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Table of contents

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After four years of recovery, the euro area continues to grow at rates that are moderate by pre-crisis standards. According to the Commission's latest forecast, growth in the euro area is projected to stay at around 1½ % this year and next. Mainly driven by private consumption, economic output is benefiting from the support of low oil prices, favourable financing conditions and the euro's low exchange rate. Downside risks to the forecast have increased in the recent months. New challenges are surfacing, in particular slower growth in China and other emerging market economies, weak global trade, as well as geopolitical and policy-related uncertainty. The medium-term outlook for the euro area remains subdued too. Potential GDP is projected to grow on average by just above 1% over the next several years, i.e. around 1 pp. below the pre-crisis trend.

The current environment of low actual and potential GDP growth, low inflation, near-zero policy rates and limited fiscal space in most participating countries leaves the euro area vulnerable to future adverse economic shocks. This is particularly true given the weak demographic trends and declining productivity shown in section two of this report. We have repeatedly argued in the past that all policy tools – monetary, fiscal and structural – are needed to foster confidence and strengthen the recovery. This policy response was recently reaffirmed by G20 leaders at their summit in Shanghai. The latest decisions by the European Central Bank show that monetary policy can further support economic activity while ensuring price stability. But monetary policy alone cannot ensure a balanced growth path. Fiscal policies also need to support growth, job creation and confidence, while ensuring sustainable debt ratios over the medium-term as foreseen in the Stability and Growth Pact (SGP). Finally, faster progress on and the appropriate sequencing of structural reforms is necessary to raise the growth potential of euro area economies.

This edition of the QREA provides new insights into the structural pillar of the policy response. While it is usually agreed that reforms can help boost potential growth and employment, attempts to quantify the impact of *actual* reform measures across countries in a systematic way have been rare. The literature quantifying the impact of structural reforms has either relied on stylised facts such as simple elasticities, or on hypothetical shocks, which assume that countries can achieve 'best practice'.

The focus section of this edition develops for the first time a rigorous methodology to quantify the macroeconomic impact of selected *actual* reform measures. These measures are drawn from the 2013, 2014 and 2015 National Reform Programmes of four countries (Italy, France, Spain and Portugal). Simulation results point to a sizeable positive macroeconomic effect driven by higher productivity and/or higher employment rates. The selected reform measures raise GDP by on average an estimated ½ to 2% over a five-year horizon and their impact gets larger over the longer run. In addition, the reforms improve the situation of public finances, since higher growth rates increase tax revenues.

Finally, the report explores quantitatively how the Schumpeterian process of creative destruction works in the euro area. The empirical evidence presented in section three shows a positive relationship between the entry of new firms into the market and productivity growth. Hence, policies promoting the entrance of new firms can be conducive for productivity growth, whereas facilitating the exit of firms from the market e.g. via modernisation of insolvency legislation, is particularly relevant in countries with relatively high productivity levels.

In brief, a credible three-pronged response of monetary, fiscal and structural policies is needed to foster sustainable growth in the euro area. The assessment of actual reform measures based on a rigorous methodology reveals that more progress is needed in all euro area countries. In a zero lower bound environment, credible reforms with a weaker deflationary impact in the short-run should be prioritised to minimise the potentially negative demand effects. Such measures include tax shifts from labour to consumption, R&D policies and policies to improve labour market matching.

I. The economic impact of selected structural reform measures in Italy, France, Spain and Portugal

Structural reforms launched in Italy, Spain, Portugal and France could have significant economic benefits and raise GDP, new estimates from the European Commission show.

By 2020, the selected reforms modelled in this focus section are expected to raise GDP by some 1¼ % in Italy and Spain and some 2% in Portugal, with the benefits increasing over time. In France, where only the most recently launched reforms were modelled, the increase in GDP is expected to be close to ½%. This could imply a boost to GDP growth of between 0.1 and 0.3 pps. on average over five years. The projected gains in output are seen coming from improvements in productivity and/or higher employment rates. The reforms are also generally seen as beneficial to public finances as the higher growth associated with them should boost tax revenues. Although these effects are sizeable and provide a welcome boost to growth, they also show that more could be done when compared to best performers.

It is also important to stress upfront that the positive short term impact of product and labour market reforms on output and employment can be maximised through complementary measures that support demand (such as measures to boost investment), especially under the current conditions of slow growth and very low inflation prevalent in the euro area, reduce the costs of some of these reforms (e.g. through stronger corporate insolvency frameworks), and the appropriate sequencing of the specific reform measures.

The analysis in this report is based on selected reforms reviewed in the 2013, 2014 and 2015 National Reform Programmes of Italy, Spain and Portugal, and the 2015 National Reform Plan of France. These include measures covering product markets (including network industries), labour markets (including. education), as well as pension system and tax reforms. Crucially, our methodology focusses on the structural component of reform measures by assuming revenue neutrality, and hence excludes the direct fiscal impact.

The methodology aims to provide a first impact assessment of reforms actually implemented or planned in selected Member States, but it must be acknowledged that all estimates are surrounded by large uncertainties and should be interpreted with caution.([1])

I.1. Introduction

Structural reforms can boost growth and employment and help reinvigorate growth in the EU. Previous work has shown that the potential impact of reforms can be large. Based on a benchmarking approach, it was found that closing half the gap vis-à-vis best performers could add around 3% to EU GDP after five years, and 6% after 10 years. GDP effects in member states that are further from 'best practice' can be significantly higher, up to 10% for Greece and 8.5% for Italy after 10 years. ([2]) But those estimates were based on hypothetical scenarios assuming countries can move to 'best practice'. Most of the literature quantifying the impact of structural reforms has relied on such hypothetical shocks. While this shows the potential impact of reforms in general, it does not tell us much about the impact of actual reform measures that have recently been implemented. This focus section aims to address this by focussing on selected, real reform measures in four countries (Italy, France, Spain and

([1]) This chapter summarises the main results from a forthcoming publication: 'The economic impact of selected structural reform measures in Italy, France, Spain and Portugal'. It is based on a project that was a joint effort of horizontal and geographical units in DG ECFIN. The paper has benefited from comments received from country representatives in the LIME working group of the Economic Policy Committee.

([2]) See: Varga, J. and J. in 't Veld (2014), 'The potential growth impact of structural reforms in the EU: a benchmarking exercise', *European Economy, Economic Papers*, No 541.
Varga, J. and J. in 't Veld (2014), 'The growth impact of structural reforms', *Quarterly Report on the Euro Area*, Vol. 12, No 4.
Comparable results are reported in e.g. Bouis and Duval (2011), 'Raising potential growth after the crisis: a quantitative assessment of the potential gains from various structural reforms in the OECD area and beyond', *OECD Economics Department Working Papers*, No 835; and Barkbu, B. and J. Rahman and R.Valdes (2012), 'Fostering growth in Europe now', *IMF Staff Note*, SDN/12/07.

Portugal), and tries to quantify their potential macroeconomic impact. ([3])

For Italy, Spain and Portugal the selection of measures is based on the 2013, 2014 and 2015 National Reform Programmes (NRP), while for France only measures from the 2015 NRP are considered. ([4]) The measures cover reforms in product markets (including network industries), labour markets (including education), pension reforms as well as tax reforms. The focus section describes the methodology used, the 'translation' of actual reform measures into model shocks, and the results from QUEST model simulations.

The aim was to develop a rigorous methodology that allows results to be comparable across countries. Therefore, only those measures that could be quantified realistically were taken into account. Some reform measures were not quantified, either because their impact was judged to be too small, or because quantification was considered unfeasible due to a lack of adequate information. In other cases, appropriate methodologies to translate reforms into QUEST model shocks and/or suitable, quantifiable reform indicators were lacking. This was most prominently the case for reforms of the judicial system and reforms to insolvency frameworks. These are areas where more research is needed before their macroeconomic impact can be quantified. Of course, this does not imply that these reforms have no effect, only that we were not able to quantify the impact in a sufficiently reliable and rigorous way in this exercise. Another difference with national assessments of the quantitative impact of reform measures is that in this exercise we also take into account the costs of reforms and the full policy feedback and interactions of a general equilibrium model. By assuming full financing of reform measures in our assessment, we can focus on the structural impact and isolate this from any budgetary policy effect (fiscal consolidation or expansion).

The reform measures that were considered quantifiable were translated into changes in structural indicators that are used in the QUEST model. ([5]) When possible, this was done through a 'direct' mapping to structural indicators, e.g. in the case of unemployment benefit reforms, where the impact of the reform on the net replacement rate could be calculated. Other examples of 'direct' translations were tax reforms, for which changes in implicit tax rates could be calculated and directly shocked in the model. When no direct mapping of actual measures to model variables was possible, an 'indirect' approach was applied relying on intermediate indicators and other existing empirical evidence. Examples include reforms to product market regulation, where the impact of reform measures on OECD PMR indicators were calculated and then mapped onto a mark-up shock. Other examples were reforms to employment protection legislation (EPL), for which first the impact on the OECD EPL indicator was calculated, and this was then linked to productivity shocks using available empirical estimates. Reform measures were fed into the model separately and independently of each other, and we report here only aggregate results. ([6])

When these measures are fed into the model, simulations show a sizeable positive macroeconomic impact. By 2020, the quantified reform measures are estimated to raise GDP by some 1¼% in Italy and in Spain, some 2% in Portugal, and in France, for which we only consider measures included in the 2015 NRP, just below ½%. This implies on average between 0.1 and 0.3 pps. higher GDP growth over a five-year horizon. The GDP effects become larger over time. These output gains are driven by higher productivity and/or higher employment rates. Reforms also generally improve government balances, as higher growth boosts tax revenues.

The next section describes the methodology to translate measures into model shocks. Following sections then describe the main measures quantified for Italy, France, Spain and Portugal.

([3]) In earlier work we assessed the impact of product market reform measures on microeconomic variables such as productivity and business dynamics in vulnerable countries. European Commission (2014): 'Market Reforms at Work in Italy, Spain, Portugal and Greece', *European Economy,* 5/2014.

([4]) These can cover measures introduced in previous years as well as planned future measures.

([5]) The semi-endogenous growth version of the QUEST model, which includes an R&D production sector, has been used extensively for assessing the potential impact of structural reforms.
Roeger W., J. Varga and J. in 't Veld (2008), 'Structural reforms in the EU: a simulation-based analysis using the QUEST model with endogenous growth', *European Economy, Economic Paper*, No 351.
Varga, J., W. Roeger and J. in 't Veld J. (2014), 'Growth effects of structural reforms in Southern Europe: the case of Greece, Italy, Spain and Portugal ', *Empirica*, Vol. 41, pp. 323-363.

([6]) Detailed results by reform area and by year are published in the full report.

I.2. Methodology

The translation of product market (including network industries) reforms

Product markets reforms cover a vast and heterogeneous policy area and can roughly be grouped in four broad categories: 1) the cost of starting a business; 2) administrative burdens; 3) sectoral regulations; and 4) access to finance.

As a general rule, reforms to reduce the cost of starting a business were directly implemented in QUEST as entry costs, proxied in the model by data from the World Bank Doing Business project on administrative monetary costs. The non-monetary costs, such as the time to start a business, were monetised.

Reforms regarding the simplification of the administrative framework were translated into model shocks through the impact on labour overheads. This requires quantitative estimates of the administrative burden reduction, e.g. through a standard cost model approach, as in Arpaia et al. (2007). ([7])

Reforms in the area of sectoral product market regulation were modelled through final goods mark-ups. In cases where sufficient information is available and the sector was covered by the sectoral Product Market Regulation (PMR) indicator of the OECD, we calculated the change in the PMR indicator based on a detailed analysis of how the measures impact on the underlying questionnaires. If the published 2013 values of the PMR already included the impact of the reform, a 'pre-reform' estimate of the PMR was constructed through reverse engineering. If the most recent PMR data did not yet capture the reform, a forward engineering exercise was carried out to obtain an approximation of the post-reform PMR value. After deriving the change in the PMR associated with the reform, the next step is to establish the impact on mark-ups. Thum-Thysen and Canton (2015) link mark-ups to changes in PMR indicators at the sector level. ([8]) Changes in sectoral mark-ups (in connection with reforms affecting sectoral PMRs) were rescaled in order to provide a shock in the overall final goods mark-up. In addition to the mark-up channel, an additional channel is used in the case of professional services. Using results from Canton, Ciriaci, and Solera (2014) and European Commission (2013), changes in product market regulation in regulated professions are found to have an impact on allocative efficiency, and thereby on sectoral labour productivity. ([9])

Regarding reforms on access to finance, the only reform considered in the analysis is a reform in Italy allowing firms that raise new equity or retained profits to deduct an amount from income taxes equal to the volume of new equity (incl. retained profits) times a notional rate, thereby lowering the effective corporate income tax rate.

Some reform measures could not be translated and quantified as appropriate methodologies and reform indicators were not available (e.g. insolvency frameworks). This has limited the type of reforms included in this pilot. For example, in the case of Spain, the liberalisation of professional services spreads over a large number of professions, but the four covered by the PMR are excluded from the reform (or a low regulation level already exists). This reform could thus not be included in the quantification exercise. Other reforms were not included in the exercise because the quantitative impact was considered to be limited, for example in the case of the Spanish entrepreneurship law, implying lower initial capital requirements for new firms (yielding a slight improvement in access to finance conditions).

The translation of labour market reforms (including education)

This estimation exercise covered labour market reforms in four broad areas: 1) the generosity of unemployment benefits; 2) active labour market policies; 3) education; and 4) employment protection legislation.

For unemployment benefit reforms we calculated the changes in an OECD indicator of benefit

([7]) Arpaia, A., I. Grilo, W. Roeger, J. Varga, J. in 't Veld and P. Wobst (2007), 'Quantitative assessment of structural reforms: modelling the Lisbon Strategy ', *European Economy, Economic Papers*, No 282.

([8]) Thum-Thysen, A., and E. Canton (2015), 'Estimation of service sector mark-ups determined by structural reform indicators', *European Economy, Economic Papers*, No 547.

([9]) Canton, E., D. Ciriaci, and I. Solera (2014), 'The economic impact of professional services liberalisation', *European Economy, Economic Papers*, No 533.
European Commission (2013), 'Product Market Review 2013: Financing the real economy ', *European Economy*, 8|2013. The estimated relationship between PMR and allocative efficiency is only available for the regulated professions covered by the PMR, and not for other sectors.

generosity (the Net Replacement Rate over five years after job loss for a typical worker in industry earning the average wage – average value over multiple family types). Translations were done for reforms changing both the generosity and the duration of unemployment benefits. Reforms to benefit eligibility are not reflected in this indicator.

Reforms to active labour market policies (ALMPs) were translated in terms of permanent changes in funds and spending allocated to this item. This then is fed directly into the QUEST model boosting labour demand. ALMP reforms aimed at improving the efficiency of spending, e.g. in terms of improved job matching, were not assessed in this exercise.

Education reforms have been translated via the changes in public spending on education and their estimated effects on skill shares. The latter is known in the case the reform in question states quantitative targets, for instance about increasing the share of students obtaining an upper secondary degree (in this case, some students will become medium-skilled rather than low-skilled based on the standard statistical definitions).

Reforms of employment protection legislation (EPL) tend to affect the demand rather than the supply of labour. Most importantly, they have the potential to affect aggregate productivity in the medium to long run by spurring labour market flows and thereby improving labour market matching and reallocation. The translation of job protection reforms was done in two steps. In the first step, the change in the standard EPL indicator of the OECD (protection of regular workers) was evaluated. In the second step, the change in the indicator was translated into a productivity shock using the elasticity estimated by Bassanini et al. (2009) and further elaborated by Martin and Scarpetta (2011). ([10]) It should be noted that EPL reforms could only be assessed when enough detail was provided to calculate the change in the OECD indicator, which typically is only the case when the text of the legislation is available.

([10]) Bassanini, A., L. Nunziata and D. Venn (2009), 'Job protection legislation and productivity growth in OECD countries', *Economic Policy*, Vol. 24, Issue 58, pp. 349-402.
Martin, J.P. and S. Scarpetta (2011), 'Setting it right: employment protection, labour reallocation and productivity', *IZA Policy Paper*, No 27.

The translation of tax reforms

A relatively wide range of tax reforms were identified with changes in statutory tax rates and/or changes to taxable bases. As the relevant model parameter for taxes is the implicit tax rate (ITR), tax reforms were translated into changes to the relevant ITRs – on capital (K), labour employed (L) and consumption (C) – and then the structural component of tax changes was calculated.

The starting point of the translation is a measure of the budgetary effects of the reforms, generally based on national estimates. Since actual revenue figures from Eurostat/TAXUD are usually available only with a two-year lag, assumptions had to be made on the evolution of the ITRs without policy interventions after 2012. A simple approach was chosen whereby the respective 2012 ITRs were considered as the baseline, and assumed constant over future years in the absence of policy changes. From 2013 onwards, the denominator was upgraded using the growth rate of (a proxy of) the base (e.g., compensation of employees for L, final household consumption for C) and of nominal GDP for K. The same growth rate was applied to the numerator (i.e., revenue without policy shock). Finally, the revenue impact from the policy intervention(s) when the reform was introduced was added to obtain the 'shocked' ITRs.

Reforms in the area of personal income taxation (PIT) often required an additional step. This is due to the fact that personal income taxes are raised on different types of income, namely employed labour income, income of self-employed, social transfers and pensions and capital income. Most PIT reforms affect several of these types of income. For this reason the revenue effects had to be broken down (the so-called PIT split) into the effect on the ITR on labour (i.e. the employed labour income share of the reform) and the ITR on capital (shares falling on self-employed and capital income). The share falling on transfer income and pensions – in most cases relatively small – is not captured by the three ITRs and could therefore not be modelled.

In order to calculate the structural component, the tax changes were transformed into revenue neutral tax shifts by making compensatory adjustment on the revenue side so that the reforms were ex-ante revenue neutral. This approach allows assessing whether tax measures (increases or reductions)

Table I.1: **Italy: simulated aggregate effects of selected reform measures (1)**

Years	2013	2014	2015	2016	2017	2018	2019	2020	2025
GDP	0.1	0.3	0.5	0.8	0.9	1.0	1.1	1.3	2.1
Employment	0.0	0.3	0.7	1.0	1.2	1.3	1.4	1.5	2.1
Trade balance (% of GDP)	0.0	0.0	-0.1	-0.1	-0.1	0.0	0.1	0.1	0.1
Gov balance (% of GDP)	0.1	0.1	0.3	0.3	0.4	0.4	0.4	0.4	0.7

(1) GDP and employment effects are expressed in %-difference from baseline; trade and government balance effects are expressed in pp.-difference from baseline.
Source: DG ECFIN.

improve the growth-friendliness of the tax structure, while taking out the effects on the level of taxation and its aggregate fiscal impact. Technically this was implemented by assuming a compensatory revenue change for each actual policy measure, and assigning such compensatory revenue to K, L and C proportionally to the tax structure observed in the baseline year (2012). This means that each actual tax reform would trigger changes to all three ITRs in the model, so as to ensure revenue neutrality ex-ante.

The translation of pension reforms

Only two cases of pension reform needed to be considered: Spain and Italy. Spain increased the statutory retirement age, made the conditions for access to early and partial retirement more restrictive and introduced a new indexation mechanism for pensions and a sustainability factor linking changes in life expectancy with the amount of the pension benefit. Following the projections made by the Working Group on Ageing Populations and Sustainability (AWG), these reforms were translated into a progressive increase over time in the labour participation of older people (aged 60-64): +3.2 pps. by 2020 and +6.9 percentage points by 2060. Italy abrogated the right of civil servants to postpone their retirement for two additional years within a package of measures aimed at stimulating generational change, reducing the average age and the barriers to the geographical mobility of civil servants. This reform was not translated, as insufficient information was available on its effectiveness and its impact seems likely to be limited.

I.3. Italy

Product market reforms

Italy's 2012 liberalisation package included measures to reform both the professional services sector and the energy sector. The reform of professional services removed some restrictions on fees and access by abolishing all references to minimum, maximum and recommended tariffs in all regulated professions and making it easier for young people to start practising. Reduced entry barriers foster competition and reduce mark-ups in professional services. Reform measures of the energy sector aimed at increasing competition and transparency in the gas and electricity markets through ownership unbundling of the incumbent gas operator from the gas transmission operator, and changes in the calculation method for the reference gas price, based on spot market prices rather than on oil-indexed prices.

The implied reductions in the PMR indicators were translated into reductions in the mark-up. The professional services reform also increases labour productivity through improved allocative efficiency.

The 2012-13 simplification of public administration reform and the 2014 public administration reform included a range of measures facilitating the setting-up of businesses and the digitalization and simplification of bureaucracy. These provisions are expected to reduce administrative costs.

Finally, the 2015 annual competition law and privatisation plan included the partial privatisation of the electricity company (ENEL), reforms to the telecommunication sector, changes in the monopoly position of Poste Italiane and a reduction in state ownership of the company. These measures were assessed through their impact on the PMR indicator.

Labour market reforms

The 2012-13 labour market reform targeted the rigidities and segmentation of the labour market by: (a) improving exit flexibility by modifying the legal framework on open-ended contracts and by introducing disincentives to use (or abuse)

temporary and atypical contracts; and (b) strengthening active labour market policies. The first was captured through its impact on the EPL indicator, and the second, directly through the estimated increase in ALMP spending.

The 2014-2015 reform of the labour market (Jobs Act) provides for a broad reform of the labour market, including revisions to labour protection legislation, the unemployment benefit system, the wage supplementation scheme, active labour market policies, and labour market contract types. Only the measures concerning labour protection legislation were considered in this exercise. In particular, the Jobs Act revises dismissal rules for new hires under open-ended contracts. This is captured through its impact on the EPL (EPR component) indicator. The other provisions of the act are not mapped in the exercise because of the large uncertainties and difficulties in estimating their potential impact. Furthermore, the measures taken to ease the rules for temporary contracts were also not considered in the exercise. The methodology adopted in this exercise to assess EPL reforms is based on Bassanini et al. (2009). The authors find evidence that the protection of workers with open-ended contracts has an effect on productivity growth but they do not find an effect of the regulations concerning temporary contracts. For this reason, the assessment of EPL reforms is based on the OECD indicator of the employment protection of regular workers. These measures of temporary contracts do not affect this indicator.

The 2015 Education reform aims at improving the quality of the education system and reducing the drop-out rate by, for example, increasing the number of permanent teachers. On the basis of the implied additional fiscal resources (0.07% of GDP per year) on primary and secondary levels schools, this reform is translated into a gradual shift in the skill distribution of the labour force.

Tax reforms

Since 2012, Italy adopted a number of provisions affecting the tax structure. The main interventions involved an overall decrease in the labour tax wedge of 0.75 pps. of GDP (including an EUR 80 tax credit) and a decrease in the regional corporate income tax (*IRAP*) of around 0.5 pps. of GDP. Over this period, the allowance for corporate equity (ACE) has been strengthened. These measures were financed through (i) an increase in consumption taxes in 2013 (a further increase is expected in 2017); (ii) a higher withholding tax on households' financial income; (iii) an increase in stamp duties on financial assets. In this exercise, we focus on the structural component of the tax reform and simulate tax measures in a budgetary neutral way with compensatory tax changes across the board. Overall, the tax reform has a positive effect on GDP. The measures also include the abolition of recurrent property taxation on first residences with a full compensation to municipalities of the related lost revenue, and a cut in property taxes on agricultural real estate and immovable machinery for productive use.

Aggregate effects

All in all, the reform measures assessed here should raise GDP by an estimated 1¼% by 2020 and raise employment levels by an estimated 1½%. The measures also help to improve the government budget balance by 0.5 pps by 2020, in our simulation. A word of caution is needed concerning the short term dynamic effects. According to these simulations, GDP in 2015 would already be ½% higher comparted to a no-reform baseline, which seems hard to reconcile with the low GDP growth figures of recent years. This may indicate that our assumptions on the implementation of reforms are too optimistic and lead to an overestimation of the speed in which reforms have positive effects. While the short run impact may be overestimated, this should not affect the long run effects, which are clearly sizeable.

The estimated GDP impact is smaller than the estimates from a benchmarking exercise in which half the gap with best performers is closed (Varga and in 't Veld (2014)). Under such farther reaching reforms, GDP could be boosted by 4% after five years and 8½% after 10 years This indicates that the reform measures considered in the current exercise are going some way to closing these gaps with best practice, but still more could be done.

Table I.2: **France: simulated aggregate effects of selected reform measures**

Years	2014	2015	2016	2017	2018	2019	2020	2025
GDP	0.1	0.2	0.3	0.3	0.3	0.3	0.4	0.4
Employment	0.1	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Trade balance (% of GDP)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gov balance (% of GDP)	0.1	0.1	0.2	0.2	0.2	0.2	0.3	0.4

Source: DG ECFIN.

I.4. France

Product market reforms

For France, this exercise focusses exclusively on reforms contained in the 2015 NRP. (11) On product market reforms, the quantification exercise includes the partial privatisation of network sectors (gas and telecom), which is captured in the model through its effect on the public ownership sub-indicator of the PMR. Second, it includes the reform of the Sunday and evening openings in the Macron Law, through its effect on the overall PMR in retail. Third, reforms of regulated professions included in the Macron Law are captured through their impact on the PMR for professional services and their estimated effect on allocative efficiency. Fourth, the reform of regulated electricity tariffs is modelled as a reduction in the mark-up in energy. The sum of these product market reforms was translated into a reduction in the final goods price mark-up of 0.21 pps. and a 0.03% increase in labour productivity.

In addition, the authorities have launched an innovation tax credit for SMEs and given exemptions for innovative start-ups to stimulate research and development activity in France. These schemes are translated into a permanent increase in R&D-related tax credits. Actions to foster innovation also include the extension of the Investment for the Future programme (*PIA*), focussing on financing strategically important projects in research, energy transition and manufacturing. This measure was introduced in the simulation as an increase in public investment compensated by the corresponding decrease in other government expenditure categories.

Labour market reforms

The French authorities have started two programmes for fostering the employment of young and low-skilled workers. To support young people facing multiple obstacles in the labour market, the experimental youth guarantee scheme, will be progressively extended. The '*emplois d'avenir*' was also further extended. These measures were introduced as additional increases in ALMP spending.

The French authorities also announced the creation of 60 000 additional jobs in education in the form of various measures including the reform of the priority education, for the most economically disadvantaged, the reform of secondary education system (collège), and the reform of study programmes etc. These measures should contribute towards improving the skills of the labour force, and boosting productivity in the longer run but their effects in the short run are negligible.

Tax reforms

A reduction in the social contributions of firms is taking place over the period 2013-2017 through the 'Competitiveness and employment tax credit' (*CICE*) and the 'Responsibility and solidarity pact'. Both measures aim to reduce the cost of labour and improve the profit margins of firms, thereby boosting employment and competitiveness in the medium term. The *CICE* is a corporate income tax credit based on the salaries of low and middle-income earners. The Responsibility and solidarity pact cuts both employers' social contributions for low and middle-income earners, and also includes a reduction in corporate taxation. Reducing the tax wedge on labour and capital has a positive impact on employment and growth. What is taken into account here is the impact of the reform on the structure of the tax system, and the reduction in

(11) The 2015 NRP was the first time a quantification of recent reform measures was included, some of which already implemented in previous years, and our assessment covers a selection of those.

the ITR on labour is compensated by corresponding increases in other tax rates. ([12])

Aggregate effects

All in all, the simulated measures raise GDP by close to ½% by 2020. There is also an improvement in the government's budget balance. While the short-term dynamic effects may be sensitive to assumptions on implementation speeds, the medium and long run effects are clear. And given that this is only a partial assessment of reform measures undertaken in France, the effects are not insignificant.

But for comparison, our estimates from a benchmarking exercise in which half of the gap with best performers is closed (Varga and in 't Veld, 2014) suggest that GDP could be boosted by 4% after five years, and 7¾% after 10 years. This indicates that the reform potential in France is large and that the measures quantified in this exercise are only going part of the way towards closing these gaps with best practice and therefore, that more could be done.

I.5. Spain

Product market reforms

Spain's 'market unity' law aims at removing measures that may directly or indirectly obstruct the free movement of goods and services and the establishment of new operators throughout Spain. Based on estimates from the Spanish government, we assume a reduction in the barriers for start-ups (entry costs) by 35%, which stimulates new entry, reduces fixed costs and leads to a reduction in mark-ups, so boosting GDP and employment.

The 2012 retail reform made shop opening hours more flexible, liberalised sales periods, and simplified licensing procedures for small retail outlets. Through a reverse engineering exercise we calculate the reduction in the OECD PMR indicator for retail and simulate the decrease in the mark-up.

([12]) Model simulations of reductions in social contributions included in the CICE and the Responsibility and solidarity pact but financed through cuts in expenditure and an increase in VAT are reported in Burgert M., L. Granelli and H. Naudts, 'Recent reforms on the cost of labour in France – An assessment of the "Crédit d'impôt pour la compétitivité et l'emploi" and the "Pacte de responsabilité et solidarité" in France ', *European Economy – Economic Brief*, European Commission (forthcoming).

Labour market reforms

The 2012 reform of unemployment benefits reduced the amount paid out to beneficiaries after more than six months from 60% of their last salary to 50%. In the model, this leads to an increase in labour supply and boosts growth and employment, with a corresponding improvement in the government balance as the reform affects both the expenditure (lower benefits) and revenue side (higher revenues from taxes).

Reforms to employment protection legislation in 2012 led to a small decrease in the OECD indicator for the strictness of employment protection. This was mapped to a productivity shock with an overall positive but small effect on GDP and the government balance.

The 2013 pension reforms in Spain have: (i) restricted access to early and partial retirement, (ii) introduced as of 2019 a sustainability factor, which will curtail the initial pension benefit in line with expected changes in life expectancy and (iii) introduced a new indexation mechanism for pensions. These reforms were translated into an increase in the labour participation of older people progressively over time, which boosts growth and employment, particularly in the medium and long term. The reforms also lead to a sizeable improvement in the government balance in the medium and long term.

Tax reforms

The 2012 tax reforms in Spain included (i) a VAT reform, (ii) a reduction of debt bias in the treatment of housing in personal income taxation, and (iii) new taxes on electricity generation. These are simulated as increases in the implicit tax rates on consumption, labour and capital respectively. All these consolidation measures would improve the budget, but would have negative GDP and employment effects in the short and medium run. But in this exercise we isolate their impact on the structure of taxation through offsetting compensatory tax changes, such that the measures are ex-ante revenue neutral. As these measures shift the tax burden from labour to consumption, positive GDP and employment effects are obtained.

The 2014 tax reform focuses on cuts in personal income taxes (PIT) and corporate income taxes (CIT). In the area of PIT, the number of tax

Table I.3: **Spain: aggregate impact of selected measures (1)**

Years	2013	2014	2015	2016	2017	2018	2019	2020	2025
GDP	0.2	0.4	0.6	0.7	0.9	1.0	1.2	1.3	2.1
Employment	0.3	0.6	0.8	0.9	1.0	1.1	1.2	1.3	1.9
Trade balance (% of GDP)	0.2	0.3	0.2	0.2	0.2	0.2	0.2	0.3	0.3
Gov balance (% of GDP)	0.7	1.0	1.2	1.3	1.5	1.6	1.8	2.0	3.0

(1) GDP and employment effects are expressed in %-difference from baseline, trade and government balance effects are expressed in pp. difference from baseline.
Source: DG ECFIN.

brackets has been lowered from seven to five, rates have been reduced, family allowances increased, and some measures have been taken to broaden the tax base. The tax rates on savings income have also been reduced in two steps. The reduction in CIT rates was a two-step reduction in the standard rate and a reduction in reduced rates, as well as a broadening of the base and a reduction of the debt bias. These tax shifts have an expansionary effect.

The aggregate effects

All in all, the aggregate effects of these measures are positive even in the short term. By 2020, GDP is some 1¼% higher than in the baseline. Similar effects are found for employment, while the government balance improves by about 2% of GDP, mainly due to the reform of unemployment benefits. There is also a small positive effect on the trade balance. The gains in output are significant and imply that on average up to 0.2 pps. is added to growth rates over the next five years.

To put these estimates in perspective, in Varga and in 't Veld (2014) we report a GDP gain of 3¼% after five years if, for all structural indicators, half the gaps with best performers are closed, and some 6% after 10 years. This indicates that the reform measures quantified here go some way in closing the gaps with best practice, but more could still be done.

I.6. Portugal

Product market reforms

Portugal has liberalised some of its highly regulated professional services, eliminating excessive restrictions and facilitating access to professions. The reforms have been gradually implemented since 2013, but some legal restrictions remain to the access of a number of regulated professions that in practice reduce the importance of the reforms. Thus the overall impact on the PMR indicators that cover these professions (legal, accounting, architectural and engineering services) is limited, and so is the corresponding reduction of the mark-up. The deregulation is also expected to contribute to allocative efficiency.

During its EU/IMF adjustment programme, Portugal took measures to complete the liberalisation of services, facilitating market entry and competition. The reforms cover many different service sectors in areas such as retail and wholesale, tourism, business services, services related to the maintenance of equipment or real estate. Based on earlier work on the economic impact of the Services Directive, we estimate the impact on sectoral labour productivity in the affected service sectors at 1.8%. ([13])

Administrative simplification through the *Simplificar* initiative is estimated to lead to a reduction in overhead labour cost of EUR 150 m, which is translated into a reduction in fixed labour costs in the model.

Reforms in network industries include privatisations in the communication sector (post and telecom), and rail freight. These are captured through their impact on the PMR indicators and then translated into a mark-up reduction.

Labour market reforms

The Portuguese reforms to employment protection legislation in 2011 and 2012 have reduced the discrepancy between the protection of temporary

([13]) Monteagudo, J., A. Rutkowski, D. Lorenzani (2012), 'The economic impact of the Services Directive: a first assessment following implementation', *European Economy, Economic Paper*, No 456. Note that the estimated impact refers to labour productivity, not to the earlier mentioned impact of product market regulation on allocative efficiency available for the regulated professions only.

Table I.4: **Portugal: simulated aggregate effects of selected reform measures**

Years	2013	2014	2015	2016	2017	2018	2019	2020	2025
GDP	0.3	0.6	0.9	1.2	1.4	1.7	1.9	2.1	2.9
Employment	0.2	0.4	0.7	0.8	0.9	1.0	1.0	1.1	1.3
Trade balance (% of GDP)	0.2	0.3	0.3	0.4	0.3	0.3	0.3	0.3	0.3
Gov balance (% of GDP)	0.7	1.1	1.3	1.5	1.7	1.8	2.0	2.2	3.3

Source: DG ECFIN.

and permanent employment contracts. We assess the impact using the OECD EPL indicator for regular workers (individual dismissals) and map this to a productivity shock based on the empirical study of Bassanini et al. (2009).

The 2012 reform of unemployment benefits increased the coverage of the system and work incentives while reducing the maximum duration and generosity of the benefits after six months, which in the model reduces job search disincentives. This reform has a large positive impact on the government budget balance.

A programme was introduced offering basic vocational courses as an alternative path to students at risk of leaving education. On the basis of available data, we assume the programme will have a permanent effect and that each year 13,300 additional medium-skilled (instead of low-skilled) workers will join the labour force.

Tax reforms

The 2012 tax reforms in Portugal included (i) the broadening of the VAT base, (ii) the reduction of PIT credits, (iii) the cancellation of the reduced corporate income tax (CIT) rate and introduction of CIT surcharges for larger enterprises and (iv) the reassessment of property values for the recurrent property tax (IMI). The 2013 tax reforms in Portugal included (i) the PIT structure review (brackets and temporary surcharge) and (ii) a reinforced clamp down against tax fraud and evasion. In 2014, tax reforms included (i) a major CIT reform and (ii) further measures to combat against tax fraud and evasion, while in 2015 reforms included (i) a major PIT reform (ii) and a green tax reform.

The reforms have led in most cases to increases in implicit tax rates, but in structural terms, there has been a shift towards less distortive taxes with a positive effect on growth.

Aggregate effects

All in all, the reform measures assessed here raise GDP by some 2% by 2020, and employment levels by some 1%. It also leads to an improvement in the government's budgetary position of 2¼ pps., mainly through the decrease in unemployment benefits. Note that according to these simulations GDP was some 1% higher by 2015 due to reforms undertaken in previous years. This may indicate an overestimation of the speed of implementation, and there is considerable uncertainty on this. But that would not affect the medium and long run effects, and these are sizeable.

The estimated GDP impact is in fact close to what was estimated in a benchmarking exercise in which half the gap with best performers is closed (Varga and in 't Veld (2014)). Under such reforms, it was found that GDP could be boosted by some 2½% after five years, and 5½ % after 10 years. While this suggests that some progress has been made in closing these gaps with best practice, it also indicates the gap remains large at longer horizons and that more could be done to remove remaining structural rigidities, improve education, upgrade the labour force, and improve the skills distribution.

I.7. Concluding remarks

This impact assessment shows that recent structural reform measures should yield sizeable GDP effects. The measures quantified here should on average add between 0.1 and 0.3 pps. to GDP growth over the next five years. The GDP effects become larger over the longer run. These output gains are driven by higher productivity and/or higher employment rates. Reforms also generally improve government balances.

The simulated impacts are typically smaller than what was found in a benchmarking analysis in which half the gaps in structural indicators with best performers were closed. That suggests that while some progress has been made towards closing these gaps, more could still be done.

As stressed in the introduction, the estimated GDP effects reported here are for those measures that could be quantified in a reliable manner. The aim was to develop a rigorous methodology that allows results to be comparable across countries and therefore only those measures that could be quantified realistically were taken into account. That does of course not mean that other reform measures that have not been quantified here have a negligible impact. It is only because those measures are much harder to verify in an analytically rigorous manner that they were not included. It could therefore be that for this reason, the estimated GDP impact reported here gives a lower bound of the potential impact of all the reforms undertaken.

However, there are other reasons to believe these results may overestimate the short term impact of reform measures. First, we considered planned measures, not only implemented ones, and there is some uncertainty about the speed at which measures are actually implemented or even retracted at a later stage. Second, assumptions were made about the speed in which, say, deregulatory reforms changed mark-ups or raised productivity, while there is much uncertainty about the true dynamic effects of reforms. Hence, there may have been an overestimation of the short run impact in the first years.

Another caveat concerning the partial nature of the analysis is outlined below. Reform measures are considered in isolation, one at the time, and spillovers of joint implementation, as well as those based on a wider geographical scope, are ignored. Previous research has shown that structural reforms can have somewhat ambiguous spillover effects, as competitiveness effects can partly offset the positive demand spillovers. Overall, however, spillovers tend to be small but positive. ([14]) It is therefore likely that if reform measures in all member states were considered together, the effects might be somewhat larger. ([15])

This exercise highlights the difficulties for quantifying the economic impact of actual reform measures. The translation of reform measures into quantifiable shocks is a challenging task and is surrounded by large uncertainties. First, as emphasised above, not all measures are easily quantifiable and around one-third of identified measures were not assessed quantitatively in this exercise. This was not always merely because they were deemed insignificant, but in some cases because it was not clear how the macroeconomic impact of the reforms, if any, could be quantified. There are reform areas – most prominently reforms in the judicial system and reforms to insolvency frameworks – where more research is needed on their microeconomic impact and on how to translate that into a macroeconomic impact. Second, even for those measures that were included, the 'translation' of reform measures into quantifiable changes in structural indicators is surrounded by large uncertainties, related to the direct quantification of the measures, but also to the assumed implementation speed and robustness of empirical estimates on which the assessment had to rely. Third, the impact assessment is based on a macroeconomic model, and results are sensitive to certain model assumptions. All this means these estimates of the impact of reforms are surrounded by large uncertainties and should be interpreted with caution.

Keeping these caveats in mind, this focus section has presented a novel approach in macroeconomic impact assessments of structural reforms by quantifying *actual* reform measures. It thereby complements other existing studies which typically use more stylised approaches. While these latter studies give estimates on the potential impact of structural reforms, the present analysis gives a more realistic assessment of the benefits of the reforms actually implemented or planned in selected Member States.

([14]) See Varga and in 't Veld (2014), ibid.

([15]) Given the low weight of each country considered here in the ECB reaction function, no sizeable interest rate response is included in these scenarios, hence the monetary conditions are similar as under a zero lower bound. Some authors have argued the impact of structural reforms on economic activity in the short term can be counter-productive when the zero bound on monetary policy rates is temporarily binding, due to the downward pressure on prices and increase in real interest rates (e.g. mark-up reductions in Eggertsson et al., 2014). In a larger macroeconomic model like QUEST, the contractionary short term effects of deflationary supply-side reforms at the ZLB are smaller due to various mitigating factors: the impact of reforms on the profitability of investment, the disposable income of liquidity-constrained households and the competitiveness effect in external trade. The adverse real interest rate effect also depends on the short term deflationary impact of the reform (which can be smaller for other measures) (see Vogel, 2014).
Eggertsson G., A. Ferrero, and A. Raffo (2014), 'Can structural reforms help Europe?', *Journal of Monetary Economics*, Vol. 61(C), pp. 2-22.
Vogel, L. (2014), 'Structural reforms at the zero lower bound', *European Economy, Economic Papers*, No 537.

II. Special topics on the euro area economy

II.1. The effects of a slowdown in total factor productivity growth and ageing on GDP growth, inflation and interest rates

Demographic ageing and the slowdown of productivity growth are considered as two concerns for medium-term growth prospects affecting the euro area prior to the financial crisis, that have gathered further momentum since 2008. This section presents a model-based assessment of the effects of changes in total factor productivity (TFP) and the dependency ratio on the euro area economy. In particular it assesses their short- and medium-term impact on growth, inflation and interest rates. Interestingly, these underlying alleged causes of secular stagnation, which accelerated in 2008, produce distinct macroeconomic effects, particularly when assessed over different time horizons. Both shocks generate demand- and supply-side effects leading to a substantial decline in GDP growth, a sizeable fall in inflation, and a drop in interest rates. Following a temporary decline in TFP, the short-term fall in GDP growth is stronger than in the case of an ageing shock, but GDP, inflation and interest rates return to baseline in the medium-term. The shock to the dependency ratio causes the GDP deflator and the nominal interest rate to decline by more than the shock to TFP in the short run due to increases in savings and a fall in consumption. Its GDP effect, while much smaller in the short-term is also much more protracted and still visible in the medium term. The ageing shock also produces an increase in inflation in the medium-term following the projected reduction in labour supply. In the current economic juncture, an expected decline in productivity and a deterioration of demographic trends could leave Europe particularly vulnerable to stagnation following adverse shocks in the region. ([16])

Introduction

After the financial crisis, actual and potential GDP growth has been slowing in many industrialised countries and in the euro area, in particular. There is also a wider debate about secular stagnation which, according to Larry Summers, ([17]) began prior to the financial crisis and is characterised by demographic ageing and a slowdown in productivity growth (see, for example, Gordon (2014) ([18])).

This section presents the results of model simulations to assess the effects of a decline in productivity and ageing on the European economy in the short- and the medium-term. It complements previous contributions in this Report on the topic of secular stagnation, ([19]) by assessing the duration and magnitude of the change in output, interest rates, inflation, labour productivity and employment caused by changes in TFP and the dependency ratio from 2008 to 2025.

In the current setting of low GDP growth, inflation and interest rates, all of which are legacies of the global financial crisis, a decline in productivity and a deterioration in demographic trends could weaken Europe's resilience in facing additional adverse shocks in the region. This is especially likely in the current environment of limited fiscal space and constraints on monetary policy. Looking ahead, it is therefore important to understand the consequences of such effects on aggregate economic activity and, in particular, on inflation and interest rates.

Cette, Fernald and Mojon ([20]) present evidence in support of the fact that productivity growth in Europe was slowing down prior to 2008, especially with respect to the US. ([21]) Arguments put forward to explain these developments relate to the slow

([16]) This section was prepared by Romanos Priftis.

([17]) Summers, L., (2014), 'US economic prospects: secular stagnation, hysteresis and the zero lower bound', speech delivered at the Economic Policy Conference organised by the National Association for Business Economics, 24 February 2014.

([18]) Gordon, R., (2014), 'A new method of estimating potential real GDP growth: implications for the labour market and the debt/GDP ratio', *NBER Working Papers,* No 20423.

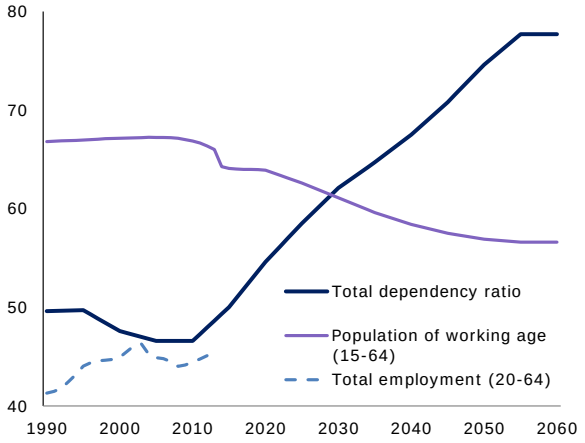
([19]) See:
McMorrow, K., and W. Roeger, (2013), 'The euro area's growth prospects over the coming decade', *Quarterly Report on the Euro Area,* Vol. 12, No 4, pp. 7-16.
Roeger, W., (2013), 'ECFIN's medium term projections: the risk of 'secular stagnation', *Quarterly Report on the Euro Area,* Vol. 13, No 4, pp. 23-29.

([20]) Cette, G., J. Fernald, and B. Mojon, (2015), 'The pre-great recession slowdown in productivity', mimeo.

([21]) See also van Ark, B., O'Mahony, M., and Timmer, M. P., (2008), 'The productivity gap between Europe and the United States: trends and causes', *The Journal of Economic Perspectives*, Vol. 22, No 1, pp. 25-44.

ICT diffusion process in continental Europe ([22]) and falling real interest rates in the periphery that were the result of a convergence process associated with the euro. ICT diffusion required flexible labour and product market institutions, which were not necessarily prevalent in the 2000s, inhibiting the development of the most efficient production techniques.

Graph II.1.1: **Economic dependency ratio, working age population and total employment, euro area (1)**
(1990-2060, %)



(1) The economic dependency ratio is defined as the ratio between the total inactive population and employment. The population of working age and total employment are defined as a share of the total population.
Source: United Nations, OECD & AMECO.

On the other hand, low interest rates triggered capital inflows. However, these primarily boosted non-tradable output, such as the services and construction sectors ([23]), in which productivity is usually lower than in the tradables and manufacturing sectors. ([24]) In parallel, the collapse of interest rates led to a misallocation of capital, whereby firms with high potential were unable to crowd out the least efficient firms. ([25]) Moreover, DG ECFIN output gap calculations suggest the TFP contribution to potential growth was already falling from 0.9 in 2002 to 0.5 in 2008.

The dependency ratio, defined as a ratio of the number of inactive participants in the labour force, remained stable in the 1990s and only started sluggishly increasing from the end of the 2000s (Graph II.1.1). The onset of the global financial crisis in 2008 accelerated this development.

The output gap forecasting exercises by DG ECFIN suggest that in 2025 a gap of about 10 % will open up between pre-crisis and post-crisis productivity trends (see Graph II.1.2), while projected demographic developments suggest that, since the beginning of the crisis, both the working-age population and the number of employed people have begun falling faster (Graph II.1.1). Although migration flows and the participation rates of female and older workers are expected to increase, these will be offset by the ageing of the European population, which is expected to be progressing rapidly by 2025. The number of people in employment during the period 2025 to 2060 is expected to fall by approximately 13 million (Ageing Report 2015 ([26])).

This section presents the results of analysis carried out to quantify these effects and assess the impact of changes in TFP and the dependency ratio on the European economy over the short- and medium-term. The section consists of two parts: the first presents the results of model simulations and assesses the duration and magnitude of the change in interest rates, inflation and output caused by changes in TFP and ageing between 2008 and 2025. A second section (Box II.1.1.) discusses the construction of the TFP and dependency ratio shocks used in the analysis and the way in which they are incorporated into the macroeconomic model designed for policy simulations.

([22]) See also Dabla-Norris, E., Guo, S., Haksar, V., Kim, M., Kochhar, K., Wiseman, K., and Zdzienicka, A., (2015), 'The new normal: a sector-level perspective on productivity trends in advanced economies', *IMF Staff Discussion Note*, SDN/15/03.

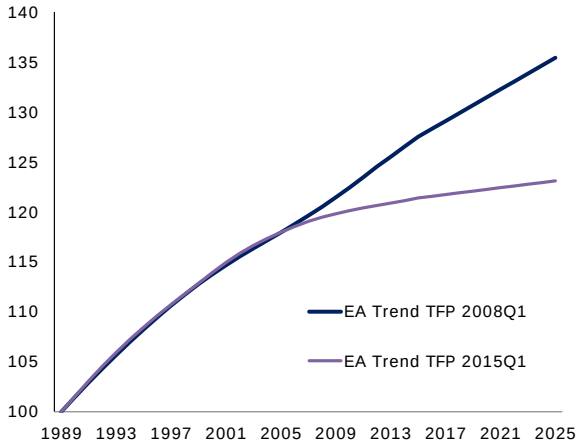
([23]) See Reis, R. (2013), 'The Portuguese slump and crash and the Euro crisis', *Brookings Papers on Economic Activity*, 46, pp. 143-193, Spring 2013. .

([24]) See Kalantzis, Y. (2014), 'Financial fragility in small open economies: firm balance sheets and the sectoral structure', *Working papers*, 505, Banque de France, forthcoming in the Review of Economic Studies.
and Benigno, G., N. Converse, and L. Fornaro (2015), 'Large capital inflows, sectoral allocation, and economic performance', *Journal of International Money and Finance*, Elsevier, Vol. 55(C), pp. 60-87.

([25]) See Gopinath, G., S. Kalemli-Ozcan, L. Karabarbounis, and C. Villegas-Sanchez (2015), 'Capital allocation and productivity in south Europe', *NBER Working Paper*, No 21453.

([26]) European Commission (DG ECFIN) and Economic Policy Committee (Ageing Working Group) (2015), 'The 2015 ageing report: economic and budgetary projections for the 28 EU Member States (2013 –2060)', *European Economy,* No 3.

Graph II.1.2: **Euro area, trend TFP,**
(1989-2015, Index: 1989=100)



Source: DG ECFIN calculations of trend TFP using production function methodology.

Simulation Results

The simulations begin in 2009, at the start of the financial crisis. The model is placed as closely as possible within the context of the current economic environment, which is characterised by constraints on monetary policy. In this regard, it is important to point out that other major disturbances that have affected the European and the global economy since the start of the crisis, such as shocks to investment risk and private and public deleveraging pressures, have not been assessed. Therefore, the findings of the simulations reflect only the effects of shocks leading to a fall in TFP and ageing.

Information from DG ECFIN's medium-term projections of output gaps is used to construct the shock to TFP. A comparison of pre-crisis and post-crisis TFP projections suggests that by 2025 a gap of about 10 % will open up between the two projections. Information from the 2015 Ageing Report is used for the shock to the dependency ratio. This provides the expected changes in European demographics, with the dependency ratio projected to rise by 17 % by 2025. See Box II.1.1. for further information on the shock calibration and the set-up of the model.

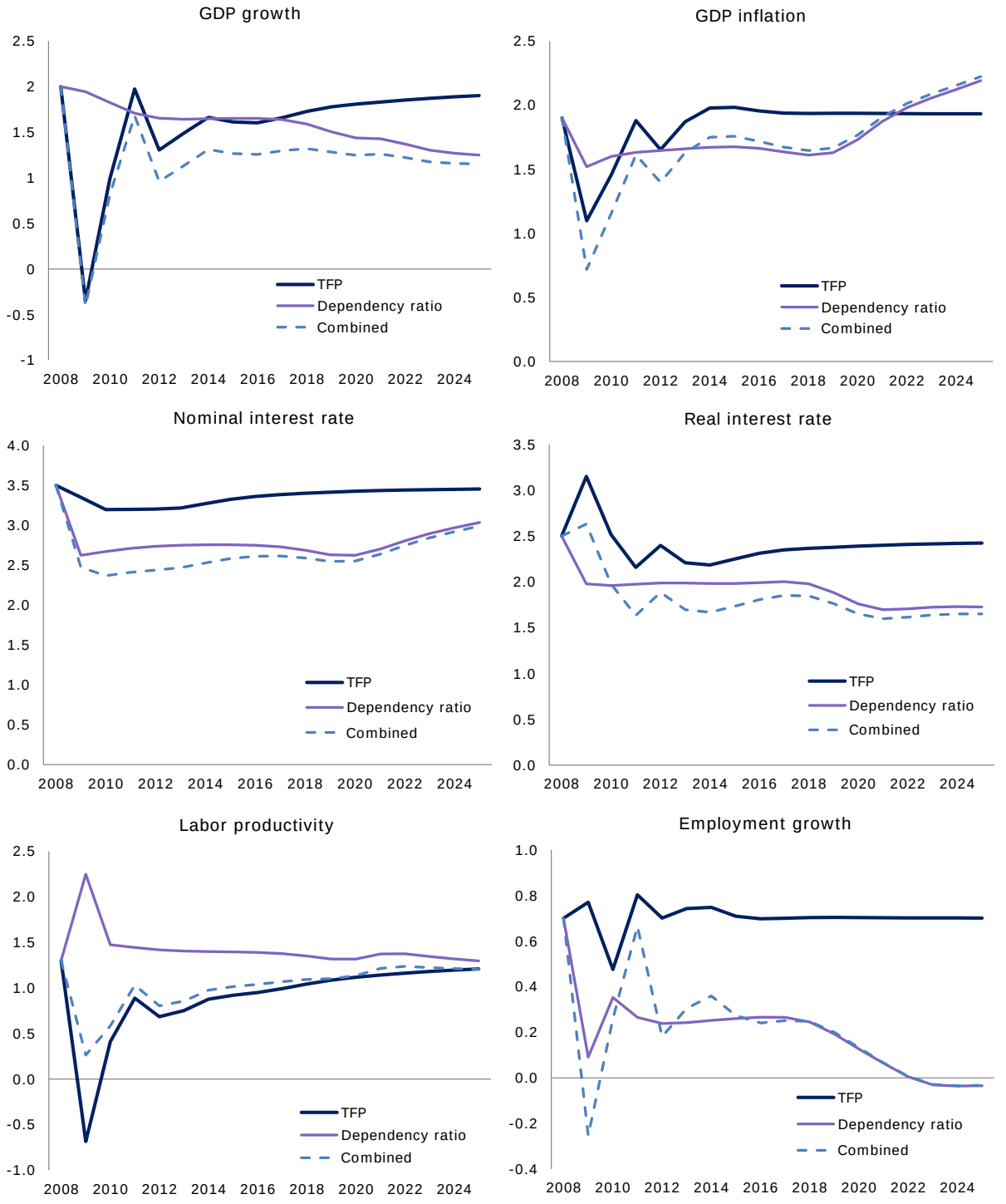
Although both the TFP and demographic shocks are negative supply shocks, they will also produce demand-side effects that lead to deflation. The TFP shock affects the demand side due a reduction in expected per-capita income. The shock to the dependency ratio is also defined as a negative supply shock as it will ultimately lead to a reduction in the labour supply, through an increase in the labour market non-participants (e.g. pensioners). However, as agents in the economy also anticipate changes in demographic trends in the future, the increase in the dependency ratio will generate significant demand-side effects in the short and medium term. The expected fall in future income per capita will lead to an increase in household savings, and a fall in consumption and the real interest rate.

Graph II.1.3 shows model simulations of the analysis. Each subplot presents the effects of an individual TFP or dependency ratio shock, and the aggregate effect of both shocks combined.

Both shocks lead to a substantial decline in GDP growth by 2025 relative to a 2 % pre-crisis baseline trend. Quantitatively, the effects of the shock on the dependency ratio are larger and more long-lasting. This is due to the fact that, for TFP, it is assumed that the decline in the growth rate is only temporary and that it will return broadly to pre-crisis levels within 10 years. As a result, a TFP shock is associated with more front-loaded effects than a shock to the dependency ratio. Moreover, agents in the economy not only revise downwards their TFP growth expectations but also revise down the 2009 TFP level (by about 2 %, see calibration of TFP shock in Box II.1.1.) Consequently, this leads to a sizeable decline in GDP growth for 2009 – stronger than in the case of the shock to the dependency ratio. The ensuing recovery in GDP growth following the TFP shock is a consequence of the downward level shift of consumption and investment, which subsequently remain low over the medium-term. If agents only gradually learned about the future fall in TFP, then we could observe a more protracted decline in GDP growth.

It is important to emphasise that the contrasting results of the two shocks hinge on their constructed paths. For the dependency ratio, it is clear that ageing will be a long-lasting development and so the effects will be more durable. For TFP, it is assumed that the growth slowdown will fade away over time and that the gap between pre-crisis and post-crisis trends will not widen further after 2025 (see Graph II.1.2). Given the documented pre-crisis slowdown in TFP in Europe, our calibration of the TFP shock can be taken as a lower bound. However, the construction of the

Graph II.1.3: **QUEST Simulations of an ageing shock and a TFP shock, euro area**
(2008-2025)



Source:

TFP shock is consistent with the much larger uncertainty regarding future technological progress.

A future acceleration in productivity growth cannot be ruled out (for example as a result of breakthroughs in ICT (e.g. robotics, artificial intelligence). A recent optimistic growth scenario by Bartelsman ([27]) confirms this hypothesis. It is

([27]) Barterlsman, E. J., (2013), 'ICT, reallocation and productivity', *European Economy, Economic Papers*, No 486.

also the reason why Gordon ([28]) does not make a productivity prediction beyond 2025. Another argument why the TFP growth decline may not be a persistent phenomenon is that TFP itself is a consequence of worsening financing conditions for innovations. ([29])

Both shocks lead to a significant and persistent decline in inflation. However, after 2015 the inflation rate slowly moves back towards the 2 % target. The shock to the dependency ratio causes the GDP deflator to decline by less on impact, but has a stronger effect in the short-term due to demand effects resulting from an increase in savings and a fall in consumption. In the medium-term the persistent effects of the shock leading to a reduction in labour supply will ultimately entail inflationary pressures that cause inflation to overshoot the 2 % target.

Both shocks lead to a sizeable and persistent decline in the nominal interest rate. Following a TFP shock, the nominal interest rate returns to baseline by 2025, whereas following a shock to the dependency ratio it remains persistently low.

The growth rate of labour productivity reacts differently to both shocks. Although labour productivity declines with a TFP shock it increases with an ageing shock. The latter response is due to the fact that higher savings allow for an increase in the capital-labour ratio, through an increase in the investment rate. This is because until the start of the crisis, agents project a constant dependency ratio, but from 2009, the increasing future path for the dependency ratio is incorporated into savings and investment decisions of the private sector.

Although both the shock to TFP and to the dependency ratio qualitatively contribute to the patterns observed in actual data, neither shock alone, nor combined, can explain the aggregate quantitative behaviour. Arguably, the simulation would need to account for additional negative demand shocks, such as increases in investment risk premiums, or private and public deleveraging episodes, in order to fully capture these features. ([30])

In summary, our results suggest that two underlying supposed causes of secular stagnation, which gained strength from the onset of the crisis, lead to quite different macroeconomic effects, especially when their medium-term outlook is taken into consideration.

On the policy front, structural reforms of labour markets could be appropriate policy responses for tackling the consequences of these supply-side disturbances. For example, pension reforms that extend the working age limit (as discussed in the 'Focus' section of this report) could slow the increasing trajectory of the dependency ratio. More generally, the current migration inflows that the euro area is experiencing could also prove beneficial in offsetting the effects of its ageing population in the longer term. Regarding the TFP slowdown, by fuelling investment into technological processes the productivity slowdown could be reversed. An increased supply of skilled labour inputs, as well as an increased demand for R&D, could lead to a creation of new technologies and intensify the speed of adoption of these.

Given the contribution of both these shocks in keeping interest rates low in the medium-term, and hence, limiting the ability of monetary policy to stimulate the economy, alternative measures for exiting episodes of secular stagnation should be pursued.

([28]) Gordon, R. (2014), 'A new method of estimating potential real GDP growth: implications for the labour market and the debt/GDP Ratio', *NBER Working Papers*, No 20423.

([29]) See Anzoategui, D., D. Comin, M. Gertler, and J. Martinez (2016), 'Endogenous technology adoption and R&D as sources of business cycle persistence', *NBER Working Papers*, No 22005.

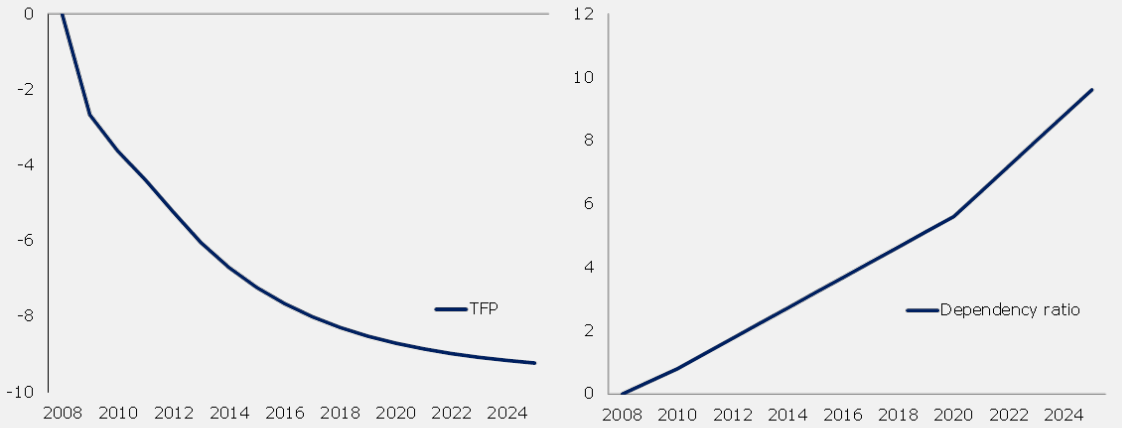
([30]) For such an analysis using an estimated model see:
Kollmann, R., B. Pataracchia, R. Raciborski, M. Ratto, W. Roeger, and L. Vogel (2015), 'The post-crisis slump in the Euro Area and the US: evidence from an estimated three-region DSGE model', DG ECFIN, mimeo.
For such an analysis using a calibrated model see:
Priftis, R., W. Roeger, and J. in 't Veld (2015), 'The slow recovery in the Euro Area', DG ECFIN, mimeo.

Box II.1.1: Calibration of shocks and model set-up

In order to calibrate the shock to TFP we have used information from the European Commission's medium-term projections. With each forecasting exercise the Commission calculates output gaps using a production function approach. A crucial component of this exercise is the estimate of trend TFP together with a 5-10 year projection. By comparing various vintages of trend TFP we are able to trace the speed at which revisions to TFP have occurred.

A comparison of pre-crisis and post-crisis TFP projections suggests that, by 2025, a gap of about 10 % will open up between the two projections. However, it is assumed that the TFP growth slowdown will fade over time, so this gap will not widen further after 2025 (see graph below). Given the documented pre-crisis slowdown in TFP in Europe, our calibration of the TFP shock can be taken as a lower bound.

Graph : **Euro area, shock Calibration,**
(2008-2025)



Source: DG ECFIN calculations.

For the shock to the dependency ratio, we used information from the European Commission's 2015 Ageing Report. This describes the expected changes in European demographics, and predicts that the dependency ratio will rise by 17 % by 2025. We constructed the shock by directly feeding into the model the projected path of the total dependency ratio. The latter is modelled as an increase in the population share of labour market non-participants (e.g. pensioners). The two calibrated shocks can be seen in the graph above.

The model used to conduct the simulations is a two-region dynamic general equilibrium set-up of the European economy and the rest of the world. Each region has two production sectors that produce tradable and non-tradable goods. There are two types of households: liquidity-constrained households and intertemporally optimising Ricardian households. All households consume and supply labour. Ricardian households also invest in domestic productive capital, domestic government bonds and foreign bonds, own firms, and obtain profits from firms. There is no cross-border mobility of labour. Since the TFP slowdown and projected ageing of the population is not purely a European phenomenon, we also assume that the rest-of-the-world section of the model will experience the same exogenous disturbances, although to a lesser extent. (1)

(1) A full description of the model can be found in: Priftis, R., W. Roeger, and J. in 't Veld (2015), 'The slow recovery in the Euro Area', DG ECFIN, mimeo.

II.2. Drivers of total factor productivity growth in the EU — the role of firm entry and exit

This section investigates the relationship between business dynamics and total factor productivity growth. Schumpeterian growth models predict a positive association between business dynamics (market entry and exit of firms) and productivity improvements, through the process of innovation and creative destruction. Macro-level data for EU countries over the period 2002-2012 are used to quantitatively assess this relationship, while controlling for other important factors such as distance to the technological frontier, R&D investments, and capacity utilisation. The results provide evidence of a positive relationship between the market entry of new firms and productivity growth. A 1 percentage point increase in the birth rate of new firms is associated with an increase in total factor productivity growth by 0.1 percentage points. This finding is also validated when using alternative specifications of the model. Also some evidence is found for a positive role of market exit in explaining total factor productivity growth. However, the impact of the exit rate is less when the productivity levels of countries are lower, and the econometric estimates are less compelling. The results suggest that policies promoting the entrance of new firms can be conducive to productivity growth, whereas facilitation of market exit (for example, by modernising insolvency legislation) is relevant particularly in countries with relatively high productivity levels. ([31])

Introduction

This section investigates the relationship between economy-wide productivity growth and the market entry and exit of firms. This work is part of ongoing research in the European Commission on drivers of productivity. It complements the analysis in the Product Market Review 2013 ([32]), where it was found that an increase in market entry is positively associated with allocative efficiency (defined as the extent to which the most productive firms also have the highest market shares). ([33]) It also complements a previous contribution to this report on the drivers of total factor productivity (TFP), considering a variety of factors, but not the firm entry/exit channel. ([34])

According to economic theory, there is a link between these firm dynamics and productivity developments. Various channels proposed in the literature may explain this link. These include Schumpeterian creative destruction (replacement of less efficient firms by more efficient ones through the process of innovation), the disciplining effect of market entry on existing firms, and reallocation of productive resources towards more efficient uses facilitated by the process of market entry and exit.

Policymakers recognise the importance of firm dynamics for economic performance. Indeed in many countries, they try to imp rove the conditions to start a business, or to smooth market exit conditions, facilitated by appropriate insolvency legislation.

When these policies are successful, one would expect that there are also benefits at the macro level, for example in terms of GDP, employment, and productivity. The empirical evidence on the macroeconomic benefits of firm dynamics is rather scarce. The aim of this section is to provide a quantitative assessment of the relationship between firm dynamics and productivity developments in EU countries, while including other relevant variables. The analysis concentrates on growth in TFP, as this is — in the long run — a crucial factor in determining living standards of the population.

The role of firm entry and exit in explaining economic growth is explicitly considered in Schumpeterian growth literature. For example, Aghion, Akcigit and Howitt ([35]) show that — in a basic theoretical industrial organisation model (see also Tirole ([36])) — the rate of economic growth

([31]) This section was prepared by Erik Canton.

([32]) European Commission (2013), 'Product Market Review 2013: Financing the real economy', *European Economy*, No 8, European Commission.

([33]) See also Canton, E., D. Ciriaci, and I. Solera (2014), 'The economic impact of professional services liberalisation', *European Economy, Economic Papers*, No 533, European Commission, who investigate the relationship between product market regulation, business dynamics, and allocative efficiency for selected regulated professions.

([34]) Balta, N., and P. Mohl (2014), 'The drivers of total factor productivity in catching-up economies', *Quarterly Report on the Euro Area*, Vol. 13, No 1, pp. 7-19.

([35]) Aghion, P., U. Akcigit, and P. Howitt (2013), 'What do we learn from Schumpeterian growth theory?', Harvard University, mimeo.

([36]) Tirole, J. (1988), 'The theory of industrial organisation', MIT Press.

Box II.2.1: Derivation of total factor productivity

An indicator for total factor productivity (TFP) is derived from a standard growth accounting exercise. Output is produced based on a Cobb-Douglas specification of the following type:

(1) $$Y = A(LHQ)^{\alpha}K^{1-\alpha}$$

where Y is total output, L is employment, H is the average number of hours worked, Q is labour quality, K is the capital stock, and A is an index measuring total factor productivity. Assuming constant returns to scale, the production elasticity of labour (capital) is given by α (1-α). This production function then implies:

(1') $$A = Y/((LHQ)^{\alpha}K^{1-\alpha})$$

Taking logarithms and first differencing, the growth rate of TFP is calculated as:

(2) $$\Delta a = \Delta y - \alpha(\Delta l + \Delta h + \Delta q) - (1-\alpha)\Delta k$$

where small letters indicate logarithms. In order to enable cross-country comparison, GDP data from Eurostat based on chain-linked volumes are used. GDP and the capital stock are in constant prices. Account is taken of the labour quality, using the initial education level of labour as a proxy. This initial education level is computed as the average productivity per person employed relative to the productivity of the low-skilled.

increases with the birth rate of new firms. This is because innovation leads to market entry and to replacement of existing firms (creative destruction).

Aghion, Blundell, Griffith, Howitt and Prantl ([37]) studied a sample of over 3 800 British firms in the manufacturing sector during the period from 1980 to 1993. They found that foreign entry into the United Kingdom (measured by the change in employment levels in foreign-owned plants) has a positive impact on incumbent firms' growth in TFP. This result is in line with the theoretical prediction in Schumpeterian models that entry drives TFP growth, as incumbent firms that are closer to the technological frontier innovate more in order to escape competition from entry. In a similar framework, Aghion and Bessonova ([38]) used a sample of Russian manufacturing firms to show that incumbent firms' reaction to foreign entry depends on their position relative to the technological frontier. Specifically, incumbent firms closer to the frontier prior to foreign entry innovate more when faced with entry. On the contrary, incumbent firms that are further away from the technological frontier appear to innovate less when there is increased entry and eventually exit the market.

Cincera and Galgau ([39]) report that a 1 percentage point increase in the current entry rate leads to a relatively large rise in labour productivity growth by 0.6 percentage points. ([40]) They based their conclusions on sectoral data that included industry, country and year dummies and lagged entry rates, but not other control variables that may be relevant, such as investment.

Griffith and Harrison ([41]) studied the impact of a wide range of product market reforms (including those that facilitate entry) on economic rents and productivity growth in a sample of EU countries during the 1980s and 1990s. Contrary to most of the empirical literature, Griffith and Harrison found that regulatory reforms that increased market entry — and thus reduced the level of economic rents — appear to be associated with lower levels of labour and total factor productivity.

([37]) Aghion P., R. Blundell, R. Griffith, P. Howitt, and S. Prantl (2004), 'Entry and productivity growth: Evidence from microlevel panel data', *Journal of the European Economic Association*, Vol. 2, pp. 265 – 276.

([38]) Aghion, P., and E. Bessonova (2006), 'On entry and growth: theory and evidence', *Revue OFCE*, pp. 260-278.

([39]) Cincera, M., and O. Galgau (2005), 'Impact of market entry and exit on EU productivity and growth performance', *European Economy, Economic Papers*, No 222, European Commission.

([40]) The authors interpret 0.6 as an elasticity.

([41]) Griffith, R. and R. Harrison (2004), 'The link between product market reform and macro-economic performance', *European Economy, Economic Papers*, No 209, European Commission. They use a two-step approach in which they first estimate the relationship between product market reforms and the level of economic rents; and, then, the relationship between rents and macro-economic performance, using indicators of product market reforms as instruments for economic rents (mark-ups).

Table II.2.1: **Descriptive statistics**

Acronym	Description	Observations	Mean	Standard deviation
Δln(TFP)	growth rate of TFP (%)	300	0.73	2.81
Distance	distance to the TFP frontier (%)	300	41.03	34.42
Birth	birth rate of new firms (%)	257	10.62	4.02
Death	death rate of existing firms (%)	225	9.19	3.69
R&D	R&D investments (% of GDP)	298	1.50	0.94
Caputil	capacity utilisation (%)	281	77.71	7.22
Gov	government expenditure (% of GDP)	257	45.04	6.33

Source: DG ECFIN calculations based on LIME Assessment Framework and Eurostat data.

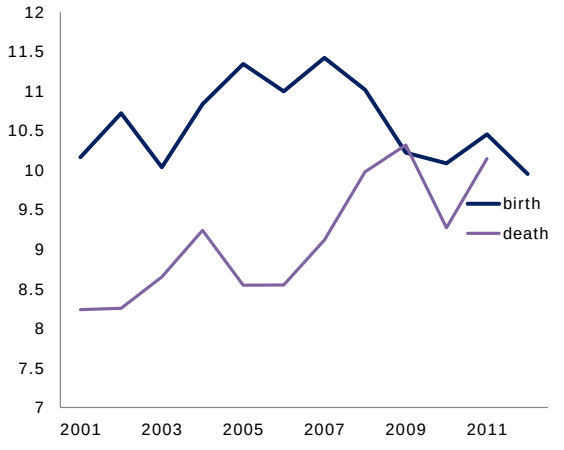
The role of exit is also important in explaining productivity growth. Foster, Haltiwanger and Krizan ([42]), for example, found that restructuring was the main cause of the productivity gains in the US retail trade sector during the 1990s. Restructuring in this case is entry by more productive establishments from large, national chains, which displaced much less productive single-unit establishments. Similarly, for a large sample of UK manufacturing establishments during the period 1980-1992, Disney, Haskel and Heden ([43]) reported that 'external' restructuring (i.e. exit, entry and changes in market shares) accounted for 80-90 % of TFP growth at establishment level. They also found that much of the external restructuring effect comes from multi-establishment firms closing down poor-performing plants and opening high-performing new ones.

Data

The total factor productivity (TFP) data used in this section are derived from the growth accounting methodology developed in the context of the LIME Assessment Framework (LAF) database. ([44]) This growth accounting approach provides a detailed breakdown of the underlying drivers (more details are provided in Box II.2.1).

The other variables come from Eurostat, and cover 25 Member States (all EU countries except Croatia, Greece and Luxembourg) during the period from 2002 to 2012. Unfortunately, no other countries could be included because comparable data, such as for the US, were not available. The sample size is also limited, which limits the econometric analysis. Table II.2.1 presents some descriptive statistics.

Graph II.2.1: **Firm entry and exit (%)**



Source: Eurostat

The dependent variable in the empirical analysis is the annual TFP growth rate, which in the sample is about 0.73 % on average. The key explanatory variables are birth and death rates, which are equal to the number of firms created and de-registered, respectively, in year 't', divided by the number of all active firms in the same year. Birth and death rates are about 10 %, with average birth rates somewhat higher than average death rates: the number of firms therefore shows a net expansion over time. The time pattern of birth and death rates (averaged across countries in the sample) are shown in Graph

([42]) Foster, L., J. Haltiwanger and C.J. Krizan (2006), 'Market selection, reallocation, and restructuring in the U.S. retail trade sector in 1990s', *Review of Economics and Statistics*, 88(4), pp. 748-758.

([43]) Disney, R., J. Haskel and Y. Heden (2003), 'Restructuring and productivity growth in UK manufacturing', *Economic Journal*, 113, pp. 666-694.

([44]) Mourre, G. (2009), 'What explains the differences in income and labour utilisation and drives labour and economic growth in Europe? A GDP accounting perspective', *European Economy, Economic Papers,* No 354, European Commission.

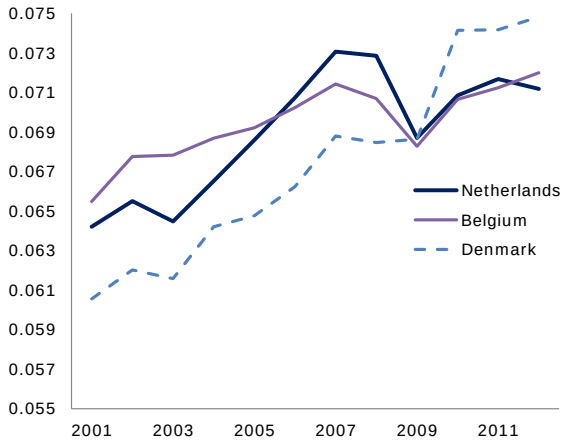
Table II.2.2: **Correlation matrix**

	Δln(TFP)	Distance	Birth	Death	R&D	Caputil	Gov
Δln(TFP)	1						
Distance	0.32	1					
Birth	0.22	0.44	1				
Death	-0.04	0.39	0.62	1			
R&D	-0.15	-0.60	-0.35	-0.33	1		
Caputil	0.12	-0.47	-0.22	-0.35	0.48	1	
Gov	-0.25	-0.55	-0.43	-0.30	0.70	0.32	1

Source: DG ECFIN calculations.

II.2.1. The graph shows that, after 2007, birth rates went down, while death rates increased.

Graph II.2.2: **Leapfrogging in TFP frontier: Belgium, the Netherlands, and Denmark**
(2001-2012)



Source: DG ECFIN calculations.

Another important independent variable in the regression framework is a country's distance to the technological frontier, where the frontier is represented by the country with the highest TFP level in the sample. During the period of investigation, TFP leadership was held by Belgium (2002-2005), the Netherlands (2006-2009), and Denmark (2010-2012). ([45]) This is known as leapfrogging: countries taking over TFP leadership from each other. The leapfrogging pattern is illustrated in Graph II.2.2.

As shown in Table II.2.1, the distance, i.e. the TFP gap between a particular country and the TFP leader, is on average 41 %. Such a large average distance towards the frontier in EU countries suggests substantial cross-country discrepancies in TFP levels. Yet it also shows the potential gains from catching-up that could be achieved by laggard countries.

The notion of distance towards the TFP frontier is important for the analysis for two reasons. First, countries lagging behind in terms of TFP levels can benefit from relatively fast productivity growth by adopting and implementing state-of-the-art technologies developed elsewhere.

The empirical relevance of this catching-up mechanism is widely documented in the economic growth literature. It is illustrated in Graph II.2.3. While distance towards the frontier is decreasing over time, this pattern of convergence was interrupted in 2009, and there is even evidence of some widening afterwards. Second, TFP growth in the frontier economy could generate positive spillovers to laggard countries. To capture the diffusion of existing technologies and knowledge from the frontier country to laggards, TFP growth at the frontier is also included as an explanatory variable in the regression framework. ([46])

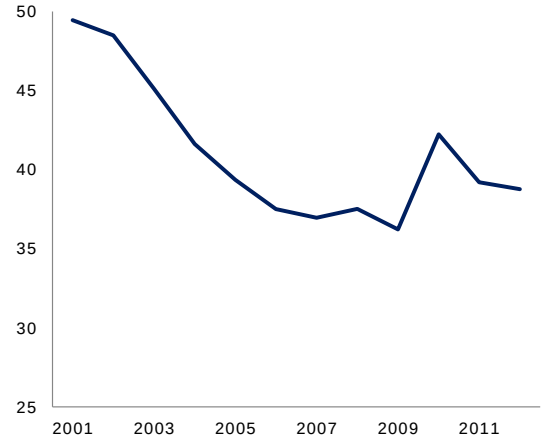
In addition to the business dynamics indicators and distance, several other explanatory variables were included. Specifically, the model includes R&D intensity (total R&D spending as a percentage of GDP) ([47]), the capacity utilisation rate (%) and government expenditure (as a percentage of GDP). The time series for the capacity utilisation rate and government expenditures are shown in Graph II.2.4 and Graph II.2.5, respectively.

([45]) The pattern of TFP leadership may differ when other data sources are used. For example, an exercise using EUKLEMS data is provided in Kegels, C., M. Peneder, and H. van der Wiel (2008), 'Productivity performance in three small European countries: Austria, Belgium, and the Netherlands', FPB, WIFO and CPB.

([46]) Cf. OECD (2015), 'The future of productivity', OECD, Paris.

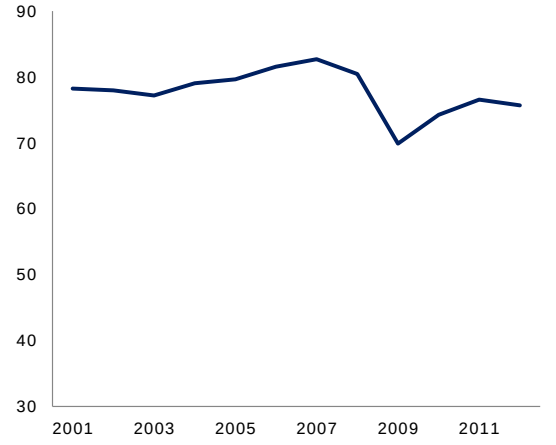
([47]) There is an extensive literature on the relationship between R&D investments and productivity growth, see for example Griffith, R., S. Redding, and J. van Reenen (2004), 'Mapping the two faces of R&D: Productivity growth in a panel of OECD industries', *The Review of Economics and Statistics*, Vol. 86, No 4, pp. 883-895.

Graph II.2.3: **Distance towards frontier (%)**



Source: DG ECFIN calculations.

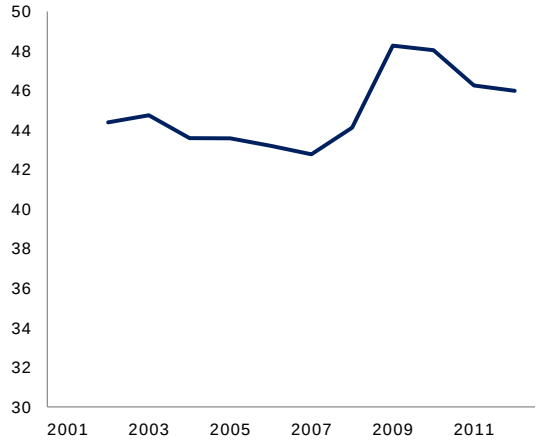
Graph II.2.4: **Capacity utilisation (%)**



Source: Eurostat.

Before turning to the econometric analysis, some descriptive statistics are presented. Table II.2.2 shows correlation coefficients. It shows in particular that the correlation between TFP growth and the birth rate is positive, while the correlation between TFP growth and the death rate is much weaker and negative. Also, birth and death rates are strongly correlated, which suggests that they should be included separately in the regressions (as the inclusion of both indicators simultaneously might give rise to multi-collinearity issues). The counter-intuitive result that TFP growth is negatively correlated with R&D intensity may be due to the fact that countries further away from the frontier tend to have lower R&D intensity and higher TFP growth, benefiting from the catch-up mechanism mentioned earlier. This illustrates the need to build a multiple regression model in order to check for the major drivers of TFP growth simultaneously. Indeed, as will be shown later, the above-mentioned counter-intuitive result on the relationship between TFP growth and R&D intensity disappears in the regression analysis.

Graph II.2.5: **Government expenditure (% of GDP)**



Source: Eurostat

Empirical analysis

This section describes the econometric findings. The approach and main results for the relationship between business dynamics and TFP growth are presented in Box II.2.2.

Birth rate and total factor productivity growth

The results provide evidence of a positive relationship between market entry of new firms and productivity growth, where a 1 percentage point increase in the birth rate of new firms is associated with a 0.1 percentage point increase in TFP growth. This finding is validated when using alternative specifications of the model. In quantitative terms, this indicates a rather strong relationship between firm entry and productivity developments (NB average TFP growth in the sample period is 0.7 % per year). These results are in line with the creative destruction mechanism widely documented in the literature. The other explanatory variables included in the regression framework typically appear with significant regression coefficients with the expected sign. For example, the distance variable appears with a positive coefficient, implying catching-up of laggard countries, and R&D investments also show up with a positive coefficient, confirming their importance for TFP growth.

Death rate and TFP growth

The empirical results for the relationship between the death rate of firms and TFP growth are less conclusive. For the four regression models used in case of firm entry, no significant positive coefficients for the death rate are found. In one model, the coefficient is even negative, and statistically significant. Interestingly, adding an interaction term between the death rate and distance to the TFP frontier generates a positive and significant coefficient of the death rate, and a negative coefficient of the interaction term. This result says that the cleansing effect of firm exit is mainly found in countries operating at or close to the TFP frontier.

In this context, Mongelli, Reinhold and Papadopoulos recently argued that specialisation in countries like Germany and Austria is taking place in line with competitive market forces. This is because allocative efficiency is relatively high so that more productive firms attract a relatively large part of the labour market. ([48]) In contrast, for example in Italy and Portugal (which operate at a greater distance to the technological frontier), there is evidence that allocative efficiency is much lower, and that the reallocation process seems hampered by frictions. This could imply that in countries with an inefficient allocation of labour, firm exit may also hit the more productive firms. More research would be needed to investigate these mechanisms in greater detail.

Another finding is that the coefficient of the death rate may be higher in the pre-crisis period (though the standard error is slightly too large to draw a firm conclusion). The usual pattern of creative destruction under 'normal' circumstances may differ from the pattern emerging in a deep recession. Indeed, firm exit in a deep and prolonged recession could be dictated by other factors. For example, in a balance sheet recession, even productive firms could be forced to discontinue business operations when credit lines are frozen. All in all, the relationship between the death rate and TFP growth is inconclusive, but there is some evidence that this relationship could depend on a country's distance to the TFP frontier.

([48]) Mongelli, F.P., E. Reinhold, and G. Papadopoulos (2016), 'What's so special about specialisation in the euro area? Early evidence of changing economic structures', *Occasional Papers*, No 168, European Central Bank.

Discussion and conclusion

Improving the conditions for new firms to enter the market — and for existing ones to exit — is important to obtain an efficient allocation of resources and ultimately to increase productivity and enhance economic growth. This section has analysed the relationship between business dynamics and TFP growth using macro-level data. The results provide evidence of a positive contribution of firm entry to TFP growth, and this finding is validated when alternative specifications are tested. A 1 percentage point increase in the birth rate of new firms is associated with a 0.1 percentage point increase in TFP growth. There is also some evidence of a positive role of market exit in explaining TFP growth, but the impact of the exit rate weakens when countries are lagging behind in terms of productivity levels. So the 'cleansing effect' of inefficient firms leaving the market only seems to yield macro-relevant benefits in countries close to the TFP frontier. ([49]) All in all, the evidence reported in this note mainly refers to the productivity-increasing impact of firm entry, and is less clear about the role of firm exit.

In addition to the results for birth and death rates of firms, several other conclusions can be drawn. First, the TFP growth rate in the frontier economy exerts a positive effect on the TFP growth rate in lagging countries, indicating knowledge spillovers. The distance to the TFP frontier has a positive impact on TFP growth — the well-documented catch-up effect — but the role of distance for productivity growth weakened during the crisis period. R&D intensity appears with a sizeable and statistically significant regression coefficient in the empirical estimates, but this impact of R&D on TFP growth weakened during the crisis years.

It should be noted that the time series available for empirical analysis is relatively short, which makes it difficult to assess whether the obtained results truly represent a long-run effect, or whether the impact becomes weaker over time. Such a distinction between short and long-run effects is therefore left for further research. The econometric conclusions should therefore be interpreted with some caution. This is particularly the case for the estimated effects of the death rate.

([49]) Also see Lee, Y., and T. Mukoyama (2008), 'Are there cleansing effects of recessions? Entry and exit of manufacturing plants over the business cycle', VOX, 7 January 2008.

Additional research in this area could consider sector-level data (as for example in Balta and Mohl ([50])), provided that sectoral TFP data can be computed using suitable price deflators to enable cross-country comparability. This would also be a response to the issue that this section uses economy-wide TFP data, while the birth and death rates refer to the business sector only (cf. Box II.2.2).

Another logical extension could be to investigate the role of physical distance between countries. This would enable an investigation of whether countries geographically closer to the frontier economy can benefit more from productivity spillovers, for example through trade links or more intense cross-border movement of workers.

It would also be interesting to investigate the relationship between market entry and productivity performance at the level of individual firms, using for example the ORBIS database. ([51]) The OECD is actively undertaking research using such micro-databases, which enables studying new research questions, for example related to learning from technological leaders at the national or global level (see OECD ([52])).

The findings on the empirical relationship between firm entry and TFP growth provide an additional mechanism through which firm entry can be conducive to productivity, in addition to its impact through allocative efficiency and mark-ups. The results can be used in ECFIN's workstream on quantifying the economic impact of structural reforms (see also the first article in this review). For example, reforms of the justice system have been shown to have an impact on firm entry rates ([53]), and — combined with the findings in this note — the impact on TFP growth can be calculated.

([50]) Balta, N., and P. Mohl (2014), 'The drivers of total factor productivity in catching-up economies', *Quarterly Report on the Euro Area*, Vol. 13, No 1, pp. 7-19.

([51]) Provided by Bureau Van Dijk.

([52]) OECD (2015), 'The future of productivity; Annex 2 Frontier firms, technology diffusion and public policy: Micro evidence from OECD countries', ECO/CPE/WP1(2015)6/ANN2, OECD, Paris.

([53]) See for example ECFIN (2014), 'Market reforms at work in Italy, Spain, Portugal and Greece', *European Economy*, 5.

Box II.2.2: Business dynamics and total factor productivity growth: econometric analysis

The general regression model takes the form:

$$\Delta \ln(TFP)_{it} = \alpha + \beta BD_{it} + \gamma Z_{it} + \varepsilon_{it},$$

where i denotes country, and t denotes time. BD (business dynamics) is either the birth rate or the death rate, while Z is a vector of control variables. β and γ are the vectors of the regression coefficients, and ε is the error term. α is an intercept term.

Role of firm entry

The table below presents the results for the birth rate of new firms. The econometric approach is Ordinary Least Squares (OLS) in model (1) and (2), while panel data estimation methods are employed in model (3) (fixed country effects) and (4) (random effects). Year dummies are included in all specifications and robust standard errors are calculated to control for heteroskedasticity.

Regression (1) is the basic model where TFP growth is explained from the TFP growth rate in the frontier economy, the country's distance towards the TFP frontier, the birth rate and R&D intensity. The regression coefficient of the birth rate implies that a 1 percentage point increase in the birth rate corresponds with a rise in the TFP growth rate by 0.1 percentage points, and this effect is statistically significant at the 5 % level. The TFP growth rate in the frontier country appears with a positive and statistically significant regression coefficient. This suggests that the frontier economy generates positive technology spillovers to laggard countries. The distance variable has a positive regression coefficient, meaning that countries further away from the technological frontier tend to show faster TFP growth, illustrating the catch-up mechanism widely documented in the economics literature (see for example Barro and Sala-i-Martin ([1])). Also an economically and statistically significant regression coefficient of R&D intensity is found, in line with the literature. In model (2) the capacity utilisation rate and government expenditure are added as additional control variables to the OLS equation. The TFP data refer to the whole economy (as opposed to the market economy). The inclusion of government expenditure is an (admittedly crude) attempt to take into consideration the size of the non-market economy. Both control variables appear with statistically significant regression coefficients. A higher capacity utilisation rate corresponds with an increase in TFP growth, while higher government expenditures are negatively associated with TFP developments. Inclusion of these additional variables does not have an important impact on the other explanatory variables, except for a now somewhat stronger effect of R&D investments on TFP growth.

Model (3) is a fixed effects version of model (2), where the variable measuring TFP growth in the frontier economy has been dropped because of multi-collinearity with the year dummies. The coefficient of the birth rate is somewhat higher, whereas the standard error of the coefficient of R&D investments is sharply increased, due to the inclusion of country fixed effects. The last regression model, model (4), uses a random effects estimator. Now the results closely resemble the ones presented in model (1) and (2). To decide between the fixed effects and the random effects model, a Hausman test has been run, suggesting that the random effects model is the preferred method. Also, to choose between the random effects model and a simple OLS specification, the Breusch-Pagan Lagrange multiplier test has been performed. This test showed that there is no evidence of significant differences across countries, so that the simple OLS model can be used. All in all, regression (2) can be considered as the preferred specification.

Some additional sensitivity checks have been carried out. ([2]) First, the stability of the coefficients of the distance variable, the birth rate and R&D spending has been investigated by including interaction terms between these variables and a dummy for the crisis period (taking value 1 for 2008 and afterwards). The interaction term with the birth rate is not significant, meaning that there is no evidence for a significant change in the coefficient before and during the crisis. The interaction terms with distance and R&D spending both appear with negative and significant regression coefficients, and the results imply that during

([1]) Barro, R., and X. Sala-i-Martin (2003), 'Economic growth', second edition, MIT Press.
([2]) The econometric results are not presented, but are available from the author upon request.

(Continued on the next page)

Box (continued)

the crisis period the catching-up process of TFP levels across countries essentially appears to have come to a stand still (Graph II.2.3), and that R&D investments may have contributed much less to TFP growth.

Second, along the lines of the above-mentioned study by Aghion and Bessonova, it has been investigated whether the impact of firm entry and R&D on TFP growth depends on the country's distance to the TFP frontier. This is done by including interaction terms between the birth rate and the distance variable and between R&D spending and the distance variable to the model specification. Both interaction terms appear with insignificant coefficients, so in these regressions no support is found for the role of distance through entry and/or R&D.

Table 1: **Birth and TFP growth**

	(1) OLS $\Delta\ln(TFP)$	(2) OLS $\Delta\ln(TFP)$	(3) FE $\Delta\ln(TFP)$	(4) RE $\Delta\ln(TFP)$
$\Delta\ln(TFP^F)$	0.441***	0.422***		
	(0.056)	(0.058)		
Distance	0.017***	0.017**	0.040	0.017**
	(0.006)	(0.007)	(0.050)	(0.008)
Birth	0.103**	0.105**	0.167**	0.106***
	(0.041)	(0.045)	(0.078)	(0.035)
R&D	0.280*	0.430**	1.471	0.445*
	(0.166)	(0.171)	(1.248)	(0.255)
Capacity utilisation		0.088**	0.211*	0.087***
		(0.034)	(0.109)	(0.030)
Government exp.		-0.093***	-0.063	-0.092**
		(0.030)	(0.085)	(0.043)
Observations	241	218	218	218
R-squared	0.548	0.581	0.599	0.586

Note: Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

In the regression results presented above it was assumed that the birth rate is an exogenous variable, uncorrelated with the disturbance term. In order to correct for potential endogeneity bias, an instrumental variables (IV) approach is adopted, using the lagged birth rate and foreign direct investment as a fraction of total investment as instruments. This generates results broadly in line with above reported findings. However, more work — especially on finding suitable instruments — would be needed before causality can be determined with more certainty.

Role of firm exit

Table 2 presents the results for the death rate. The econometric analysis is carried out in a similar fashion as for the birth rate. The impact of the death rate is less conclusive, and its coefficient is mostly insignificant.

Similar sensitivity checks have been carried out as in the case of firm entry. As these checks now generate new findings with regard to the role of the death rate, the main findings are reported in Table 3. First, for the main explanatory variables interaction terms with the dummy for the crisis period are included. Results are shown in model (1). The findings suggest that the catching-up mechanism appears to have come to a halt in the crisis period, and R&D spending contributes less to TFP growth in the crisis years. The death rate and the interaction term between the death rate and the crisis dummy appear with insignificant coefficients.

Second, inclusion of interaction terms with the distance variable now generates interesting findings, as shown in model (2). The death rate appears with a significant regression coefficient of 0.185, while the interaction term with the distance variable has a significantly negative coefficient. The estimated coefficient of the death rate pertains to the situation when the distance is zero, i.e. in the country operating at the TFP frontier. This result implies that the death rate contributes to TFP growth, but this contribution becomes weaker if countries are further away from the TFP frontier. The empirical results imply that the contribution is zero at a distance of 44.6 % to the frontier. Similar findings are obtained for R&D investments: R&D spending has the strongest effect on TFP growth in countries close to the frontier, and the impact weakens for countries at greater distance to the frontier.

(Continued on the next page)

Box (continued)

Table 2: **Death and TFP growth**

	(1) OLS Δln(TFP)	(2) OLS Δln(TFP)	(3) FE Δln(TFP)	(4) RE Δln(TFP)
$\Delta \ln(TFP^F)$	0.437***	0.414***		
	(0.056)	(0.060)		
Distance	0.024***	0.024***	0.054	0.027**
	(0.007)	(0.007)	(0.053)	(0.012)
Death	-0.013	-0.022	-0.154*	-0.049
	(0.053)	(0.057)	(0.076)	(0.062)
R&D	0.325*	0.515**	2.796*	0.599*
	(0.196)	(0.199)	(1.373)	(0.332)
Capacity utilisation		0.093**	0.206*	0.089**
		(0.040)	(0.110)	(0.039)
Government exp.		-0.112***	-0.089	-0.111**
		(0.034)	(0.075)	(0.048)
Observations	209	188	188	188
R-squared	0.536	0.572	0.620	0.595

Note: Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Finally, along the lines of the earlier mentioned contribution of Balta and Mohl, the effect of the death rate and R&D investments on TFP growth, conditional on the distance towards the TFP frontier, is presented in the Graph included below. The econometric method developed in Kam and Franzese is used. ([3]) The two panels show the marginal effects and their 90 % confidence bands. The left panel refers to the death rate and the right panel to R&D. Statistically significant effects are found when the zero line is not inside the two bounds. The results show that the marginal effect of the death rate is only significant in countries at or very close to the TFP frontier. The marginal effect of R&D is significant if the country's distance to the technological frontier is not too large (smaller than about 18 %). This evaluation of marginal effects across the complete spectrum of the distance variable thus shows that the results on the interaction terms presented in model (2) in Table 3 should be used with caution.

([3]) Kam, C.D., and R.J. Franzese (1999): 'Modeling and interpreting interactive hypotheses in regression analysis: A refresher and some practical advice', University of California, Davis.

(Continued on the next page)

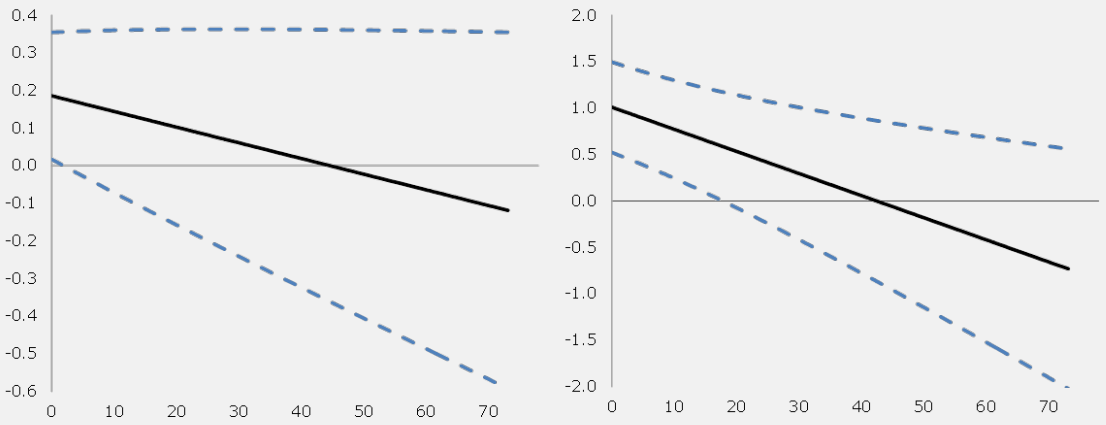
Box (continued)

Table 3: **Alternative specifications**

	(1) Δln(TFP)	(2) Δln(TFP)
$\Delta \ln(TFP^F)$	0.431***	0.425***
	(0.054)	(0.057)
Distance	0.044***	0.085***
	(0.008)	(0.026)
Distance×crisis	-0.049***	
	(0.012)	
Death	0.094	0.185*
	(0.057)	(0.102)
Death×crisis	-0.128	
	(0.090)	
Death×distance		-0.004*
		(0.002)
R&D	0.958***	1.008***
	(0.238)	(0.294)
R&D×crisis	-0.772**	
	(0.360)	
R&D×distance		-0.024**
		(0.009)
Capacity utilisation	0.090**	0.098**
	(0.036)	(0.040)
Government exp.	-0.114***	-0.097***
	(0.033)	(0.034)
Observations	188	188
R-squared	0.627	0.599

Note: Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Graph : **Marginal effects of death rate (left panel) and R&D (right panel) on TFP growth, conditional on distance to the frontier**



Source: DG ECFIN calculations.

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