European Commission Press release IP-18-4469 available here: http://europa.eu/rapid/press-release_IP-18-4469_en.htm - This updates the previous estimate contained in EIB (2018).

References

- Acemoglu, D., Aghion, P., and Zilibotti, F. (2006). Distance to frontier, selection, and economic growth. *Journal of the European Economic Association* 4, 37–74.
- Acemoglu, D. and Zilibotti, F. (1997). Was Prometheus unbound by chance? Risk, diversification and growth. *Journal of Political Economy* 105, 709–752.
- Afonso, A., Schuknecht, L., and Tanzi, V. (2005). Public sector efficiency: An international comparison. *Public Choice* 123, 321–347.
- Afonso, A., Schuknecht, L., and Tanzi, V. (2010). Public sector efficiency: evidence for new EU member states and emerging markets. *Applied Economics* 42(17), 2147–2164.
- Aschauer, D. A. (1985). Fiscal Policy and Aggregate Demand. *The American Economic Review* 75(1), 117–127.
- Aschauer, D. A. (1988). The Equilibrium Approach to Fiscal Policy. *Journal of Money, Credit, and Banking* 20, 41–62.
- Baltagi, B.H., Demetriades, P.O., and Law, S.H. (2009). Financial development and openness: Evidence from panel data. *Journal of Development Economics* 89, 285–296.
- Bekaert, G. and Campbell, R.H. (2000). Foreign speculators and emerging equity markets. *Journal of Finance* 55, 565–613.
- Bekaert, G., Harvey, C. R., and Lundblad, C. (2005). Does financial liberalization spur growth? *Journal of Financial Economics* 77, 3–56.
- Bhagwati, J. (1998). The capital myth: The difference between trade in widgets and dollars. *Foreign Affairs* 7, 7–12.
- Bom, P.R.D. and Ligthart, J.E. (2014). What have we learned from three decades of research on the productivity of public capital? *Journal of economic surveys* 28(5), 889–916.
- Boston Consulting Group (2016). Digitizing Europe. Available at: http://image-src.bcg.com/BCG-Digitizing-Europe-May-2016_tcm22-36552.pdf
- Chinn, M. and Ito, H. (2008). A new measure of financial openness. *Journal of Comparative Policy Analysis* 10, 309–322.
- Copenhagen Economics (2010). The economic impact of European digital single market. Final report, March 2010. Available at: https://www.copenhageneconomics.com/dyn/resources/Publication/publicationPDF/5/305/1435823773/study_by_copenhagen.pdf
- Edison, H.J., Levine, R., Ricci, L.A., and Sløk, T.M. (2002). International financial integration and economic growth. *Journal of International Money and Finance* 21, 749–776.
- EIB (2018). Assessing the macroeconomic impact of the EIB group. Economics - Impact Studies. European Investment Bank, June 2018.

EIF (2016). Pan-European Venture Capital Fund(s)-of-Funds programme. Available at: http://www.eif.org/what_we_do/equity/paneuropean_venture_capital_fund_of_funds/index.htm

ESRB (2014). Is Europe overbanked? Reports of the Advisory Scientific Committee no. 4/June 2014.

Europe Economics (2006). Evaluation of Public Procurement Directives, Report for the European Commission. DG MARKT, European Commission. Available at: http://ec.europa.eu/internal_market/publicprocurement/studies_en.htm

European Commission (2015a). Building a Capital Markets Union. COM(2015) 63 final. Brussels, 18.2.2015.

European Commission (2015b). Action Plan on Building a Capital Markets Union. COM(2015) 468 final. Brussels, 30.9.2015.

European Commission (2015c). Upgrading the Single Market: more opportunities for people and business. COM(2015) 550 final. Brussels, 28.10.2015.

European Commission (2015d). A Single Market Strategy for Europe - Analysis and Evidence. Accompanying the document " Upgrading the Single Market: more opportunities for people and business". Commission Staff Working Document, SWD(2015) 202 final. Brussels, 28.10.2015.

European Commission (2015e). A Digital Single Market Strategy for Europe. COM(2015) 192 final. Brussels, 6.5.2015.

European Commission (2015f). A Digital Single Market Strategy for Europe - Analysis and Evidence . SWD(2015) 100 final. Brussels, 6.5.2015.

European Commission (2016a). Europe's next leaders: the Start-up and Scale-up Initiative. COM (2016) 733 final. Strasbourg, 22.11.2016.

European Commission (2016b). Financing ideas from Europe. Speech by Commissioner Moedas, 31 March 2016, Innovative Enterprise Conference, The Hague.

European Commission (2016c). Establishing the European electronic communications code. Directive of the European Parliament and of the Council. COM(2016) 590 final. Brussels, 12.10.2016.

European Commission (2016d). Proposal for a directive of the European Parliament and of the Council amending Directive 2012/27/EU on energy efficiency. COM(2016) 761 final. Brussels, 30.11.2016.

European Commission (2016e). Impact Assessment PART 1/3: Accompanying the document: Proposal for a directive of the European Parliament and of the Council amending Directive 2012/27/EU on energy efficiency. SWD(2016) 405 final. Brussels, 30.11.2016.

European Commission (2016f). Impact Assessment PART 2/3. Accompanying the document: Proposal for a directive of the European Parliament and of the Council amending Directive 2012/27/EU on energy efficiency. SWD(2016) 405 final. Brussels, 30.11.2016.

European Commission (2017a). On the Mid-Term Review of the Capital Markets Union Action Plan. COM(2017) 292 final. Brussels, 8.6.2017.

European Commission (2017b). Helping investment through a voluntary ex-ante assessment of the procurement aspects for large infrastructure projects. COM(2017) 573 final. Brussels, 3.10.2017.

European Commission (2017c). Measurement of impact of cross-border penetration in public procurement - Final report. DG GROW, European Commission, Brussels.

European Commission (2017d). A framework for the free flow of non-personal data in the European union. Regulation of the European Parliament and of the Council. COM(2017) 495 final. Brussels, 13.9.2017.

European Commission (2017e). Second Report on the State of the Energy Union. Brussels, COM(2017) 53 final.

European Commission (2018a). Completing the Capital Markets Union by 2019 – time to accelerate delivery. COM(2018) 114 final. Brussels, 8.3.2018.

European Commission (2018b). VentureEU: €2.1 billion to boost venture capital investment in Europe's innovative start-ups. Press release, 10 April 2018.

European Commission (2018c). Artificial Intelligence for Europe. COM(2018) 237 final. Brussels, 25.4.2018.

European Commission (2018d). Promoting fairness and transparency for business users of online intermediation services. Regulation of the European Parliament and of the Council. COM(2018) 238 final. Brussels, 26.4.2018.

European Commission (2018e). A New Horizon for Europe. Impact Assessment of the 9th EU Framework Programme for Research and Innovation. Luxembourg: Publications Office of the European Union, 2018.

European Investment Bank (2018). Assessing the macroeconomic impact of the EIB group. Economic – Impact Studies, June 2018. Available at: <http://www.eib.org/en/infocentre/publications/all/assessing-the-macroeconomic-impact-of-the-eib-group.htm>

EPRS (2017). *Mapping the Cost of Non-Europe 2014-2019*. PE603.239. Fourth edition: December 2017. European Parliamentary Research Service.

Gehring, A. (2013). Growth, productivity and capital accumulation: the effects of financial liberalization in the case of European integration. *International Review of Economics & Finance* 25, 291–309.

GHK Consulting Ltd. (2014). The Cost of Non-Europe in the Single Market III - Digital Single Market. Study commissioned by the European Added Value Unit, EPRS, September 2014. Available at: [http://www.europarl.europa.eu/thinktank/en/document.html?reference=EPRS_STU\(2014\)536356](http://www.europarl.europa.eu/thinktank/en/document.html?reference=EPRS_STU(2014)536356)

Giannetti, M., Guiso, L., Jappelli, T., Padula, M., and Pagano, M. (2002). Financial market integration, corporate financing and economic growth. *European Economy - Economic Papers* 2008 - 2015 no. 179. Directorate General Economic and Financial Affairs (DG ECFIN), European Commission.

Guiso, L., Jappelli, T., Padulla, M., and Pagano, M. (2004). Financial market integration and economic growth in the EU. *Economic Policy* 19, 523–577.

Hsu, P.H., Tian, X., and Xu, Y. (2014). Financial development and innovation: Cross-country evidence. *Journal of Financial Economics* 112(1), 116-135.

IMF (2015). Making public investment more efficient. IMF Policy Papers, June 2015.

Kancs d. and Siliverstovs B. (2016). R&D and non-linear productivity growth. *Research Policy* 45(3), 634-646.

Klein, M. and Olivei, G. (1999). Capital account liberalization, financial depth, and economic growth. NBER working paper no. 7384.

Kose, M.A., Prasad, E.S., and Terrones, M.E. (2009). Does openness to international financial flows raise productivity growth? *Journal of International Money and Finance* 28, 554-558.

Lecca, P., Barbero, J., Christensen, M., Conte, A., Di Comite, F., Diaz-Lanchas, J., Diukanova, O., Mandras, G., Persyn, D., and Sakkas, S. (2018). RHOMOLO V3: A Spatial Modelling Framework. EUR 29229 EN, Publications Office of the European Union, Luxembourg, 2018, ISBN 978-92-79-85886-4, doi:10.2760/671622, JRC111861.

Lecca, P., McGregor, P. G., Swales, J. K., and Turner, K., (2014). The added value from a general equilibrium analysis of increased efficiency in household energy use. *Ecological Economics* 100(C), 51-62.

Leontief, W. (1986). *Input-output Economics*. Oxford University Press, Oxford.

Levchenko, A.A., Rancière, R., and Thoenig, M. (2009). Growth and risk at the industry level: The real effects of financial liberalization. *Journal of Development Economics* 89, 210-222.

Masten, A., Coricelli, F., and Masten, I. (2008). Non-linear growth effects of financial development: Does financial integration matter? *Journal of International Money and Finance* 27, 295-313.

Miller, R.E. and Blair, P.D. (2009) *Input-Output Analysis. Foundations and Extensions*. Cambridge University Press, UK: Cambridge.

Mishkin, F.S. (2006). *The Next Great Globalization: How Disadvantaged Nations Can Harness Their Financial Systems to Get Rich*. Princeton: Princeton University Press.

Neumann, R.M., Penl, R., and Tanku, A. (2009). Volatility of capital flows and financial liberalization: Do specific flows respond differently? *International Review of Economics and Finance* 18, 488-501.

Obstfeld, M. (1994). Risk-taking, global diversification, and growth. *American Economic Review* 84, 1310-1329.

Quaglia, L., Howarth, D., and Liebe, M. (2016). The political economy of European Capital Markets Union. *Journal of Common Market Studies* 54(S1), 185-203.

Quinn, D.P. and Toyoda, A.M. (2008). Does capital account liberalization lead to economic growth? An empirical investigation. *Review of Financial Studies* 21, 1403-1449.

Rajan, R.G. and Zingales, L. (2003). The great reversals: The politics of financial development in the twentieth century. *Journal of Financial Economics* 69, 5-50.

Sakkas, S. (2018). The macroeconomic implications of the European Social Fund: An impact assessment exercise using the RHOMOLO model. JRC Working Papers on Territorial Modelling and Analysis No. 01/2018, European Commission, Seville, 2018, JRC113322.

Sandri, D. (2010). Growth and capital flows with risky entrepreneurship. IMF working paper no. 10/37.

Sapir, A., Veron, N., and Wolff, G.B. (2018). Making a reality of Europe's Capital Markets Union financial system. Policy Contribution Issue n°07 | April 2018, Bruegel.

Stiglitz, J.E. (2004). Capital-market liberalization, globalization, and the IMF. *Oxford Review of Economic Policy* 20, 57–71.

Véron, N. and Wolff, G.B. (2015). Capital Markets Union: a vision for the long term. *Journal of Financial Regulation* 2(1), 130–153.

Vogel L., (2009). Macroeconomic effects of cost savings in public procurement. European Economy, Economic Papers 389. European Commission.

GETTING IN TOUCH WITH THE EU

In person

All over the European Union there are hundreds of Europe Direct information centres. You can find the address of the centre nearest you at: https://europa.eu/european-union/contact_en

On the phone or by email

Europe Direct is a service that answers your questions about the European Union. You can contact this service:

- by freephone: 00 800 6 7 8 9 10 11 (certain operators may charge for these calls),
- at the following standard number: +32 22999696, or
- by electronic mail via: https://europa.eu/european-union/contact_en

FINDING INFORMATION ABOUT THE EU

Online

Information about the European Union in all the official languages of the EU is available on the Europa website at: https://europa.eu/european-union/index_en

EU publications

You can download or order free and priced EU publications from EU Bookshop at: <https://publications.europa.eu/en/publications>. Multiple copies of free publications may be obtained by contacting Europe Direct or your local information centre (see https://europa.eu/european-union/contact_en).



The European Commission's science and knowledge service

Joint Research Centre

JRC Mission

As the science and knowledge service of the European Commission, the Joint Research Centre's mission is to support EU policies with independent evidence throughout the whole policy cycle.



EU Science Hub

ec.europa.eu/jrc



@EU_ScienceHub



EU Science Hub - Joint Research Centre



Joint Research Centre



EU Science Hub