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Quarterly Report on the Euro Area

VOLUME 12 N° 4 (2013)

Highlights in this issue

- The euro area's growth prospects over the coming decade
- The growth impact of structural reforms
- Firms' investment decisions in vulnerable Member States
- Corporate taxation and the composition of capital

Economic and Financial Affairs

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Directorate-General for Economic and Financial Affairs

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Since the start of the recovery in spring 2013, euro-area wide GDP growth has remained subdued. While the recent pick-up in domestic demand is encouraging, financial fragmentation and ongoing private and public balance sheet adjustments still weigh on growth. In addition, high unemployment — especially among the young — remains a key concern in many euro area countries. Over the next few years, output is expected to continue to recover at a moderate pace, supported by global demand and gradually strengthening domestic demand.

Looking further ahead, medium-term projections for the euro area do not give grounds for excessive optimism. As shown in the first chapter of this report, under a "no-policy-change scenario" potential GDP of the euro area is expected to grow on average by just above 1 % over the next ten years, i.e. around 1 pp lower than in the decade before the crisis. Over the same period, GDP per capita growth is expected to decline by more than ½ pp to less than 1 %. These projections reflect firstly the impact of the weak pre-crisis trends, the fallout from the financial crisis and forthcoming population ageing.

The encouraging message, however, is that the subdued growth outlook is not 'set in stone'. The projections reported above are based on a "do nothing" scenario, i.e. assuming that current policies remain unchanged. Policy makers can avoid the dire growth scenario by implementing reforms that contribute to enhancing the economy's full potential.

There are at least two reasons why structural reforms are crucial in the euro area. First, successful structural reforms can improve living standards in our economies, by raising factor productivity and potential output, creating new jobs and boosting real income growth. Moreover, structural reforms can enhance resilience to economic shocks. This is of particular importance in EMU, since countries cannot use monetary policy to react to idiosyncratic shocks. The findings presented in the second chapter of this report show that comprehensive structural reforms can yield large gains in output. They also contribute to debt sustainability by improving fiscal positions in the medium to long run.

So why, despite their necessity, has it been so difficult in several cases to implement structural reforms? First, reforms can involve choices that impact on organised interest groups, while the benefits are distributed to a wider part of the population. Second, their positive economic impact often only occurs with a considerable time lag, while in some cases there is a short-term (political) cost. Since re-election outcomes are uncertain, policy makers tend to discount the future at a higher rate than socially desirable. This may leave the impression of an uncertain outcome of the reform process. If the needs for and consequences of reforms are left unclear, voters are unlikely to move from the known to the unknown, resulting in a 'status quo bias'.

Due to strong interactions between its members, the euro area, in particular, has an important role to play in coordinating and promoting structural policies. Experience shows that structural imbalances may amplify the impact of negative shocks in one country in a way that can destabilise the euro area as a whole. Conversely, this report shows that successful reforms have positive spillover effects on output within the euro area. As a consequence, effective and credible peer pressure conducted at the euro area level remains decisive to support reforms, reap their full benefits and ensure the smooth functioning of EMU. The policy coordination carried out in the context of the European Semester is essential in this respect.

It is encouraging to note that the financial and sovereign crisis has acted as a catalyst for reforms in a number of Member States. This is not to be taken for granted, since deep crisis periods can impede reforms due to poorly functioning financial markets or calls for stronger protection. Many vulnerable countries, in particular, have initiated ambitious reform processes, as shown by the OECD reform responsiveness indicator. If properly implemented, these reforms will boost growth in the years ahead.

Nevertheless, further reform efforts, carefully designed to mitigate their possible negative social impact, are needed in all euro area countries. In particular, reforms in core countries would, through their positive supply and demand effects, facilitate ongoing rebalancing processes and make the recovery more sustainable. Combined with the repair of financial markets, full implementation of the recommendations, agreed by the Member States in the context of the European Semester, would give a substantial boost to the euro area's medium-term growth prospects.

I. The euro area's growth prospects over the coming decade ([1])

The European economy is showing signs of a turnaround from the economic and financial crisis. However, this has not been an ordinary cyclical downturn, as macroeconomic imbalances accumulated over many years. It is also not an ordinary cyclical upswing and return to growth. Structural trends in Europe have been weakening since the mid-1990s, most notably visible in total factor productivity. In addition, the credit boom that started in the early-2000s brought a misallocation of investment and resources, which now poses an additional weight on the recovery. The profound structural challenges in Europe are gradually being corrected. But the reallocation of resources remains slow, given the necessary deleveraging, the structural rigidities and the remaining weaknesses in the banking sector. Persistent efforts remain necessary to reverse long-lasting trends and to counter the forthcoming impact of ageing populations on growth. This chapter presents a simulation based on a "do-nothing"-scenario under which, over the coming decade, growth rates would be substantially lower than those enjoyed in the decade prior to the financial crisis, averaging less than 1%, which is about half the rate projected for the US. However, the chapter also shows that the euro area has enormous potential for catch-up growth, compared with the US. Consequently, with the introduction of a range of per capita income enhancing structural reforms, focussed in particular on the many unexploited growth opportunities linked to both labour and TFP, policy makers could significantly improve future growth prospects and ease the fiscal strains which any permanent deterioration in income growth inevitably implies. Over the last years with the reinforced economic governance, a strong framework has been created for advancing on the path of reforms, and Member States should implement the recommendations made to them.

Introduction

As the euro area starts to show signs of an economic turnaround, with growth expected to pick up gradually in 2014 and 2015, now is perhaps a good time to assess the longer term prospects for the area as a whole. In this chapter, we take a look at the euro area's growth outlook over the coming decade in a "do-nothing" scenario, comparing it with that of the last few years; with the decade prior to the financial crisis; as well as with the US. In overall terms, the chapter does not predict a period of secular stagnation, but without further reform efforts, it does point to relatively subdued growth prospects for the euro area over the next 10 years. The reasons for this to some extent pre-date the economic and financial crisis and its build-up phase. Especially total factor productivity (TFP) has been weak on average already for a longer period, and indicates missed reform opportunities already before. In the build-up phase of the financial crisis, the underlying low potential growth was hidden behind relatively benign actual growth rates, particularly in catching-up economies. The high debt associated with the financial crisis is a further drag on growth at present. Looking forward, the declining working-age population also impacts on growth. Whilst growth will be low on average, the expectation however is for an acceleration in growth over the second half of the decade, especially in those euro area countries currently undergoing significant economic adjustment programmes, with TFP trends starting to gain from restructuring efforts and with unemployment and investment rates recovering towards their pre-crisis levels.

Regarding the impact of the financial crisis, whilst quantifying its medium to long run effects still provokes controversy, with the literature on creditless recoveries suggesting that it may not necessarily act as a significant constraint on economic activity, ([2]) the results from the present chapter are much more in agreement with the considerable historical evidence that financial crises are associated with abnormally deep recessions; abnormally weak recoveries and prolonged, even permanent, reductions in the level of output. ([3]) As

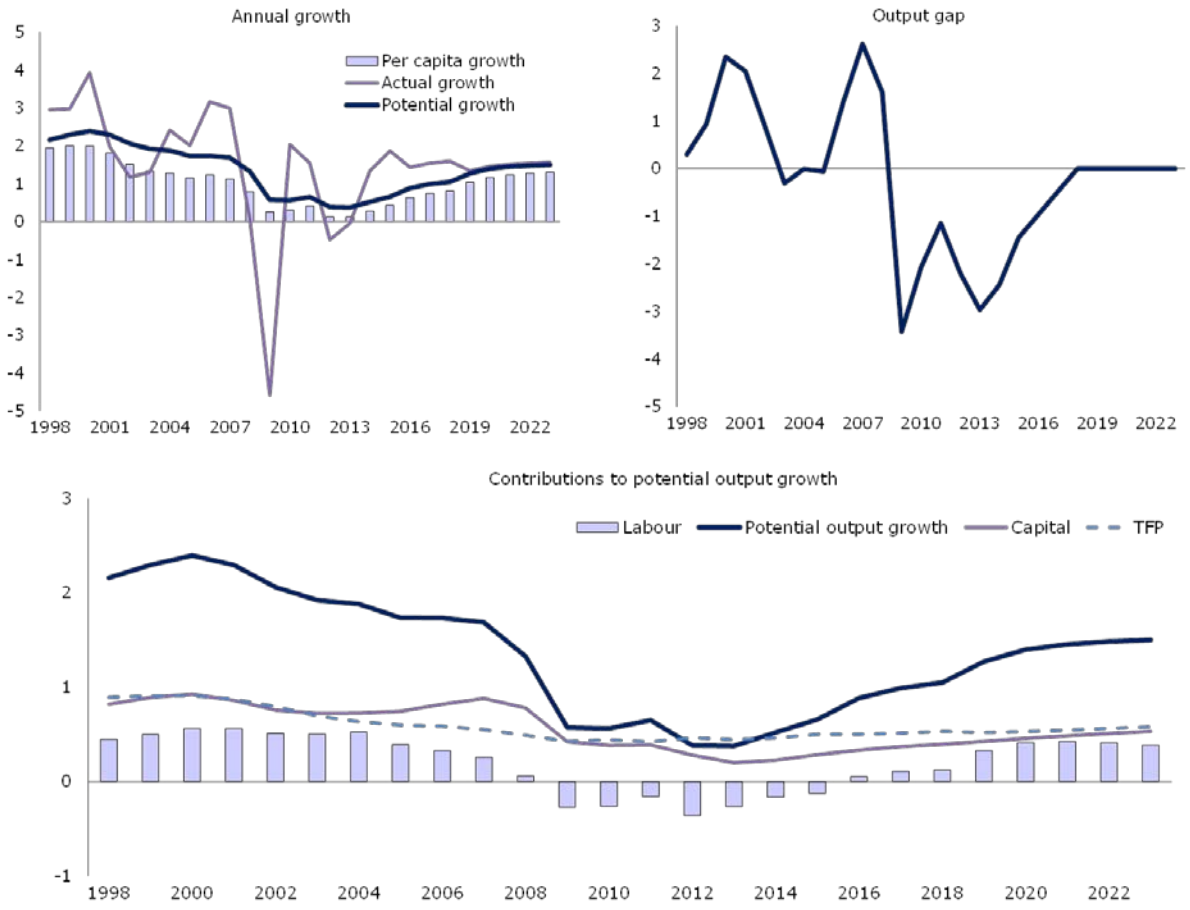
([1]) Section prepared by Kieran McMorrow and Werner Roeger

([2]) See for example: Takats, E and C. Upper (2013), "Credit and growth after financial crises", *BIS Working Papers*, No 416. Claessens, S, A. Kose and M. Terrones (2009), "What happens during recessions, crunches and busts?", *Economic Policy*, Vol. 24(60), pp. 653-700.

([3]) See for example: Cerra, V. and S. Saxena (2008), "Growth dynamics: the myth of economic recovery", *American Economic Review*, Vol. 98(1), pp. 439-457. Haugh, D., P. Ollivaud and D. Turner (2009), "The macroeconomic consequences of banking crises in OECD countries", *OECD Economic Department Working Paper*, No. 683. Reinhart, C.M. and K. Rogoff (2009), "The aftermath of financial crises", *NBER Working Paper*, No. 14656.

Graph I.1: **GDP, potential and per capita income growth, output gaps, euro area**

(1998-2023, in %)



Source: DG ECFIN.

well as looking at the evidence regarding the growth impact of the financial crisis, the present chapter will attempt to disentangle the effects of the crisis from the two other key influences on future growth, namely negative trends with respect to both the euro area's TFP (Total Factor Productivity) and demographic developments. (4)

Whilst this chapter is essentially analytical in nature, its overall message has clear policy implications. Without reform, the euro area's medium to long run growth potential inevitably implies weaker growth than that experienced in the past and continuing divergence relative to US standards of living. However, with reform, the euro area can be placed on a growth trajectory which will ensure the maintenance of past levels of income growth and a revival of the pre-1995 pattern of convergence to US living standards.

(4) TFP measures the overall efficiency of an economy's production processes.

I.1. Growth prospects for the euro area

Using an EPC-approved methodology for forecasting, namely a no-policy-change, (5) baseline growth scenario over the coming decade, Table I.1 and Graph I.1 show the likely outlook for the euro area's economy over the period to 2023. To put this outlook into its proper context, these forecasts are compared with the outturns for the pre-crisis decade (i.e. 1998-2007) and for the crisis period, 2008-2013.

Table I.1 looks at period averages, with Graph I.1 showing the evolution, of actual GDP, potential GDP and GDP per capita over the period 1998-2023. Regarding future growth prospects – actual and potential euro area growth rates are, on

(5) For more details on the EPC approved methodology, see D'Auria, F., C. Denis, K. Havik, K. Mc Morrow, C. Planas, R. Raciborski, W. Röger and A. Rossi (2010), "The production function methodology for calculating potential growth rates and output gaps", *ECFIN Economic Papers*, No. 420.

average, forecast to be nearly 1 percentage point lower in the next ten years than in the pre-crisis decade. Potential rates are expected to only gradually return towards their pre-crisis levels over the period to 2023, as the contributions from capital and labour slowly recover from the significant impact of the crisis. This indicates the need for more structural reform to remove rigidities in the allocations of resources, which is essential in order to raise living standards. Otherwise, per capita growth rates could be expected to fall by over half a percentage point over the coming decade compared with the pre-crisis period (i.e. from an annual average of 1.6% to less than 1%). Per capita growth rates had been trending lower already before the crisis. It can also be seen from the graph that the pre-crisis boost to capital accumulation did not lead to increased TFP growth. Post crisis, capital and labour resources are only gradually re-allocated to more productive uses, which further strains potential growth.

Table I.1: **Actual, potential and per capita growth, euro area (average annual in %)**

	GDP Growth	Potential Growth				
		Total Potential Growth	Contributions to Total			GDP per capita (Potential)
			Labour	Capital	TFP	
1998-2007	2.3	2.0	0.4	0.8	0.8	1.6
2008-2013	-0.3	0.7	-0.2	0.4	0.4	0.4
2014-2023	1.4	1.1	0.2	0.4	0.5	0.9

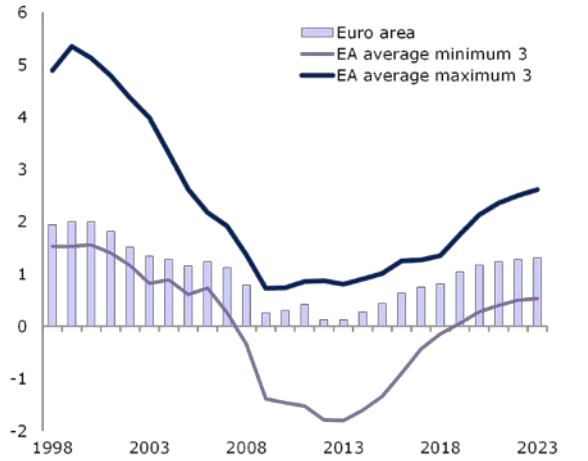
Source: DG ECFIN.

At the same time, actual GDP growth rates are expected to be slightly higher than potential rates over the coming decade since the euro area will still be faced with a significant negative output gap at the end of the short term forecasts in 2015, of the order of 1.5%. This should not be taken as a reason for complacency. In normal circumstances, given this negative output gap, one would expect that actual GDP growth rates would be higher than potential as the gap is progressively closed over the medium term to 2018. With potential growth rates averaging around 1% over the medium term, and with a linear closure of the output gap, one would therefore expect to see actual GDP growth rates of roughly 1.5% each year over the period 2016-2018. Once the gap is closed, actual GDP growth rates will then simply equal the potential growth rates for the period 2019 up to 2023.

Whilst the growth patterns for the euro area as a whole are expected to evolve along the path just described, the respective paths for the individual euro area countries are forecast to diverge significantly from the euro area average. This divergence pattern will represent a continuation of the trends seen since the mid-1990's and exacerbated by the crisis, where existing imbalances and differences with respect to the need for, and consequently the speed of, deleveraging have strongly influenced relative actual growth patterns in the euro area as a whole. Regarding potential growth, this deleveraging process is showing up in particular in a drop in investment rates and persistently high unemployment rates, with knock-on effects on per capita income developments. Regarding the latter, the expected, relatively weak, overall performance for the euro area as a whole over the coming decade is not shared by all of its constituent members, with a number of countries expected to achieve annual average growth rates substantially higher than that of the euro area average, with future growth rates, in some cases, broadly comparable to that of the pre-crisis decade.

Graph I.2: **Potential GDP per capita growth, euro area**

(1998 - 2023, in %)



Source: DG ECFIN.

One indication of the degree of dispersion in the respective performances of the individual euro area countries is highlighted in Graph I.2. This graph shows that the 3 best performing euro area countries in the pre-crisis decade were doing dramatically better than the average over that period, with the 3 weakest performers managing to

grow close to the euro area average. ([6]) During the crisis years (2008-2013), the striking feature was the dramatically worse performance of the 3 weakest countries, with the forecast recovery in per capita income growth rates, over the coming decade, expected to be accompanied by growing convergence in the individual euro area performances.

I.2. Pre-crisis and post-crisis growth drivers in the euro area

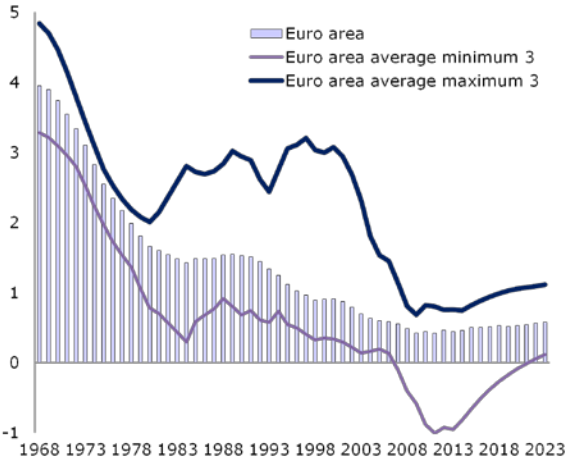
The current section of the chapter will try to show that the euro area's medium to long run growth outlook will mainly be driven by three key factors, firstly the influence of weak pre-crisis trends, most notably for TFP; secondly, the fallout from the financial crisis (including the misallocation of resources during the bubble years) provoking a slower than average recovery over time (especially with respect to structural unemployment and investment patterns) and finally by the expected impact from ageing populations.

Pre-crisis TFP trends:

Regarding TFP, Graph I.3 shows euro area TFP trends since the late-1960's, ([7]) with the Graph indicating that the euro area as a whole experienced relatively high rates of TFP growth in its successful catching up period from the mid-1960's up until the mid-1990's. This catching-up period was however increasingly marked by growing divergences in the respective performances of individual euro area countries from the early 1980's onwards. In addition, Graph I.3 highlights the significant break in the TFP series around 1995, with the post-1995 period not only marked by a sharp decline in the euro area's average TFP performance but also by striking differences in the outturns for individual euro area countries, with some experiencing robust TFP trend rates, whereas others have been characterised by TFP growth rates of close to zero for an extended period of time. The downward movement over the period from the mid-1990's up until the onset of the crisis was, in part, explained by a deceleration to more normal rates for some of the high TFP growth economies whereas the post-crisis period is marked by a further deterioration in some of the weakest TFP performers in the euro area, as well as by tentative signs of a recovery in some of the economies undergoing adjustment programmes.

Graph I.3: **Trend TFP growth, euro area**

(1965-2023, in %)



Source: DG ECFIN.

Whilst the origins of the growing heterogeneity in TFP performances in the euro area has a number of possible sources, there is little doubt that differences in the ability of the respective countries to produce and absorb new technologies, most notably in the ICT area, was a significant driver of growing internal euro area divergences in the post-1995 period. ([8]) Trend TFP breaks are clearly evident in a significant number of euro area countries around 1995, with this break especially evident in those countries where the share of ICT-production in overall output is relatively small, most notably in a number of the southern European countries. Whilst the break undoubtedly occurred, it is not however possible to disentangle the effects of ICT from other important TFP drivers such as non-ICT knowledge investments and changes in the skills composition of the euro

([6]) The composition of the 3 "strongest" and 3 "weakest" country groupings can change from year to year.

([7]) Note : Since trend TFP growth rates are calculated with two different estimation techniques for the pre-1980 (HP filter) and post-1980 (Kalman Filter) periods, this results in a break in the series around 1980. We have used linear interpolation to link these two TFP series, with the break being smoothed out over a four year period.

([8]) See for instance: Colecchia, A. and P. Schreyer (2002), "ICT investment and economic growth in the 1990's: Is the United States a unique case? A comparative study of nine OECD countries", *Review of Economic Dynamics*, Vol. 5(2), 408-442. Inklaar, R., M.P. Timmer and B. van Ark (2008), "Market service productivity across Europe and the US", *Economic Policy*, Vol. 23(53), pp. 139-194. Oulton, N. (2010), "Long term implications of the ICT revolution for Europe: applying the lessons of growth theory and growth accounting", *ICTNET 2nd Workshop on ICT, Intangibles and Innovation*, London.

area's labour force. At the aggregate euro area level, this break in TFP trends resulted in a drop in TFP growth rates from an annual average rate of 1.5% over the period 1985-1994 to 1% over the subsequent decade, with Graph 1.3 indicating both a significant deceleration in the growth rate of the best performing group post-2000 (linked perhaps to the waning TFP gains in the ICT producing sector and the bursting of the dot-com bubble) and a persistent decline in the performance of the weakest grouping. Regarding likely future developments, the current forecasts suggest a relatively subdued recovery in TFP growth rates over the coming decade, with an assumption of less heterogeneity in the performances of individual euro area Member States.

Impact of the financial crisis

On top of the deterioration in trend TFP since 1995, the euro area has been badly affected by the financial crisis. The build-up of the crisis started in the early 2000s and it erupted in autumn 2008, and over the last few years has had, and continues to have, a major impact on the euro area's economic performance. With an annual average actual GDP growth rate of -0.5% over the five year period 2009-2013, the immediate, highly negative, impact of the crisis on the euro area's growth performance is already resoundingly evident. However, the repercussions for growth over the medium and long-run are much less apparent, and depend on an assessment of the various channels via which the crisis could impact on labour market developments, investment and the rate of technological progress.

Regarding labour markets, the key determinants relate to the time needed to reallocate the newly unemployed into alternative employment opportunities in expanding industries, and whether countries can avoid "hysteresis effects" whereby a severe loss in human capital endowments, induced by long spells of unemployment, lead to long-lasting exclusion from the labour market. ([9]) Assessing the likely negative effects of the crisis with respect to the contribution of labour to potential growth depends strongly on an assessment of the impact of any real or nominal rigidities / frictions existing in the respective euro area economies, with the latter linked to rigid labour / product market institutions. The failure of labour / goods markets to provoke a sufficient degree of adjustment, following a large adverse shock such as the financial crisis, hinders the reallocation of labour, with considerable negative knock-on effects in terms of rising structural unemployment / falling employment rates. Currently, high unemployment levels are being mainly driven by medium term cycles which tend to persist for quite extended periods of time. Real adjustment rigidities (such as sectoral reallocation frictions, slow adjustment of reservation wages; skill mismatches etc…) are tending to slow down the necessary reallocation of labour out of crisis hit industries such as construction. These medium term real rigidities are expected to slowly resolve themselves over time, as resources are reallocated between sectors, with unemployment then progressively heading downwards towards its long run structural anchor. Whilst this scenario assumes no major hysteresis effects, it nevertheless implies that, in the absence of continued reforms, the euro area risks ending up with an unemployment rate in 2023 which is higher than in the pre-crisis period (see Orlandi (2012) ([10])).

With respect to investment, trends have already fallen dramatically in the crisis, resulting in a slowdown in the rate of accumulation of productive capital because of increases in risk premia on loans to firms and households, the more cautious lending behaviour of banks and a correction to more "normal" investment levels following the overinvestment pattern of the pre-crisis boom period (with Graph I.4 clearly indicating that investment was being driven by factors other than the fundamentals of trend employment and trend TFP from 2005 onwards, resulting in a pre-crisis potential growth path which was exaggerated by a number of unproductive, leverage-induced, investments). This slowdown, when combined with ongoing deleveraging and an impaired capital allocation system (resulting in a sub-optimal reallocation of capital resources in the restructuring phase), is contributing to a lowering

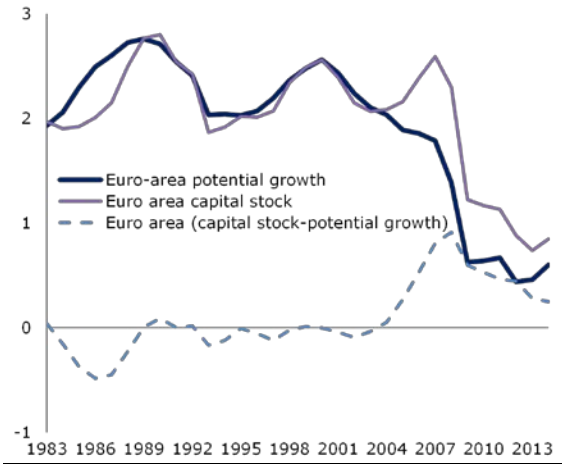
([9]) See Blanchard, O and L.H. Summers (1989), "Hysteresis in unemployment", *NBER Working Paper*, No. 2035; or Blanchard, O. and J. Wolfers (2000), "The role of shocks and institutions in the rise of European unemployment: The aggregate evidence", *The Economic Journal*, Vol. 110(462), pp. C1-C33.

([10]) Orlandi, F. (2012), "Structural unemployment and its determinants in the EU countries", *ECFIN Economic Papers*, No. 455.

of potential growth over the short- to medium-run. (11)

Graph I.4: **Pre-crisis divergence between the growth rates of potential output and of the capital stock**

(1983-2013, in %)



Source: DG ECFIN.

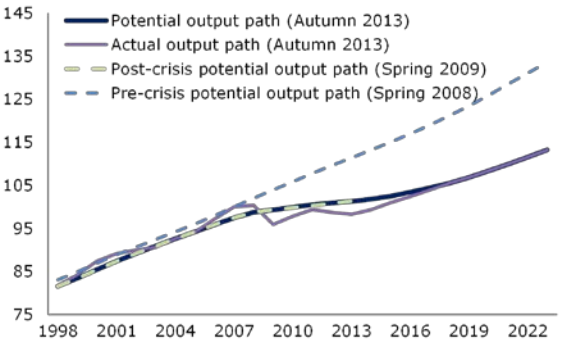
These tangible investment developments can also affect the rate of technological progress in the long run, if, for example, they lead to disincentive effects for intangible investments, such as R&D, and innovative activities in general, resulting in durably negative effects on long run innovation and TFP trends and lower success rates in the development and diffusion of new, leading-edge, technologies. (12) However, the overall impact of the crisis on long-run TFP remains ambiguous. Besides a number of mechanisms that tend to dampen TFP in the aftermath of a crisis, there are also arguments that downturns can have a positive TFP impact as they can induce a process of essential restructuring and cleansing in the economy. (13)

In spring 2009, the Directorate-General for Economic and Financial Affairs (DG ECFIN) looked at the various labour, capital and TFP channels and made an overall assessment of the implications of the crisis for potential output (14). It concluded that the most realistic scenario for the euro area's economy, would be for a prolonged period of slow growth in the aftermath of the crisis, as economies adjusted to their lower post-crisis growth paths, and with the most likely long-run effect being a cumulated loss in the level of the euro area's potential output of around 5% of GDP. This viewpoint was consistent with the mainstream predictions for such 'shocks' emanating from the literature and from an analysis of a number of relevant individual country experiences such as Finland, Sweden and Japan in the 1990's.

Given that the period 2009-2013 has indeed been highlighted by a prolonged period of slow growth, with significant implications in terms of the living standards of the euro area as a whole, a key question now arises, namely whether the outturn for growth over the last 4½ years fundamentally changes the spring 2009 assessment of the long run impact of the crisis. In this regard, Graph 1.5 shows the Autumn 2013 assessment of the future path of potential output in the euro area (produced by the official Production Function methodology and based on the current autumn 2013 Commission services forecasts) and compares this path with alternative pre-crisis (i.e. spring 2008) and post-crisis (spring 2009) potential output paths.

Graph I.5: **Potential and actual output paths, euro area**

(1998-2023)



Source: DG ECFIN.

This graph shows that whilst the real time performance of the PF method in the pre-crisis

(11) See Furceri, D. and A. Mourougane (2009), "The effect of financial crises on potential output: New empirical evidence from OECD countries", *OECD Economic Department Working Paper*, No. 699.

(12) See, for example, Aghion, P., P. Askenazy, N. Berman, G. Cette and L. Eymard (2008), "Credit constraints and the cyclicality of R&D investment: Evidence from France", *PSE Working Papers* or Barlevy, G. (2007) "On the cyclicality of Research and Development", *American Economic Review*, Vol. 97(4), pp. 1131-1164.

(13) Caballero, R.J. and M.L. Hammour (1994), "The cleansing effects of recessions", *American Economic Review*, Vol. 84(5), pp. 1350-1368.

(14) European Commission, Directorate-General for Economic and Financial Affairs (2009), "Impact of the current economic and financial crisis on potential output", *European Economy Occasional Papers 49*, June 2009.

Graph I.6: **Contribution to potential growth from labour input and key determinants of labour input, euro area**

(1998-2023)

Source: DG ECFIN.

period may not have been very good, ([15]) this is clearly not the case in the post-crisis period, with the euro area continuing to track the post-crisis potential output path produced using the spring 2009 forecasts.

In terms of the position of the euro area's economy at the present time relative to ECFIN's 2009 estimate of a long run loss of 5%, if one compares the Autumn 2013 potential output levels relative to the pre-crisis trend path, one can see from Graph I.5 that most of the effect of the crisis has been structural, not cyclical, in nature (with this structural decline in growth mainly driven by a much lower contribution from labour – i.e. increases in structural unemployment and a slower growth in the population of working age - and from weaker investment trends). In addition, since the pre-crisis trend growth path was predicated on an unrealistic TFP growth outlook and was also exaggerated by the pre-crisis investment boom conditions in some euro area economies, ([16]) the best estimate of the long run impact of the crisis continues to be a permanent loss of 5% in the level of the euro area's potential output compared with the most likely output trajectory in the absence of the crisis.

Ageing populations will start to weigh on the overall contribution of labour over the coming decade

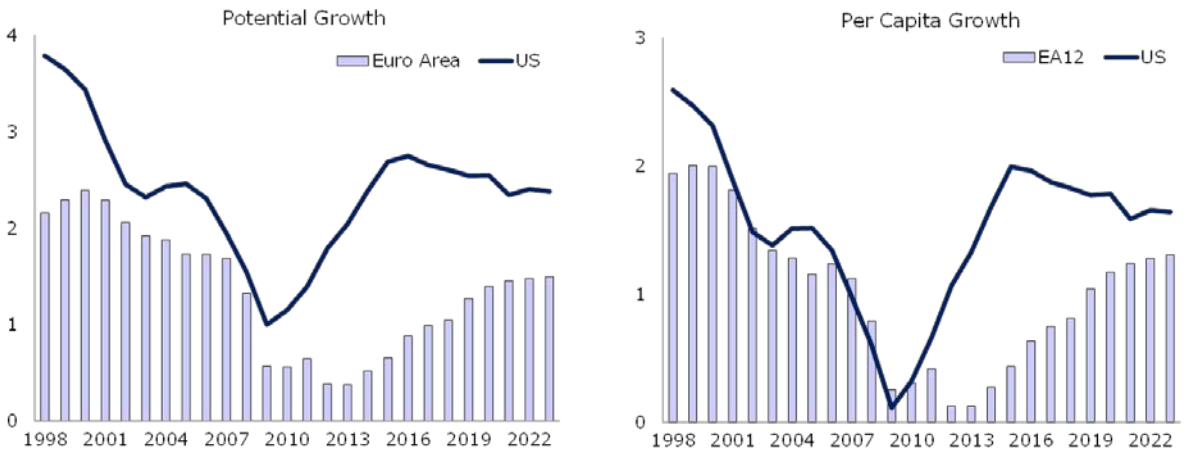
The earlier Table I.1 showed that labour is on average expected to contribute 0.2 p.p. to overall potential growth rates over the coming decade, half the contribution of the pre-crisis decade but nevertheless an improvement relative to the -0.2 experienced in the aftermath of the crisis from 2008-2013. Graph I.6 shows that this recovery in the contribution of labour will be slow but steady over the coming years before tapering off towards the end of the period. Regarding the key drivers of this recovery, positive contributions are expected from both the decline in the euro area's NAWRU and from a small increase in participation rates, with these positive influences being slowly offset towards the end of the period due to the declining contribution from developments in the population of working age. If one compares the contribution to potential from demographic changes over the coming decade compared with the pre-crisis decade, one sees that the contribution from population trends will be restricted to about ¼ of

([15]) The method produced a pre-crisis trend path which pointed to the euro area having a roughly zero output gap whereas subsequent revisions now show a relatively large positive output gap in the years preceding the crisis.

([16]) This implies that the underlying, "speed limit", rate of growth of the euro area's economy in the pre-crisis era was actually lower than the real time estimates suggested, due to the persistent pattern of resource misallocation in the bubble years.

Graph I.7: **US and euro area potential and per capita income growth**

(1998-2023, in %)



Source: DG ECFIN.

that of the pre-crisis period (on the basis of Eurostat's current population projections).

I.3. Euro area versus the US over the coming decade

Table I.2 and Graph I.7 provide a comparison between the euro area and the US over the period 1998-2023 with respect to potential and GDP per capita growth rates. The evidence provided in the table and graph suggests that not only has the US's growth performance been relatively less affected by the financial crisis but also that the US is expected to emerge from the crisis in a stronger position compared with the euro area. Following the inevitable rebalancing / restructuring of their respective economies in the immediate post-crisis period (i.e. 2008-2013), the US is expected to achieve average potential and per capita income growth rates over the period 2014-2023 which are broadly comparable with the pre-crisis decade, whereas the euro area's equivalent growth rates are expected to be halved. Why does the US come out faster? Were there fewer imbalances, fewer structural rigidities?

On the assumption that the euro area and US forecasts underpinning this scenario prove accurate, the euro area is forecast to end up in 2023 with living standards relative to the US which would be lower than in the mid-1960's. If this was to materialise, euro area living standards (potential GDP per capita) would be at only around 60% of US levels in 2023, with close to 2/3 of the gap in living standards due to lower labour productivity levels, and with the remaining 1/3 due to differences in the utilisation of labour (i.e. differences in hours worked per worker and the employment rate).

Table I.2: **Potential and per capita income growth in the euro area and the US (average annual in %)**

	Euro Area		US	
	Potential Growth	GDP per capita (Potential)	Potential Growth	GDP per capita (Potential)
1998-2007	2.0	1.6	2.8	1.7
2008-2013	0.7	0.4	1.5	0.7
2014-2023	1.1	0.9	2.5	1.8

Source: DG ECFIN.

Whilst divergences in euro area and US potential growth rates are of course problematic (with stronger US population trends playing a role), what is relatively more concerning is the emerging gap with respect to overall living standards (driven by a growing divergence with respect to labour productivity trends), with Graph I.8 putting recent, and expected future, euro area and US per capita income developments into their longer term historical perspective.

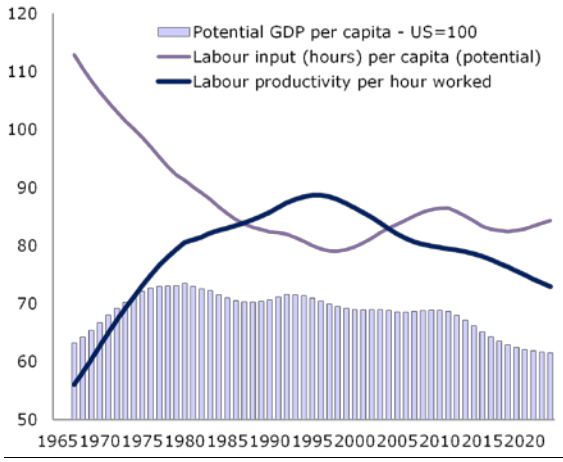
This graph shows that the euro area ([17]) enjoyed a relatively strong pace of convergence to US living standards over the 1960's and 1970's and broadly

([17]) A synthetic euro area aggregate, comprising 11 of the current 17 euro area countries, was constructed to enable a comparison to be made for the period from the mid-1960's up to the establishment of the Euro, with the 11 countries being Belgium, Germany, Ireland, Greece, Spain, France, Italy, the Netherlands, Austria, Portugal and Finland.

matched US GDP per capita trend growth rates over the 1980's and early 1990's. This process of convergence then went into reverse around the mid-1990's, with this shift been driven by a relatively abrupt reversal of long established labour input and labour productivity trends. On the positive side, the previously downward movement in the euro area's labour input trend relative to the US came to an end and, on the negative side, the post-World War II convergence of the euro area to US productivity levels went into reverse. In fact, after having peaked in the mid-1990's at close to 90% of US levels, relative hourly labour productivity levels in the euro area deteriorated by a full 10% points over the subsequent period to 2013 and are currently projected to decline a further 6% points to around 73% of US levels in 2023.

Graph I.8: **Potential GDP per capita, euro area relative to US**

(1965-2023, US=100)

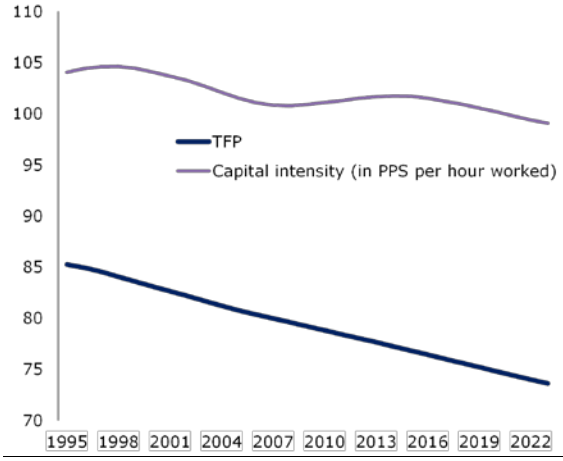


Source: DG ECFIN.

Graph I.8 makes it clear that the halt in the euro area's drive to converge to US living standards in the mid-1990s has been due to the euro area's persistently poor labour productivity performance over the subsequent period. A key supplementary issue is the need to understand what is driving these divergent labour productivity trends. Labour productivity per hour can be decomposed into two components, namely TFP and capital intensity (i.e. levels of investment per hour worked), with Graph I.9 showing that although there has been some relative deterioration in the euro area's investment performance relative to the US over the period since 1995, the main driver of the euro area's relatively dismal productivity performance over that time period has been the decline in euro area TFP levels relative to the US. Relative TFP levels fell from around 85% of US levels in 1995 to 78% currently, and are projected to fall further to a level of around 73% in 2023. Since TFP trends are what drive an economy's living standards over the long run, the premature halting of the euro area's convergence process at 85% of US TFP levels in the mid-1990's and the subsequent decline of the relative position of the euro area are a source of concern. This indicates that the divergence in future growth prospects is not only due to the crisis but has its roots reaching further back.

Graph I.9: **TFP and capital intensity levels, euro area relative to US**

(1995-2023, US=100)



Source: DG ECFIN.

As alluded to earlier, there appears to have been a break in the euro area's TFP series around 1995. Since that time the US and the euro area have diverged, with US TFP growth rates accelerating and those of the euro area decelerating. This divergence in TFP trends is undoubtedly linked to relative ICT developments, with the US enjoying a much stronger burst of TFP growth in a range of industries producing ICT equipment and with the falling relative prices of ICT boosting the rate of ICT capital deepening to a greater extent in the US than in Europe (see Jorgenson et al. (2008)). ([18]) These diverging euro area and US trends have persisted over time. Currently, there is relatively little evidence, at the overall euro area level, that TFP trend growth rates are converging to those in the US. However, as stated earlier, the performance

([18]) Jorgenson, D.W. and K.J. Stiroh, (2008) "US economic growth at the industry level", *American Economic Review*, Vol. 90(2), pp. 161-167. Jorgensen, D.W., M.S. Ho and K.J. Stiroh (2008), "A retrospective look at the US productivity growth resurgence", *Journal of Economic Perspectives*, Vol. 22(1), pp. 3-24.

of individual euro area Member States is very heterogeneous, with certain countries characterized by robust TFP trend growth rates relative to the US and with others continuing to diverge from the US technology frontier.

In overall terms therefore, whilst one must be cautious about making judgements regarding the expected ongoing impact of pre-crisis trends, or more importantly of the financial crisis itself, on future US and Euro Area growth prospects, what can be said is that the US entered the crisis in much better economic shape than the Euro Area (underpinned by a significantly better TFP performance). In addition, the US's future demographic and TFP trends are currently forecast to be substantially more favourable, with positive knock-on effects with respect to US investment (and overall productivity) developments over the coming decade.

I.4. Concluding remarks

This chapter has highlighted the structural decline in the euro area's growth rate over the last 15-20 years, and on the assumption that euro area governments do not react with appropriate policies, has suggested that this trend is forecast to continue over the coming decade. Low future growth rates will essentially reflect the influence of weak pre-crisis trends, most notably for TFP (especially since the mid-1990's), with these pre-existing problems being exacerbated over the coming decade by the ongoing negative fallout from the financial crisis and by the emerging drag on growth emanating from ageing populations.

Regarding the euro area's expected future performance relative to the US, annual average euro area potential growth rates, over the next 10 years, are forecast to be 1 ½% points lower than in the US (i.e. 1% versus 2 ½%). As to future prospects for euro area living standards, GDP per capita growth rates are expected to be only half those of the US.

Since this growth scenario to 2023 assumes unchanged policies, the picture presented could improve significantly with the implementation of an ambitious programme of structural reforms focussed on boosting the labour and TFP components of growth, with capital accumulation responding endogenously to a better outlook for both labour and TFP. Since TFP levels in the euro area are expected to be at less than 75% of US levels in 2023 and since structural unemployment rates will be substantially higher than those of the US, it is clear that there are a large number of significant, unexploited, growth sources in the euro area's economy.

Consequently, whilst commentators such as Gordon (2012) ([19]) may speculate about the reduced future prospects for the US to produce and exploit new technologies for extending its growth frontier, this prediction of a lower rate of US innovation is less of an immediate concern for the euro area given the enormous room for catch-up growth which currently exists. As stressed in the accompanying study in this edition of the QREA on the growth impact of structural reforms in euro area labour and product markets, if Member States could manage to close half of the gap with the three best performing euro area Member States, euro area GDP growth rates could be boosted by ½ a % point each year, over a 10 year period. Equivalent simulations for convergence to the US knowledge-technology frontier would produce significantly higher growth rate gains for the euro area.

This issue of the need to boost euro area growth prospects was forcefully highlighted at the launch of the Lisbon Strategy back in 2000, when EU potential growth rates were at a healthier 2 ½% annual rate. It is necessary to highlight this issue again, more than a full decade later, with the case for reform now being manifestly more pressing. As demonstrated by the wide variation in the past and current growth performances of individual euro area countries, policies matter greatly in determining medium to long run growth and income outcomes. Over the last years, Europe has reinforced its economic governance. In order to bring the growth potential of all euro area countries up to that of the best performers, structural reforms must be continued and further advanced in line with the priorities identified in the European Semester and the "Europe 2020" programme.

([19]) Gordon, R.J., (2012), "Is US economic growth over ? Faltering innovation confronts the six headwinds", *NBER Working Paper*, No. 18315.

II. The growth impact of structural reforms ([20])

The financial and sovereign debt crises have highlighted the need for structural reform. Unemployment rates have risen to dramatic heights in many countries and the duration and depth of the crisis weigh on long-term growth prospects. Low growth could also hamper debt sustainability and have forced more consolidation measures in vulnerable Member States, which have further reduced growth. All this has provided an impetus to carry out reforms to boost growth – country-specific recommendations in the European Semester aim to increase competition and reduce labour market rigidities in Member States.

This article presents a quantitative model-based assessment of the potential impact of structural reforms in selected core and vulnerable periphery Member States. Using structural indicators of labour and product markets, scenarios in which part of the gap vis-à-vis best performance is closed show large potential gains in output and employment, raising GDP by 1.5 % to 6 % after five years and in the case of Greece by up to 15 % after ten years. Crucially, while competitiveness gains are smaller under simultaneous reforms, higher demand effects help to support growth in trading partners. GDP spillovers are positive, with growth effects in Member States mutually bolstering each other.

This article aims to provide a quantitative assessment of the potential macroeconomic impact of jointly implemented reforms and to evaluate possible spillovers of policy actions onto the EU's partners. We focus on the four largest euro-area countries (Germany, France, Italy and Spain) and the three 'programme countries' (Greece, Portugal and Ireland). The benchmarking methodology is based on structural indicators of labour and product markets, and applies a distance-to-frontier approach to quantify the potential for reform by assuming a gradual and partial closure of the gap vis-à-vis the average of the three best EU performers. Crucially, to avoid setting unrealistic and/or unattainable targets, the scenarios involve only half of the gaps being gradually closed. Assuming the results are roughly linear, more ambitious reforms closing the full gap would double the effects, while reforms closing only part of the gap can be expected to have a proportionally lower impact.

This assessment uses the semi-endogenous growth version of the QUEST model specifically adapted for the analysis of structural reforms, which includes an R&D production sector. The model follows the QUEST3(RD) model structure of Roeger et al. (2008) in a multi-country setting (d'Auria et al., 2010), and includes the EU Member States individually and the rest of the world as a single separate region, thus allowing an analysis of spillover effects in a context of simultaneous reforms. Previous exercises using this model have shown that structural reforms can have sizeable macroeconomic effects. ([21]) Similar conclusions have been reached in other studies which have quantified the potential gains from EU structural reforms through regression analysis and/or model simulations of exogenous productivity or aggregate mark-up shocks. ([22])

II.1. Methodology

In this exercise, reform shocks are based on a set of structural reform indicators covering a wide range of areas, including market competition and regulation, R&D expenditure, skill structure, tax structure, labour market participation, unemployment benefit 'generosity' and active labour market policies.

As mentioned above, we define the potential for reform as a closing by one-half of the gap in these indicators vis-à-vis the three best-performing countries in the EU. To allow for implementation lags, all reforms are phased in gradually. Closing half the gap implies that for almost all Member States there is potential to introduce further

([20]) Section prepared by Janos Varga and Jan in 't Veld.

([21]) See 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 Papers*, No. 351; D'Auria, F. A. Pagano, M. Ratto and J. Varga (2009), "A comparison of structural reform scenarios across the EU member states: simulation-based analysis using the QUEST model with endogenous growth", *European Economy Economic Paper,* No. 392; Varga, J., W. Roeger and J. in't Veld (2013): "Growth effects of structural reforms in Greece, Italy, Portugal and Spain", *Economic Papers* (forthcoming).

([22]) e.g. Bouis, R. and R. 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; Barkbu, B. et al. (2012), "Fostering growth in Europe now", *IMF Staff Note*, SDN/12/07.

reforms, without imposing 'unrealistic' change for countries that fall far short of best performance.

It is important to note a number of caveats as to the scope of this exercise. First, the focus here is on the main macroeconomic variables, in particular GDP, employment, trade balance and government balances. However, reforms can have important distributional consequences, with some measures affecting certain household groups more than others. This may require that compensatory measures are taken to support poorer households.

Second, while this benchmarking approach shows the *potential* that reforms could deliver, it is not an assessment of measures *actually taken* in a given country. The latter would require detailed information on reform measures already partly adopted and/or planned in each Member State, and knowing how they impact on structural indicators that feed into the model. While such information may be available in the Member States' National Reform Programmes (NRPs), the results reported in the current simulation exercise, given their wider-ranging scope, could be seen as providing an upper limit for such impact assessments. The indicators used in this exercise are based on the most recent available data (see sources, Table II.11), but these may not reflect reforms that have already been adopted. In particular, some Member States (particularly some of the most vulnerable) have recently launched ambitious reform processes, the benefits of which would be included in the simulations presented here.

Third, there could be considerable time-lags before actual reforms have a measurable macroeconomic impact. Delays in implementing reform measures are likely and it will also take time before the measures have a visible impact on structural indicators (e.g. time between creating more childcare facilities and an actual rise in female participation rates). In this exercise, we assume that reforms are implemented gradually. 'Speed limits' are applied, e.g. changes in mark-ups of at most one percentage point (pp) per year. Tax reforms are phased in over a five-year period, while educational reforms lead to only very gradual changes in skill levels due to cohort effects. However, the overall results may still overestimate how quickly reforms can have an impact in the short term, in particular at the current juncture, with depressed demand and tight credit conditions due to public and private deleveraging. We therefore focus our discussion mainly on effects over five and ten years, rather than the short term.

Another reason why the results could be considered as an upper limit is that some reforms may have considerable budgetary costs which could not always be taken into account, as they can be difficult to quantify. As regards improving childcare facilities and all-day schools, budgetary implications have been included that are based on gaps in public expenditure on pre-primary education, but in many other cases budgetary costs could not be accounted for. To the extent that reform measures have additional costs which would have to be financed through higher taxes, for example, macroeconomic impacts could be smaller than those presented here.

Spillovers

In general, the following types of spillover can be examined:

1. **Demand spillovers** whereby policy action in one country (e.g. growth-enhancing structural reforms) influences import and/or export flows with partner economies. As we can expect structural reforms to boost growth and domestic demand, reforms in one country could have a positive demand spillover effect on others.

2. **Competitiveness effects**, e.g. resulting from measures that reduce labour costs or mark-ups in one country and improve its competitiveness, but mean that other countries are relatively less competitive; this could reduce the positive demand spillover effect.

3. **International financial flows** caused by reforms in one country can have effects on others. For example, reforms which increase the rate of return on capital can lead to capital inflows until rates of return are equalised internationally. Exchange rate changes associated with international capital flows can induce further trade flows.

4. **Knowledge spillovers** resulting from the international diffusion of innovations will generally lead to a positive transmission of reforms that foster intangible capital formation. While these spillovers are less important in the short term, they play a longer-term role in the model for reforms that promote R&D. Based on empirical studies, we model domestic knowledge production (intangible

capital) as resulting from domestic R&D efforts plus knowledge gained in the rest of the world.

These four types of spillover are captured endogenously in model simulations of reform measures. Overall *net* macroeconomic spillovers are typically found to be relatively small, though not negligible, due to counterbalancing demand and competitiveness effects.

A possible additional spillover that is not endogenously captured in the simulations relates to the contagion of risk premia. If structural reforms are successful in raising potential growth rates, this could change financial markets' perception of long-term debt sustainability and lead to a gradual reduction of sovereign risk premia. ([23]) While this is captured in the model, the sovereign risk premium depends on each country's own debt-to-GDP ratio and the model includes no additional cross-correlations of risk premia. Improving fiscal positions in other countries could reduce fears of defaults or debt restructuring and/or reduce liabilities through joint institutions such as the European Stability Mechanism, and may lead to an additional decline in risk premia. However, it should be recognised that these risk spillovers can also be negatively correlated (e.g. a reversal of earlier 'flight to safety' could raise bond yields again in AAA-rated countries). All in all, the model may underestimate the impact on risk premia and disregards possible cross-country spillovers relating to this.

II.2. Structural reforms

Market competition and regulation

We distinguish between service-sector reforms and manufacturing reforms. The stylised facts from mark-up estimates indicate that mark-ups in services are larger than in manufacturing and vary more across countries. This finding is explained by high international competition in manufacturing, which limits the ability of manufacturing firms to reap large economic rents. While mark-up estimates indicate that there is scope for reducing profit margins in services, there also remains some room for reforms in manufacturing. In the simulations, we also consider administrative entry barriers in the form of the costs of setting up a business, for which country-specific indicators exist.

Negative mark-up shocks in services:

Reforms which increase competition force firms to reduce prices by lowering mark-ups. Depending on demand elasticity, this raises output and increases demand for all factors of production (tangible capital, intangible capital and labour) in the medium term. The combination of price declines and increased factor demand yields comprehensive benefits. In particular, wage income rises due to higher employment and real wages. Real wages also benefit from higher investment rates. Because of higher labour-supply elasticities for low-skilled workers, the positive employment effects will be greater for the low-skilled. Mark-up reductions also reduce export prices. In the short to medium term, the trade balance improves, largely due to a decline of private consumption in the short term due to a fall in economic rents. In turn, workers' consumption rises more gradually. With higher consumption, the trade balance returns to baseline values. Since competition-enhancing reforms are likely to be difficult to implement and it may take time before potential competitors enter the market, speed limits are introduced in the simulations which restrict a reduction of mark-ups to 1 pp per year until the target is reached.

Reducing entry barriers for start-ups in manufacturing:

By lowering profit requirements to cover initial costs, reducing administrative entry barriers increases the entry of new firms in manufacturing and the search for new business ideas. This is captured in the model as increased demand for patents, which comes from high-skilled workers. It is important to note that a reduction of entry barriers lowers fixed costs for firms and does not translate into price declines and productivity improvements at firm level, but to a wider variety of goods produced in the country in question (product innovation). Nevertheless, domestic firms can benefit indirectly from the use of more innovative intermediate and investment goods. The aggregate real wage increases because there is a higher proportion of high-skilled workers, but their wage also rises because of short-to-medium-term high-skilled labour supply constraints. These wage increases partly offset the gains from wider variety.

([23]) In the model, government bond yields depend on the current debt-to-GDP ratio. To the extent that structural reforms improve fiscal positions and reduce debt-to-GDP ratios, risk premia decline by three basis points for a one percentage point decline in the government debt-to-GDP ratio. While this is within the range of empirical estimates over longer horizons, in recent years there have been much larger swings in sovereign spreads.

In the short term, the effects on GDP can actually be slightly negative, since increased demand for R&D leads to a reallocation of workers from the production of goods and services into research. However, the innovation resulting from R&D activities (as measured by the number of patents) yields marketable benefits in the medium term. Because of persistent growth effects generated by reduced entry barriers and increased demand for labour resulting in higher wage income early on, this policy already increases important tax bases and generates beneficial budgetary effects in the short term.

Tax reform

Shifting the burden of taxation from labour incomes to consumption in a budget-neutral way makes returns to labour income more attractive and hence boosts employment, particularly at the lower end of the wage scale. Labour supply (and therefore wages) depends on total tax burden, but shifting the burden away from wage income can reduce total distortions on employment decisions and leads to an increase in employment and output. It also improves competitiveness and mimics the effects of a currency devaluation on the terms of trade ('fiscal devaluation').

Real wage costs fall only temporarily in these simulations. Nevertheless, there is a positive effect on employment and GDP. A temporary increase in employment leads to an increase in the capital stock in the medium term, until the pre-existing capital-labour ratio is re-established. At this point, however, the marginal product of labour returns to its initial level and therefore real wages that firms are willing to pay return to the baseline level at a higher level of employment and capital.

In our benchmarking approach, we define the benchmark in terms of the proportion of indirect taxes. Rather than moving Member States towards the lowest labour tax rates in the EU, the reforms are designed to move them towards the highest indirect tax rates (still only closing half the gap), using the ex-ante fiscal space to reduce personal income tax rates accordingly (i.e. ex-ante budgetary neutrality). It should be stressed that the effects of a switch from labour to consumption taxation will depend on how different income groups are compensated for the consumption tax increase. In particular, if unemployment benefits and other transfers are indexed to consumer prices, the output and employment effects will be smaller. ([24])

Unemployment benefit reform

A reduction in the benefit replacement rate acts in the model like a reduction in the reservation wage, which puts downward pressure on wages and so boosts labour supply. ([25]) The calibration of the wage elasticity to unemployment benefits is based on information from regression studies on the link between the unemployment rate and the benefit replacement rate. ([26])

As the employment rate is lowest for the low-skilled group, the same increase in employment means a proportionally smaller reduction in leisure for this group and this puts less upward pressure on their wages. As a result, the decline in wages for the low-skilled is larger than that for other skill groups, and the increase in their employment is also greater.

As regards the impact on other variables, the effects of lowering benefit transfers are similar to those of reducing wages. Lower benefits would reduce consumption by liquidity-constrained households, but this is more than offset by an increase in consumption by non-constrained households due to higher permanent income. The benefit reduction acts like a negative shock to wages, which increases the demand for labour and reduces labour productivity initially. Wages and productivity increase over time and return to their baseline values as investment picks up. Unlike in a model with exogenous technical progress, there is a small positive long-term productivity effect due to higher employment of high-skilled workers in the R&D sector and increased demand for new patents

([24]) The long-term output effect is greater than the increase in employment and capital accumulation, due to an endogenous R&D increase. Employment in the R&D sector is higher and the increase in output ('ideas/patents') leads to an increase in total productivity.

([25]) The target is defined as the EU average replacement rate; this scenario is not included for Member States below the average.

([26]) For example, results from Bassanini and Duval (2006) and Orlandi (2012) point to an average effect for a panel of OECD/EU countries of somewhat less than 0.2% from a 1pp reduction in the unemployment benefit replacement rate. We obtain results at a similar order of magnitude, but somewhat differentiated across countries. Bassanini, A. and R. Duval (2006), "Employment patterns in OECD countries: reassessing the roles of policies and institutions", *OECD Economics Department Working Paper*, No. 486; Orlandi, F. (2012), "Structural unemployment and its determinants in the EU countries", *European Economy Economic Papers*, No. 455.

Table II.1: **Structural indicators**

		Germany	France	Italy	Spain	Ireland	Portugal	Greece	Average 3 best EU performers
Market competition	Service sector markups	14.00	16.00	14.00	23.00	12.00	23.00	34.00	13.33
Market regulation	Entry costs	4.60	0.90	18.20	4.70	0.40	2.30	20.10	0.13
Tax reform	Implicit consumption tax rate	20.10	19.90	17.40	14.00	22.10	18.00	16.30	28.63
	Implicit labour tax rate	37.05	38.58	42.32	33.17	27.96	25.48	30.94	n.a.
Skill enhancing reforms	Share of high-skilled	7.91	7.12	3.40	8.95	7.88	3.33	6.00	9.65
	Tertiary education expenditure (% of GDP)	1.34	1.34	0.86	1.14	1.54	1.07	1.22	2.21
	Share of low-skilled	14.77	27.12	42.19	45.53	25.32	62.33	34.00	8.00
	Secondary education expenditure (% of GDP)	2.48	2.69	2.18	1.88	2.58	2.60	2.39	3.09
Labour market reforms	Female non-participation (25-59ys):								
	- low-skilled	29.03	22.14	46.40	34.77	40.04	26.18	42.32	24.99
	- medium-skilled	14.73	13.49	25.21	19.34	25.27	10.20	30.48	12.05
	- high-skilled	9.06	8.49	15.71	11.16	12.73	8.34	13.87	6.36
	Preschool expenditure (% of GDP)	0.55	0.68	0.48	0.72	0.05	0.55	0.55	1.05
	Low-skilled male non-participation (25-59ys)	16.66	13.75	17.96	14.35	22.44	12.82	10.40	11.27
	Pension related non-participation (60-64ys):								
	- low-skilled	5.21	15.79	6.94	2.05	6.16	3.46	7.08	2.58
	- medium-skilled	3.45	8.91	2.75	0.72	1.96	1.11	2.91	0.97
	- high-skilled	2.23	4.62	2.09	0.67	1.32	1.27	2.66	0.72
	ALMP (% of GDP)	0.93	1.13	0.38	0.80	0.92	0.69	0.23	1.53
	Benefit replacement rate	61.50	58.40	9.10	47.70	82.50	58.80	24.70	55.7[1]
R&D measure	R&D tax-credit rates	-0.02	0.43	0.12	0.35	0.11	0.28	0.01	0.35

(1) For benefit replacement rate: EU average.

Source: Final goods markups, 1996-2007: Commission services. Entry costs: starting business costs in % of income per capita, 2012: Doing business database. www.doingbusiness.org. Implicit consumption tax rate, 2011: European Commission, Taxation trends in the European Union, 2013 edition, Luxembourg, 2013.Skill-shares, non-participation rates and education expenditure statistics, 2011 or latest available: EUROSTAT. Benefit replacement rates, 2010: OECD, Benefits and Wages Statistics. www.oecd.org/els/benefitsandwagesstatistics.htm. R&D tax-credit rates, 2008: Warda, J. (2009). An Update of R&D Tax Treatment in OECD Countries and Selected Emerging Economies, 2008-2009, mimeo

from the entry of new firms in the intermediate sector.

The government balance improves directly as a result of the reduction in benefits and additionally as a result of indirect effects as the economy improves (i.e. higher GDP, consumption and employment).

Other labour market reforms

Rising participation rates for women, low-skilled male workers and 60-64 year-olds increase the labour force. Such reforms form an important part of our simulated packages and yield significant improvements in GDP. They have different budgetary implications: improving childcare facilities to raise female participation rates has budgetary costs, while raising the retirement age reduces pension payments and provides budgetary savings.

Active labour market policies (ALMPs) affect labour market outcomes by improving the matching process, thus favourably affecting employment. Firms can perceive ALMPs as a reduction in non-wage costs, e.g. training costs borne by government (employment subsidy). ALMPs have direct negative fiscal effects on the government budget balance. However, as the positive effects of better training for the unemployed gradually translate into improved matching, such policies can rely on a certain amount of self-financing, though the net effect on the budget balance remains negative as ALMPs are modelled as intensifying over the simulation horizon to reach their target gradually. ([27])

Human capital investment

Human capital investment is modelled as changing the relative weights of the different skill categories (or participation rates within categories). Changes in the quality of education and their effects on the quality of the labour force are also modelled as changes in the skill composition. The increase of the average skill level in the economy (e.g. reducing the proportion of low-skilled) is modelled as a gradual change, accounting for the substantial lags in achieving that objective, including lags in reforming the education system and the gradual passing through of new cohorts onto the labour market. The reform cost is modelled as an increase in education-related expenditure.

As regards the impact of such a measure, the results of the model are in line with empirical

([27]) Note that EPL reforms are not included in this exercise.

estimates. ([28]) Other effects in the model imply that, given imperfect substitutability between worker types, an increase in the share of medium-skilled workers would have positive wage effects on other types, especially low-skilled workers.

Policies aimed specifically at increasing the share of high-skilled workers (engaged in R&D activities) are also modelled. Initially, a fraction of the additional high-skilled labour will be employed in the production of final goods (replacing less efficient medium-skilled workers). Over time, however, there is a dynamic increase in employment in the R&D sector because of a decline in the wage of high-skilled workers. This reduces the price of patents and stimulates the entry of new firms. In the medium and long term, increasing the high-skilled share results in a strong 'real' R&D effect in terms of R&D employment and patent growth, yielding the highest output effect as compared with other human capital investment scenarios.

R&D investment

Firms undertake tangible and intangible (or R&D) investment. Policy can affect R&D investment; e.g. R&D tax credits reduce the capital costs of intangibles and increase R&D activities, resulting in the production of more patents, which can be used to open up new product lines. On the labour side, this is accompanied by reallocating high-skilled workers from production to research activities and by increasing the demand for high-skilled workers. The size of the output effect will therefore depend crucially on high-skilled labour supply elasticity. Because of reallocation of high-skilled workers, the effects on GDP are small in the short term and positive output effects will materialise only in the longer term, once the R&D activities have been successfully transformed into marketable products. For countries with limited high-skilled labour and limited scope for substituting high-skilled for medium-skilled workers in production, the crowding-out effect of R&D subsidies will be greater. It is also important to note that R&D tax credits are not self-financing, but lead to a deterioration of the government balance in the short and medium term.

The model can simulate only the effect of public subsidies to private R&D, e.g. in the form of tax incentives. Subsidies to R&D in public research institutes or universities could have different transmission channels and less of a crowding-out effect because business-financed R&D programmes typically focus on applied research, while public institutes and universities typically concentrate on basic research programmes which are too costly or less profitable for private R&D firms.

II.3. Macroeconomic impact of structural reforms — model-based results

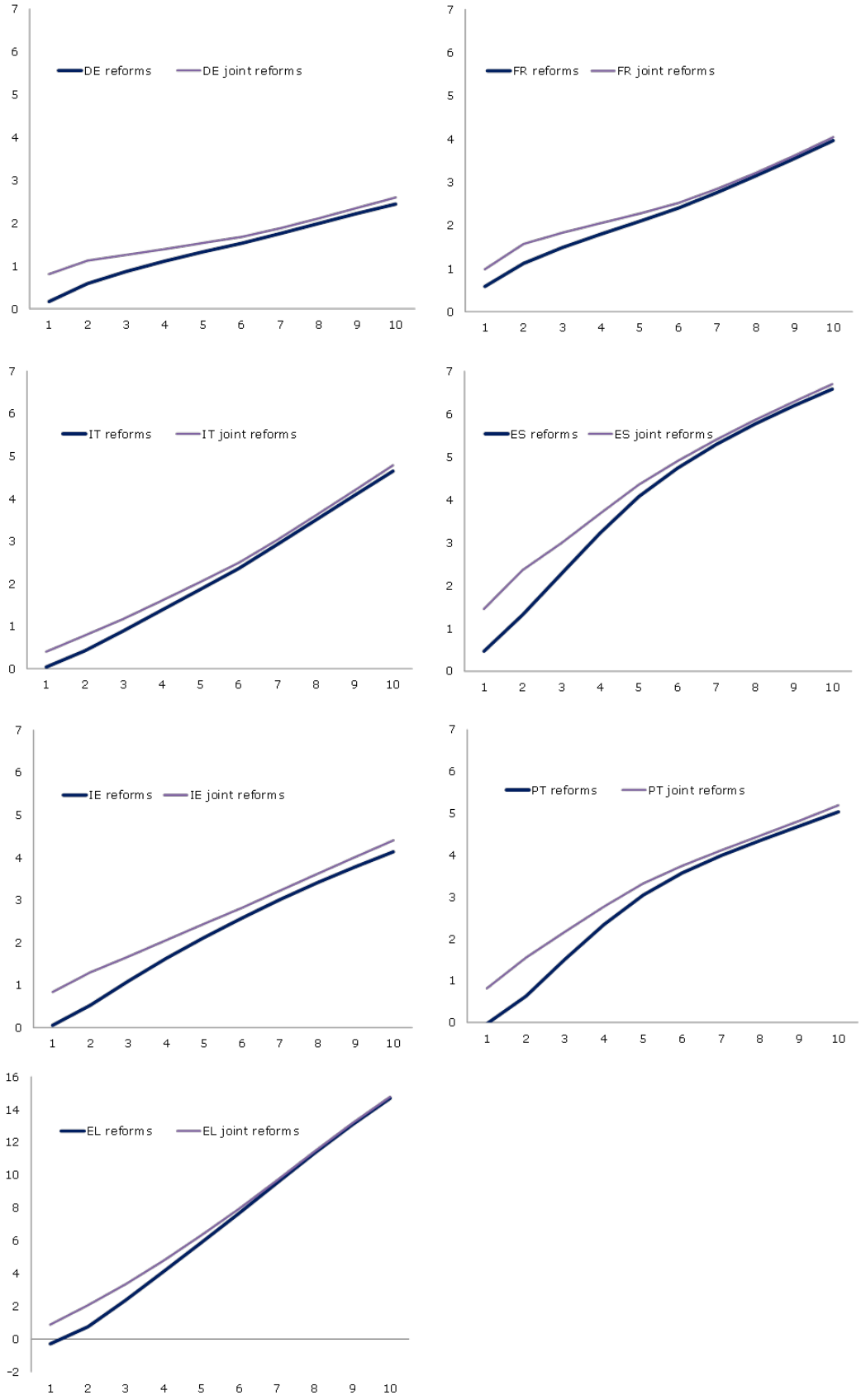
Model simulations of structural reforms that close only half the gap with best performers show that even such not overambitious reforms can have significant macroeconomic effects. In order to quantify the spillover effects, the sets of reform shocks are first run through the model for each country separately, keeping all variables in other countries constant. This yields the impact of reforms for each country acting alone, without spillover effects. In a second stage, spillover effects are taken into account by simulating the shocks for all countries simultaneously. Estimated in this way, growth impact per Member State will be composed of growth spurred both by domestic reform and by a 'spillover' component resulting from other Member States reforming at the same time.

Graph II.1 shows the impact of structural reforms on GDP for Member States acting alone and in the event of simultaneous reform. Graphs II.2 and II.3 show results for employment, trade and public finances after five and ten years. Results are presented in the standard format as deviations from a 'no-reform' baseline. ([29]) The simulated reform shocks boost GDP levels by between 1.5 % (Germany) and 6.3 % (Greece) after five years, and between 2.6 % (Germany) and 14.8 % (Greece) after ten years. Similarly, employment rises by 3 % (Germany) to 10 % (Greece) after ten years.

([28]) In particular, de la Fuente (2003) estimates the impact of an extra year's schooling in the EU on long-term productivity at 9.3%, which is close to the result yielded in our model. De la Fuente (2003), "Human capital in a global and knowledge-based economy, part II: assessment at the EU country level", *Barcelona Graduate School of Economics Working Papers*, No. 98.

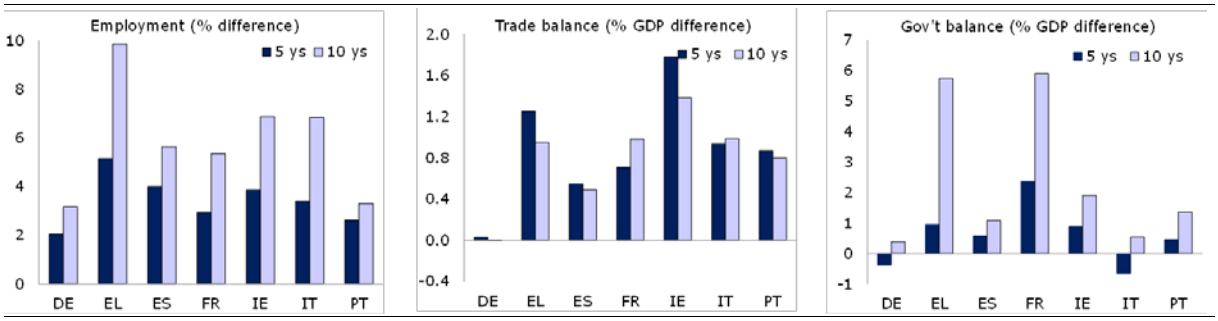
([29]) The model baseline is calibrated on the most recent available data. For most structural indicators, data are available up to 2012, but for some indicators the most recent observations are older. See Table II.1.

Graph II.1: **GDP effects structural reforms : acting alone vs. simultaneous reforms (1)**



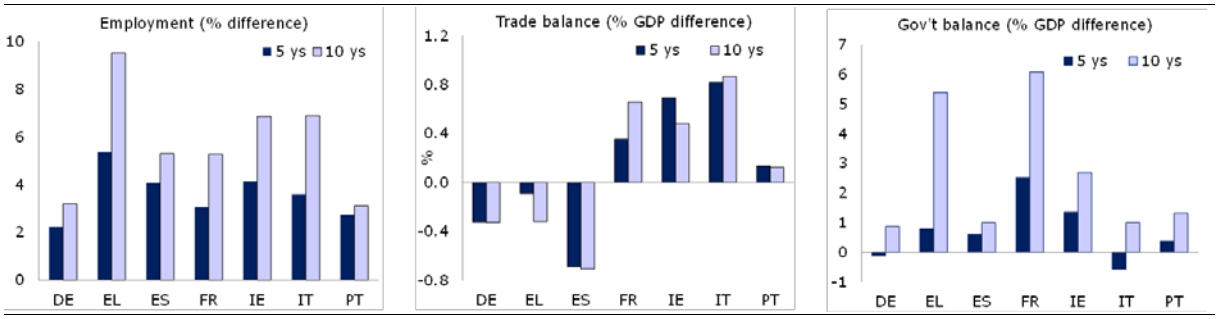
(1) Percentage difference from baseline.
Source: QUEST simulations.

Graph II.2: **Macroeconomic impact structural reforms: Stand-alone reforms (1)**



(1) Percentage point difference from baseline.
Source: QUEST simulations.

Graph II.3: **Macroeconomic impact structural reforms: Joint reforms (1)**



(1) Percentage point difference from baseline.
Source: QUEST simulations.

Output and employment differences across countries closely reflect the size of the reform gaps as compared with best practice. In particular for Greece, the benchmarking methodology shows large potential for reforms. To some extent, however, differences also reflect the degree to which the simulated reforms are biased towards measures which have a faster short-term impact on growth. Education reforms improving skill distribution and participation rates yield positive results only in the longer term, with smaller GDP effects in the first five to ten years, but up-front budgetary costs. Other reforms, such as shifting the tax burden from labour to consumption, can yield faster growth effects. However, as emphasised above, these scenarios may underestimate the timescale over which reforms can be expected to deliver positive growth effects, and more weight should be given to the medium/long-term effects. The effects after ten years indicate that significant GDP and employment improvements can be realised in all countries if reforms are implemented.

The simulations show the largest gains for **Greece**, due to the considerable scope for reforms identified in all areas by the distance-to-frontier approach, even when only half the gap is closed (see Table II.1). Reforms improving competition and reducing entry costs, increasing labour-force participation, improving labour-force skills and boosting R&D spending can raise GDP by 6 % after five years and almost 15 % after ten years. Higher growth means more tax revenue and lower transfer payments, improving the government's budget balance significantly – by more than 5 % of GDP after ten years. This indicates the degree to which structural reforms can supplement consolidation measures to restore long-term debt sustainability.

The scope for reforms in **Portugal** is also considerable, in particular when it comes to improving competition and reducing entry barriers, shifting the tax burden from labour to consumption and improving the skill structure. Taking steps in all reform areas can raise GDP by more than 3 % in five years and over 5 % in ten years.

Box II.1: Breakdown of effects of reform on GDP: Germany and Italy

A detailed breakdown of the simulated reform shocks for Germany and Italy (based on the distance-to-frontier approach) is shown below.

The table shows the contribution of each reform to total GDP after five and after ten years and in the long term. The largest contribution comes from labour market reforms to raise the participation rate of the inactive population (women and low-skilled and older workers). The shift from taxes on labour towards consumption taxes and active labour market policies also have considerable effects on GDP. Skill-enhancing measures and entry cost reductions have a major impact on GDP in the long term, accounting for almost half of the long-term GDP effects for Italy. Further contributions stem from product market reforms (mark-up reduction), while R&D-promoting policies have small negative effects in the short term but more significant positive GDP effects in the long term, especially for Germany.

Breakdown of potential GDP effects for Germany and Italy
(% difference from baseline)

	Germany			Italy		
	GDP 5 YS	GDP 10 YS	GDP 50 YS	GDP 5 YS	GDP 10 YS	GDP 50 YS
Benefit Replacement Rate	0.1	0.1	0.3	0.0	0.0	0.0
ALMP	0.1	0.4	0.5	0.2	0.6	0.7
Entry Costs	0.0	0.0	0.2	0.1	0.3	1.8
High-Sk. Share	0.0	0.1	0.6	0.0	0.1	1.9
Medium-Sk. Share	0.0	0.1	0.8	-0.1	0.2	6.1
Markup	0.1	0.2	0.3	0.2	0.3	0.6
Female Part. Rate	0.5	0.6	0.8	0.7	1.6	5.1
Low-Sk. Part. Rate	0.0	0.1	0.1	0.2	0.3	0.6
Pension Reform	0.3	0.6	2.1	0.2	0.6	2.9
R&D Tax-Credit	-0.1	0.0	1.0	0.0	0.0	0.5
Taxshift	0.2	0.3	0.3	0.4	0.5	0.5
Total	1.3	2.4	7.0	1.9	4.6	20.8

Source: QUEST simulations

In **Ireland**, reforms such as skill-enhancing changes, reducing benefit generosity and increasing labour-force participation boost GDP by 4.5 % after ten years and have an even greater effect on employment, which rises by 6.8 %.

The benchmarking approach also identifies significant room for reforms in **Spain,** in particular to improve market competition, enhance skills and shift the burden further from labour taxation to less distortionary taxes (e.g. on consumption). All reforms combined raise GDP by 4.4 % after five years and 6.7 % after ten years.

There is also considerable scope for a tax shift away from labour in **France**. This, combined with pension reform to increase the participation rate among older workers, are the two areas which can deliver large benefits as compared with the current situation. All in all, the whole package of reforms can raise GDP by 4 % after ten years, but raising the effective retirement age stands out as potentially having a significant impact on the government's budget balance. ([30]) This improves by 6 % of GDP after ten years, thanks to a large extent to a higher participation rate in the 60-64 age group and sharply reduced total transfer payments.

For Germany and Italy, a detailed breakdown of GDP impacts is given in the box showing the effects of individual reforms. According to our indicators, in **Italy** there is considerable scope to reduce entry costs for new firms, shift the tax burden from labour towards less distortionary taxes and increase the participation rate of the inactive population. Closing only half the gap vis-à-vis the best performers can raise GDP by 4.8 % after ten years. In the long term, the gains are much larger as the benefits of addressing human capital gaps take longer to have an effect (see Box II.1). For **Germany**, reforms include labour market reforms raising the participation rate of the inactive

([30]) Note that this analysis is based on the current situation and excludes the impact of measures adopted in recent years but only taking effect in the future.

population, tax shifts and policies promoting R&D. After ten years, GDP can be 2.6 % higher. Germany's trade surplus deteriorates following the reforms as the income effect dominates the competitiveness effect, but the net change is small. This suggests that these types of structural reform can boost growth and help rebalance Germany's growth pattern in the direction of higher domestic demand. At the same time, if these reforms are undertaken by Germany alone, they are unlikely to make a major contribution to reducing its current-account surplus, while joint reforms could lead to some reduction.

In all countries, structural reforms lead to higher growth and this boosts tax revenues and leads to an improvement in public finances. The impact differs significantly across countries, however. In Germany and Italy, there is an initial deterioration in government balances as the costs of reforms outweigh the benefits from higher tax revenues in the short term. To some extent, this reflects the way labour market reforms are implemented in the model. For instance, the increase in female participation rates and improved skill structures are assumed to be accompanied by increased spending on childcare facilities and education, both measures involving frontloaded costs and yielding sizeable benefits only in the medium/long term. In practice, however, alternative policy tools and financing strategies could be used to enact these reforms, thereby limiting the budgetary impact even in the short term. In any case, after ten years government balances improve in all countries, and quite significantly in some (around 6 % of GDP in Greece and France). The relatively big improvement in France is largely the result of the increase in the retirement age. As indicated above, while these scenarios may overestimate the short-term benefits to public balances, the simulated improvements in budget balances in the longer term show the role structural reforms could play in restoring fiscal positions and reducing public indebtedness.

Spillovers

In the 'acting alone' scenario (Graph II.2), the impact on trade balances is positive, as the competitiveness effects more than outweigh the absorption effect of higher domestic demand raising imports. ([31]) In the 'simultaneous reform' scenario, however, the impact is considerably less positive, and in some cases reverts to a negative overall effect (Graph II.3).

While simultaneous reforms lead to larger demand spillovers, improvements in competitiveness, by definition, have opposing effects across countries. The trade balance deteriorates for Germany, Greece and Spain, while the improvement for each other country is smaller than in a scenario where it carries out reforms in isolation.

GDP effects from structural reforms are greater when all countries implement reforms, as the difference between the two lines in Graph II.1 shows. Employment and budgetary effects are also somewhat larger, at least in the short term (Graph II.3). The positive GDP spillover is particularly strong over the first years of implementation, when demand effects dominate. Output gains are between 5 % and 10 % greater after five years, although the spillover effects become smaller in the long term. As seen above, the net spillover effect is the outcome of different channels partly offsetting each other. Demand spillovers can boost exports in other countries and raise GDP, but competitiveness-improving reforms can have a negative impact. Lower net exports are partly compensated by higher consumption growth with simultaneous reforms, due to a shallower decline in the terms of trade.

The positive short-term GDP spillovers show the benefits from coordination. Undertaking reforms in all countries together can boost GDP more than in a situation where each country acts alone.

([31]) The direction of the impact of structural reforms on the current account is ambiguous from a theoretical point of view (see, for example, Vogel, 2011, Fournier and Koske, 2010). Empirical evidence is also mixed. Jaumotte and Sodsriwiboon (2010) report a positive effect of labour productivity on current accounts, while the empirical results in Kerdrain et al. (2010) imply that such reforms have a negative impact on the current account position. Vogel, L. (2011), "Structural reforms and external rebalancing in the euro area: a model-based analysis", *European Economy Economic Paper*, No. 443; Fournier, J. and I. Koske (2010), "A simple model of the relationship between productivity, saving and the current account", *OECD Economics Department Working Papers*, No. 816; Jaumotte, F. and P. Sodsriwiboon (2010), "Current account imbalances in the southern euro area", *IMF Working paper*, No. WP/10/139. Kerdrain, C., I. Koske and I. Wanner (2010), "The impact of structural policies on saving, investment and current accounts", *OECD Economics Department Working Papers*, No. 815.

II.4. Concluding remarks

The model simulations reported here show that large potential gains could be reaped from structural reforms. Euro-area GDP could be up to 6 % higher after ten years if Member States adopt measures to halve the gap vis-à-vis the average of the three best-performing Member States in each of the reform areas considered. As it is based on only half the gap being closed, the simulated reform package should be seen as not overly ambitious nor unrealistic for Member States. A further closure of the gap would have proportionally larger impacts.

While the positive effects on growth and employment are large, it should be borne in mind that this exercise shows the *potential* effects of structural reforms. It should be noted that this analysis is based on the most recent available indicators and may exclude the impact of measures adopted in recent years but only taking effect in the future. Although some phasing-in is allowed for, a successful introduction of structural reform measures may take longer than assumed here and delays in implementation would lead to smaller effects in the first few years. In the current environment, with private and public deleveraging, and tight credit conditions in many countries, the short-term impact could be lower, as financing constraints are more binding. However, while large output gains can probably not be expected in the short term, growth effects are significant and could help boost the nascent recovery. The output and employment effects in the medium/long term are sizeable.

Of the reforms simulated in this exercise, those relating to product markets, stimulating competition in certain sectors, can lead to large output gains, but such effects are likely to emerge only gradually. R&D subsidies may crowd out final goods production in the short term, but can have significant long-term effects. Labour market reforms are equally important. Many of these can also be expected to yield results only in the medium to long term (this applies in particular to incentives to raise participation among women and/or older people, and improve the skills structure), while involving sometimes significant frontloading of budgetary costs (education, training). In contrast, reforms that increase the participation rate of older workers can yield significant budgetary savings. Structural fiscal reforms that shift the tax burden away from labour towards less distortionary taxes could be implemented relatively rapidly and boost employment and growth.

Spillovers of structural reforms are positive for output and employment. The demand effect boosts imports and supports trading partners' growth, though this is partly offset by the competitiveness effect. Trade balance effects are relatively small and can be negative where the demand effect dominates the competitiveness effect. Reforms lead to significant improvements in fiscal positions and yield sizeable reductions in debt-to-GDP ratios in the medium/long term, alleviating the need for further consolidation measures and contributing to long-term debt sustainability. The positive spillover and budgetary effects provide a strong rationale for the impetus to reform given by the country-specific recommendations in the European Semester. They also highlight the potential benefits of policy coordination and how much Member States have to gain from carrying out reform processes jointly.

III. Firms' investment decisions in vulnerable Member States ([32])

This chapter assesses firm-level patterns in investment in vulnerable Member States. The starting point is the observation that the profitability of firms in tradable sectors has recently been restored relative to those in non-tradable sectors, although it remains low in absolute terms. The study shows that tradable sector firms' investment, relative to non-tradables, has not yet responded to improved relative profitability. This development could be problematic, since capital reallocation to tradables is desirable to strengthen these countries' export capacity and to restore their external and internal balances. The analysis further reveals that companies in the tradable sectors of vulnerable Member States invest even less than what these firms' currently weak fundamentals would suggest. A tradable sector firm operating in a vulnerable Member State invests significantly less than a similar firm operating in a non-vulnerable Member State. The results suggest that low current profitability or high indebtedness alone cannot explain this investment pattern and that tight credit supply conditions could be among the factors causing current underinvestment.

The credit-fuelled boom of the early 2000s led in most vulnerable Member States to an excessive flow of productive resources into the non-tradable sector. The economic and financial crisis revealed the unsustainability of the boom-years' growth model and triggered a difficult but necessary rebalancing process. Given the central role attributed in this process to restored competitiveness through internal devaluation, swift reallocation of resources from downsizing non-tradable sectors into tradables is highly desirable. This would in turn contribute to addressing both external and internal imbalances, while reducing the social and economic costs of the adjustment and promoting sustainable medium-term growth.

This section discusses whether the conditions for an increase in investment by firms in the tradable sectors have been met. In particular, it focuses on two pre-requisites, namely (i) the improved expected return on investment in the tradable sector relative to the non-tradable sector, which serves as an incentive mechanism for capital allocation, and (ii) the ability to finance viable investment projects in the tradable sector.

III.1. Profitability and capital allocation

One of the central assumptions of economics is that profitability shapes firms' investment decisions. While in the long run a high equilibrium profit rate, especially if it signals rents related to barriers to entry and market power, could be detrimental to investment and growth, the short-term positive effects of profitability on investment are widely accepted. The debate about the specific mechanism behind this positive relationship has not been closed: possible explanations are that current profitability provides valuable signals about a firm's future demand and profitability prospects, but also that firms' internal funds serve to overcome frictions in financial markets. ([33]) The strength of the response of investment to profitability is likely to change across countries and over periods, as well as following specific shocks such as uncertainty. ([34]) Still, it is likely that relative differences in profitability across sectors in a given country and period represent an important incentive for capital allocation and reallocation decisions.

Improved relative profitability of tradables

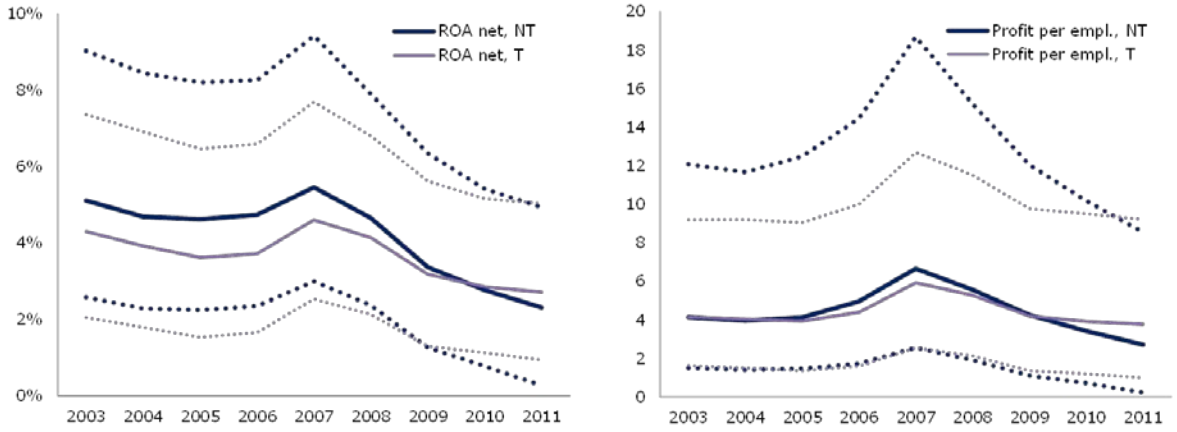
As a result of the rapid credit-fuelled expansion of internal demand in the pre-crisis years, some vulnerable Member States witnessed a shift in profitability in the non-tradable sector above that of tradables. The October 2013 issue of the QREA discussed this asymmetric effect of the pre-crisis expansion on corporate profitability, observed

([32]) Section prepared by Peter Pontuch.

([33]) See a literature overview in Hubbard, R.G. (1998): "Capital-market imperfections and investment", *Journal of Economic Literature*, Vol. 36(1), pp. 193-225.

([34]) The variability across countries is signalled by Mulkay, B., B.H. Hall and J. Mairesse (2000): "Firm level investment and R&D in France and the United States: A comparison", *NBER Working Papers* 8038. The responsiveness of investment to demand and profitability shocks is shown to be reduced in periods of uncertainty by Bloom, N., S. Bond and J. van Reenen (2007): "Uncertainty and Investment Dynamics", *Review of Economic Studies* 74, pp. 391-415.

Graph III.1: **Developments in firm-level profitability of Spanish firms in the tradable (T) and non-tradable (NT) sectors (1) (2)**



(1) Medians (solid line), 1st and 3rd quartiles (dotted) of the distribution of firm profitability. (2) Return on assets (ROA) is measured after tax as earnings before interest/total assets. Profit per employee is measured in thousands of euro as earnings before interest divided by the number of employees.
Source: Orbis, DG ECFIN.

especially in Spain, Greece, and Portugal. ([35]) Focusing on the current adjustment phase, the analysis also stressed the role of the recent limited pass-through of falling wage costs to the price of tradables, helping to restore firms' profit margins. This, together with subdued demand for non-tradable goods (most prominently for real estate-related goods) led to an inversion of the profitability differential in favour of tradable sectors. ([36])

Graph III.1 illustrates these developments using the example of Spanish firms. The left panel shows the distribution of the return on assets, which is a widely used measure of the economic profitability of a firm. The recent inversion of relative profitability in favour of tradables is clearly visible on the bulk of the distribution as given by the medians and the two quartiles. It is worth noting, however, that the absolute level of tradables' profitability decreased following the crisis, owing to the fact that only a part of tradables' output is actually traded. An improvement in profitability levels will therefore depend both on developments in the economic conditions of a country's main trading partners and on stabilisation of domestic demand. Indeed, as domestic economic conditions improve, even non-exporting local firms will be able to reap the benefits of restored competitiveness against foreign imports.

The right panel complements this analysis with a less common measure of profitability, namely profit per employee. This variable represents the return to firm claimholders given a certain level of use of labour resources and is also a proxy for a sector's attractiveness to labour. This variable provides a similar message about the recent inversion in the incentives for resource allocation between these sectors.

The country-specific analysis in the recently published European Commission Product Market Review ([37]) reveals that similar developments in relative profitability were observed recently in Portugal and Slovenia (the latter despite the fact that there was no apparent bias towards non-tradables in the pre-crisis years). No inversion of relative profitability has been observed in Greece. This could be due to (i) the fact that the tradable sector in Greece is effectively much less open than in other Member States, leading to a comparable demand shock affecting both tradables and non-tradables, and/or (ii) to product market imperfections hampering the readjustment process more than in other vulnerable economies.

([35]) See European Commission (2013a): 'Labour costs pass-through, profits and rebalancing in vulnerable member states', *Quarterly Report on the Euro Area*, Vol. 12(3), pp. 19-25, which also provides additional information about the firm-level dataset used.

([36]) A usual definition of tradable sectors is used covering agriculture, mining, manufacturing, energy and utilities, trade, transport, accommodation and food services. The concept of tradability refers to the firm's potential to engage in international trade, rather than to its actual export status.

([37]) See European Commission (2013b): 'Capital reallocation into tradable sectors: incentives and obstacles', *Product Market Review 2013*, pp. 49-72.

Investment response lagging

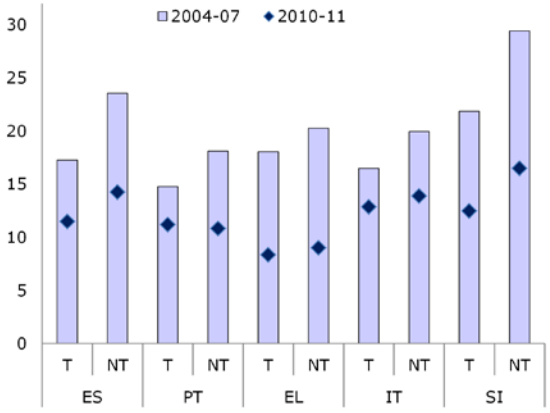
Despite the recent inversion of relative profitability between sectors in vulnerable economies, which is likely to signal relatively higher future returns on investment in tradable sectors, subdued aggregate capital formation does not point to a rise in investment activity driven by tradable sectors. The aggregate figure is, however, significantly affected by the disinvestment in downsizing sectors, most of them non-tradable. Any increased investment activity in specific tradable sectors is not easily detectable in aggregate investment figures.

Firm-level investment data can therefore provide valuable insights, especially by allowing the separation into tradable and non-tradable sectors. Graph III.2 presents the median investment rate for a set of vulnerable economies. The non-tradable sector was investing at a faster pace in the pre-crisis period in most vulnerable Member States. One can see that the difference in investment between non-tradables and tradables was reduced in 2010-11 (2011 being the last annual observation available in the firm-level dataset) in virtually all vulnerable Member States. This partial correction in the relative investment bias was achieved by a strong contraction of non-tradable sector investment. Investment rates in tradable sectors also contracted in the crisis period, although somewhat less sharply. However, the tradables series shows no apparent signs of picking up in absolute terms in the most recent available annual figures. A similar absence of resource reallocation to tradables is signalled by firms' employment and net borrowing rates. ([38]) These observations are in contrast with post-crisis developments in the non-vulnerable Member States (Germany in particular, but also France and Finland), where tradable investment rates contracted in 2008 but recovered in subsequent years.

In summary, the recent inversion of relative profitability between tradables and non-tradables is a move in the right direction. The change is likely to signal better future investment returns in tradable sectors in relative terms and, over the medium term, possibly in absolute terms as well, providing an incentive to reallocate resources to tradables. This development is in line with the rebalancing needed, as it corrects the pre-crisis bias which fostered capital to flow predominantly into non-tradable sectors. However, the correction of private incentives to invest has not yet prompted a clear reallocation of resources. One of the possible explanations for this absence of response could be that despite a relative improvement in tradable sectors' prospects vis-à-vis the non-tradable sector, tight credit supply hinders this reallocation. An alternative, credit-demand-driven explanation would be that low investment in tradables merely reflects the fact that company fundamentals are still weak (e.g. profitability is depressed in absolute terms due to firms' reliance on the domestic market or high indebtedness) or that policy uncertainty persists. The next sections attempt to disentangle these alternative explanations.

Graph III.2: **Investment rates in vulnerable Member States (1), (2)**

(2004-2011, % of fixed assets)



(1) The figure presents median gross investment rates, defined as the change of fixed capital between year t and t-1 plus estimated accounting depreciation divided by previous year's fixed assets. (2) T denotes tradable industries, NT non-tradable industries.
Source: Orbis, DG ECFIN.

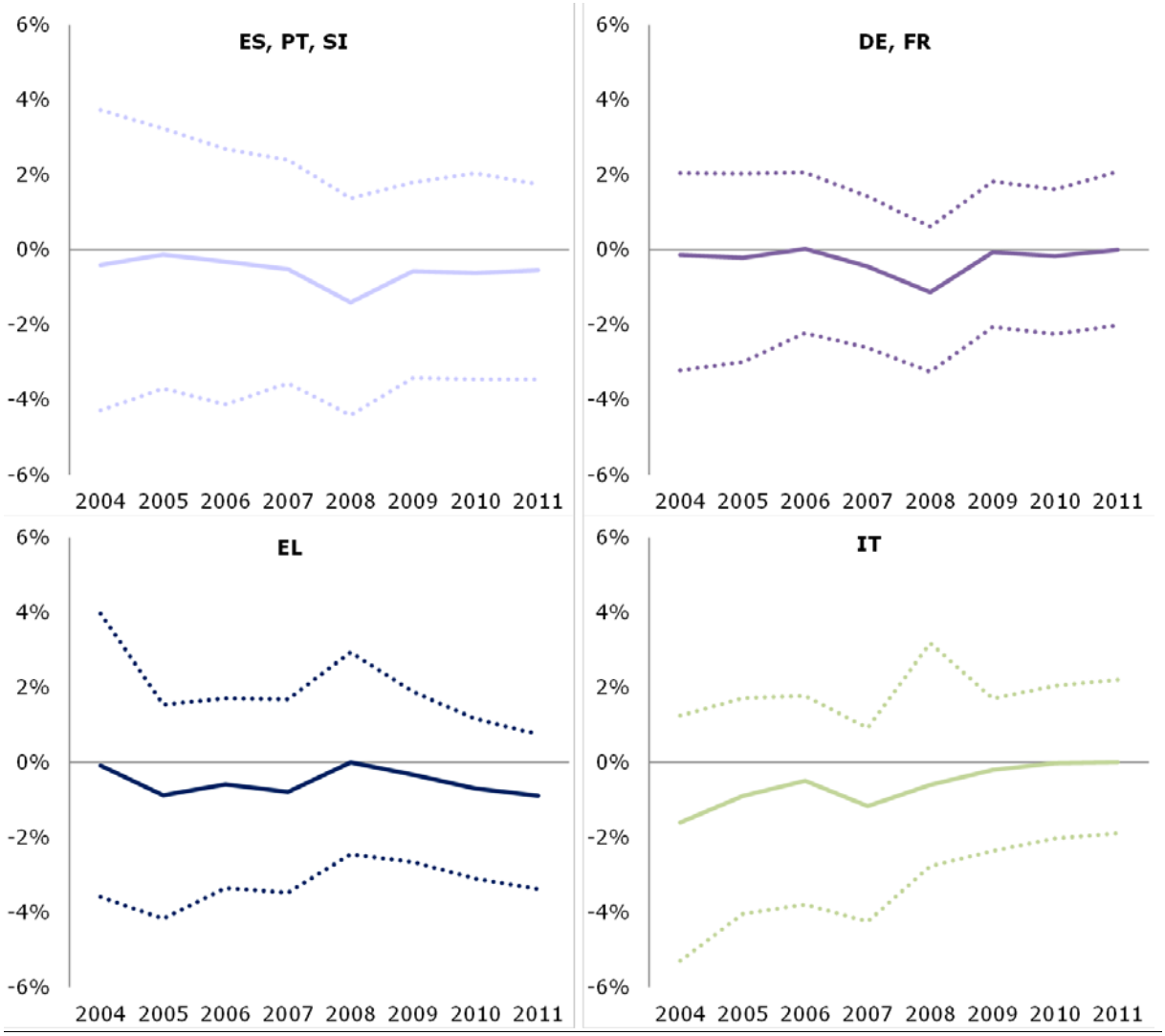
III.2. Tradable sector investment and company fundamentals

The analysis in this section relates tradable sector firms' investment to their fundamentals using an empirical investment equation. The investment equation allows one to construct a predicted investment rate that takes into account individual firm characteristics and health, as well as aggregate conditions affecting all firms within an industry across all countries. These predicted investment rates can then be compared with the actual rates to construct an investment gap (this variable of interest corresponds to the investment equation

([38]) See country-specific analysis of investment, employment and net borrowing rates in European Commission (2013b).

Graph III.3: **Gap between tradable sector firms' actual and expected investment**

(2004-2011, % of total assets)



(1) Medians (solid line), 1st and 3rd quartiles (dotted) of the distribution of the investment gap. (2) A negative value for the investment gap corresponds to underinvestment compared to what the investment equation would predict.

Source: Orbis, DG ECFIN.

residual). If a firm has a positive investment gap, its actual investment is higher than the rate the model would predict. Conversely, a negative investment gap signals that a company is underinvesting compared to what the fundamentals-based model would suggest.

The investment equation models the firm-level net investment rate ([39]) as a function of lagged company variables. The first two variables are profitability (measured by the return on assets, i.e. the company's profitability before financing costs) and sales growth, which are commonly used as signals of future demand prospects. The specification also includes size (the logarithm of total assets) and capital intensity (the ratio of fixed assets to total assets) to capture likely differences in investment related to firm scale, and the level of existing fixed capital, and financial leverage (non-current liabilities divided by the sum of non-current liabilities and equity). A firm fixed effect is included to control for unexplained heterogeneity among firms related to time-invariant characteristics. Aggregate conditions affecting all firms within an industry are taken into account by

([39]) Net investment is measured by the annual increase in fixed assets and therefore considers not only new investment flows, but also their depreciation, write-downs, disposals, and other changes in the stock.

introducing year×industry dummy variables. ([40]) The idea is to take into account the state of a given industry (e.g., current and expected future demand, technological changes, price of intermediate inputs, etc.) at EU level. The model is estimated on annual data covering the period 2003-2011 for several vulnerable and non-vulnerable Member States.

A cross-country comparison is presented in graph III.3, showing the annual median, lower and upper quartiles of tradable sector firms' estimated investment gap. The top left panel bundles three vulnerable economies with similar individual patterns in investment gaps, namely Spain, Portugal, and Slovenia. The gaps appear distributed almost symmetrically around zero in pre-crisis years, then drop below zero at the onset of the financial crisis in 2008. In subsequent years, the investment gap does not fully recover and remains in negative territory, suggesting that tradable sector firms in these countries possibly are underinvesting as of 2011. The top right panel, bundling France and Germany, shows a similar symmetric distribution in pre-crisis years followed by a drop in 2008. Unlike vulnerable Member States, however, subsequent years show a swift recovery back to a symmetrical distribution around zero.

The bottom panels of graph III.3 show two specific cases. On the left, the figure for Greece suggests that some underinvestment in tradables occurred even in pre-crisis years, with a brief normalisation in 2008 followed by further underinvestment in the crisis period. Italy, in the bottom-right panel, also has a specific position among vulnerable Member States. The Italian tradable sector appears to have underinvested for most of the early 2000s, which is consistent with the deterioration of the Italian trade balance in the first decade of the twenty-first century. As the crisis hits, the median investment gap moves upwards and is close to zero as of 2011. However, this development is not driven by an increase in investment, which would be the favourable case, but rather by a reduction in the predicted investment driven by deterioration in firm fundamentals.

The analysis using an investment equation seems to suggest that recent tradable sector investment in several vulnerable Member States is lower not only in absolute terms, as signalled in the previous section, but also after controlling for company fundamentals. Similar findings are obtained if one looks into the average difference between investment rates of firms with comparable fundamentals operating in vulnerable and non-vulnerable Member States. ([41]) The last section discusses whether this underinvestment can be at least partially related to current financing difficulties.

III.3. Funding problems as a factor in underinvestment in tradables

One of the possible interpretations of the above results is that companies in tradable industries in vulnerable Member States underinvest because of a lack of access to finance, a phenomenon often referred to as the credit supply channel effect. Financing difficulties can either take the form of excessive financing costs, or be related to quantity rationing (a situation where lenders would purposely not satisfy all credit demand at prevailing market lending rates). In both cases, the implications would be that firms are forced to forgo some economically viable investments, thereby trimming their prospects of future performance. Besides the microeconomic consequences, underinvestment imposed by financing difficulties would also have serious effects at aggregate level, postponing readjustment of the productive sector as part of broader rebalancing in vulnerable economies and reducing medium-term potential growth. Note, however, that other factors could also be responsible for the recent underinvestment. For example, vulnerable Member States' companies could simply have been very cautious with respect to debt financing since the onset of the crisis. Another explanation could be that the underinvestment is related to an unfavourable economic outlook, and the concomitant uncertainty. ([42])

In order to inspect the role of access to finance in the investment patterns observed as of 2011 this section uses a synthetic measure of financing difficulties based on the survey on the access to finance of SMEs (SAFE). The SAFE is a half-year

([40]) Industries are defined at the 2-digit level of the NACE rev. 2 classification.

([41]) See the analysis using a matching estimator in European Commission (2013b).

([42]) The effects of uncertainty on investment are discussed by Bloom et al. (2007) and in European Commission (2013c), 'Focus: Assessing the impact of uncertainty on consumption and investment', *Quarterly Report on the Euro Area*, Vol. 12(2), pp. 7-16.

survey jointly organised by the European Commission and the European Central Bank focusing on European firms' recent experience with raising external funds. ([43]) These survey data also have drawbacks, notably the fact that they rely on perceptions that may be biased in periods of stress, and that they do not fully control for the quality of loan applications.

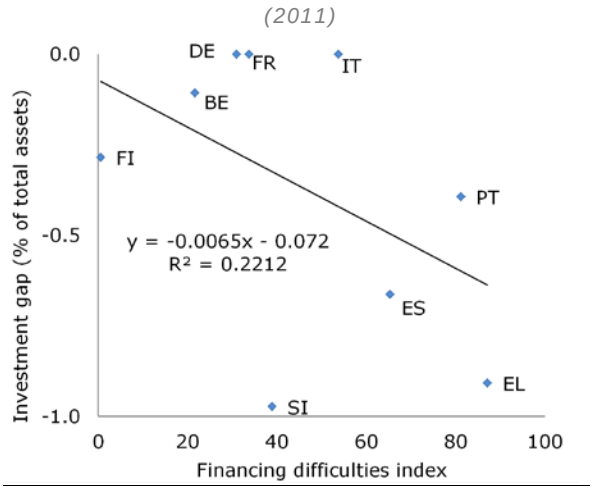
The SAFE 2011H1 data are used to construct an estimated probability for a given firm of facing financing difficulties in 2011, which is the last annual observation in the firm-level dataset. More specifically, a probit model is used to estimate the probability of a loan request failure, defined as an event where the firm does not receive at least most of the amount requested, in line with Holton et al. (2012). The explanatory variables in the probit model are the sector of activity, the firm's size, age, recent evolution of net income, and a set of country fixed effects to control for aggregate effects, such as banking sector strength or overall economic outlook. Large firms are excluded from the analysis, as some of their variables are not available in the SAFE dataset for confidentiality reasons.

The estimated model parameters are then used to construct a synthetic probability of loan rejection in the large firm dataset used at the investment equation stage. An indirect approach to modelling the likelihood of financing difficulties is necessary, as it is impossible to link the SAFE micro-data with the firm-level dataset, owing to confidentiality restrictions. This estimated probability of loan rejection, representing a measure of financing difficulties, is related to the investment gap in Graph III.4. The figure suggests that the financing difficulties of the median firm have a statistically significant negative relationship with the observed median investment gap. This preliminary graphical analysis would imply, subject to the caveat that other relevant variables are not taken into account, that tradable sector firms' underinvestment is at least partly driven by tight credit supply.

The most notable elements omitted at this stage of the analysis include the demand outlook, and the general economic and policy uncertainty, which was high in some Member States in 2011. ([44]) The economic outlook obviously affects tradable firms' investment behaviour, as it is a major driver of future demand developments. Uncertainty is also expected to have a negative effect on investment, since it increases the option value of investment projects, which may lead to their postponement (Bloom et al., 2007).

A more thorough analysis of the investment gap at firm level, controlling for alternative proxies of financing constraints (size and age), for the expected firm profitability over the next three years implied by the macroeconomic outlook in the European Commission's 2011 Spring forecast (considered as reflecting official macroeconomic expectations as of 2011), and for overall country-level heterogeneities (which therefore also capture uncertainty regarding the macro outlook) confirms the preliminary results as regards the significant relationship between financing constraints and underinvestment. ([45])

Graph III.4: **Financing difficulties and the investment gap (1)**



(1) Median measure of financing difficulties obtained from an estimated probit model using SAFE data and median investment gap (a negative value is underinvestment).
Source: Orbis, DG ECFIN.

The analysis does not exclude the possibility that demand-related factors were also at play in the underinvestment observed in 2011 (e.g., vulnerable

([43]) For more details about the survey and for similar analysis of these data, see Holton, S., M. Lawless and F. McCann (2013): 'SME financing conditions in Europe: credit crunch or fundamentals?', *National Institute Economic Review*, Vol. 225(1), pp. R52-R67, and European Commission (2013d): 'Perceived access to bank loans for EU firms in times of crisis', *Product Market Review 2013*, pp. 94-110.

([44]) The very bad economic conditions prevailing in 2011 may also have led to a temporary undershooting of demand expectations that would be reflected in even lower investment.

([45]) For the detailed analysis see European Commission (2013b).

Member States firms' higher reluctance to take on debt in the current context, higher pessimism with respect to future economic conditions compared to official forecasts and corresponding uncertainty, or other frictions such as those affecting the labour market). Similarly, some of the correlation between firm underinvestment and the loan rejection probability may also reflect genuine differences in individual firms' risks that justify some of the loan rejections. Still, the above findings seem to point to the fact that inadequate financing could be among the binding constraints of the current resource reallocation process.

III.4. Concluding remarks

This chapter presents firm-level evidence that tradable sectors' relative investment has so far only partially responded to recent improvement in relative profitability compared to the non-tradable sector. The analysis shows that the low investment rates are even below what would be justified by currently weak firm-level fundamentals, controlling *inter alia* for firm indebtedness. Stated differently, two similarly performing companies, of similar size and indebtedness, operating in the same tradable industry, invest significantly differently if one is based in a vulnerable Member State and the other is not. The conditions at country level are therefore a significant determinant of current firm-level investment, in addition to firms' fundamentals.

Several alternative factors could explain the observed underinvestment in vulnerable economies. The analysis suggests that tight credit supply conditions are a statistically and economically significant predictor of underinvestment in tradables, after controlling for different expected profitability developments over the next three years, and for country-specific effects (e.g., covering aggregate uncertainty). Although the non-tradable sector is likely to face the same degree of financing difficulties, its general need to disinvest in the wake of the economic crisis makes the financing constraint somewhat less binding. ([46])

The results suggest that tight credit conditions possibly are among the factors that make the current rebalancing in vulnerable countries more protracted and more painful. Policies should focus on restoring lending to economically sound firms with viable investment projects, particularly in those vulnerable Member States where fragile banks exert a high level of conservatism on SME lending. Once lending to viable parts of the economy is restored, other measures such as re-aligned tax incentives (see next chapter) could further stimulate corporate investment activity in tradable industries.

([46]) See for example the discussion in Box I.2. in European Commission (2013e): 'European Economic Forecast, autumn 2013', European Economy 7/2013.

IV. Corporate taxation and the composition of capital ([47])

This chapter provides evidence on the responsiveness of investment to business tax incentives measured by the tax-adjusted user cost of capital. Departing from the existing empirical literature, which mostly looks at aggregate investment, it focuses on different types of capital assets. The study shows that when asset heterogeneity is explicitly accounted for, corporate taxation might not only have negative impacts on the level of investment, but also affect its composition, and thus, the composition of the aggregate capital stock. Given the magnitude of the estimated cost elasticity, and the substitution patterns across assets, the results suggest that high taxation at the margin might be particularly detrimental for investment in ICT capital, rather than in more traditional asset types, such as non-ICT equipment and buildings. All in all, the study corroborates the view that taxation may play a significant role at the current juncture in supporting the recovery by stimulating investment, particularly in capital assets that have a significant impact on growth.

Even in the context of large consolidation needs, several Member States have reduced corporate taxes after the crisis. Countries that have cut the statutory tax rate on corporate profits in the past three years include Denmark, Finland, Slovenia, Sweden and the United Kingdom. In addition to more generous treatment of R&D expenditure, other reforms include the introduction of special reliefs, and/or the outright increase of allowances and accelerated depreciation for investment in tangible and intangible assets (e.g. in Slovenia, Finland, Lithuania). ([48])

These tax incentives, often introduced on a temporary basis, are clearly aimed at stimulating corporate investment. Against this background, and in the light of the well-known impact of the structure of taxation on growth, this section looks at the effects of corporate taxation on new investment and, in particular, on the differentiated impact of corporate taxation on the composition of capital.

IV.1. Effects of corporate taxes on capital

The corporate tax code offers a range of incentives designed to encourage investment in new capital assets. That includes statutory corporate tax rates and various types of allowances, notably depreciation allowances. While the statutory tax rate applies uniformly to profits, different capital assets might be subject to specific taxes other than those falling on the corporate income they generate. For instance, in general, tangible assets might trigger liability to net wealth taxes, or real estate taxes might be applicable to commercial and industrial buildings.

In addition, depreciation allowances may play an important role in a differentiated impact of corporate taxation on various capital assets. In standard corporate income tax systems, assets with an estimated useful life longer than the taxable year benefit from depreciation allowances. In this case, depreciation allows for a portion of the investment costs to be deducted from corporate revenue. In general, it is not neutral with respect to investment decisions. In particular, the more closely fiscal depreciation approximates true economic depreciation, the lower the distortion it creates for the investment mix.

Depreciation deductions are specified according to the tax lifetime and the depreciation method. The recovery period specifies the number of years over which depreciation deductions can be claimed. It differs substantially across types of investments. The depreciation method specifies the annual amount of deduction. The most commonly used depreciation schedules are the straight line and the declining balance (often with the possibility of a switchover to straight line at some point in the asset lifetime). Under the straight line depreciation schedule, the stream of depreciation is constant over the lifetime of the asset. Under the declining balance system, the deduction decreases exponentially over the lifetime of the asset. As such, this method can be considered a specific type of accelerated depreciation.

Moreover, the tax code can reduce taxes on the gross stream of income by shortening tax lifetimes or increasing the speed of write-off over the given asset lifetimes, i.e. allowing for an accelerated rate of deduction relative to economic depreciation.

([47]) Section prepared by Serena Fatica.

([48]) See European Commission (2013), "Tax reforms in EU Member States 2013" and European Commission (2013), "Tax policy challenges for economic growth and fiscal sustainability".

Accelerated depreciation creates an investment subsidy by allowing for large deductions at the beginning of the asset life, such that firms can retain a larger part of the after-tax income early in the depreciation cycle of the asset. ([49]) Within a conventional corporate income tax system, this instrument is used to promote specific forms of investment (e.g. green technologies), or has been introduced at particular times on a temporary basis to stimulate investment. In a dynamic perspective, accelerated depreciation changes the tax burden on different vintages of the same capital asset type.

By offering tax relief for debt-financed investment, with full taxation of equity-financed investment, the tax code creates a wedge in the cost of investment, depending on the source of finance. In general, this might discourage investment, particularly for firms with limited access to bank finance. In addition, it can also affect the investment mix, as some capital assets (for instance long-lived and less specialised assets) can easily be pledged as collateral, whereas others with different economic characteristics would need to be largely financed from new equity or retained profits.

IV.2. Taxes and investment: a review of the literature

Understanding the effects of taxes on investment and capital accumulation in the long term is a key issue for policymakers, and has attracted much interest in the academic literature. While the theoretical literature supports significant effects, the available empirical evidence falls short of providing a conclusive answer on the nature and the magnitude of the impacts. ([50])

In the traditional approach dating back to Jorgenson (1963) and Hall and Jorgenson (1967), the effects of tax policy on investment demand are captured by the (tax-adjusted) user cost of capital. ([51]) Conceptually, it is the minimum pre-tax real rate of return needed for the marginal investment to generate a zero post-tax economic rent. Therefore, the net present value of depreciation allowances and the tax rate are important parameters in the determination of the user cost of capital. Formally, the user cost of capital is obtained in the maximisation process of the firm's net present value, whereby the optimal level of investment is chosen, subject to a standard neoclassical production function.

The econometric identification of the effect of the cost of capital on investment is hampered by several factors. For instance, in the presence of an upward sloping supply curve in the capital goods market, at least in the short run, prices, and not only quantities (investment), would react to increased demand for capital goods following a decrease in the cost of capital. ([52])

Moreover, the responsiveness of investment to changes in its user cost might be underestimated if the adjustment of capital stock is constrained by technological or market-originated reasons. Furthermore, measurement error in the user cost has been considered one of the main culprits for the small empirical elasticities. ([53])

Tackling these issues has enabled more recent studies to estimate statistically significant effects of user cost on investment. For instance, Caballero, Engel and Haltiwanger (1995) find that once the sluggish adjustment of capital stock is accounted for, the long-run elasticities of capital-to-output ratio with respect to the tax-adjusted user cost of capital are in the range of -0.01 to -2.0 for various sectors, with an average of about -1.0, which is consistent with the prediction from Hall and Jorgenson (1967). ([54])

Using tax reforms as natural experiments can arguably reduce measurement error problems. The underlying idea is that in most years, the tax component of the user cost may vary little. As a consequence, other factors, such as cyclical output

([49]) The declining balance method is an example of accelerated depreciation.

([50]) Comprehensive surveys of the literature can be found in Chirinko R.S. (1993), "Business fixed investment spending: a critical survey of modelling strategies, empirical results, and policy implications", *Research Working Paper,* Vol. 93-01; Chirinko R.S. (2008), "Sigma: the long and the short of it", *Journal of Macroeconomics*, Vol. 30(2), pp. 687-690; Hubbard, G. and K.A. Hassett (1997), "Tax policy and investment", in A.J. Auerbach, ed., *Fiscal policy: lessons from economic research*.

([51]) See Jorgenson, D.W. (1963), "Capital theory and investment behaviour", *American Economic Review*, Vol. 53, pp. 247-259; and Hall, R.E. and D.W. Jorgenson (1967), "Tax policy and investment behaviour", *American Economic Review*, 57(3), pp. 391-414.

([52]) Goolsbee, A. (1998), "Investment tax incentives, prices, and the supply of capital goods", *Quarterly Journal of Economics*, 113(1), pp. 121-148.

([53]) Goolsbee, A. (2000), "The importance of measurement error in the cost of capital", *National Tax Journal*, 53(2), pp. 215-228.

([54]) Caballero, R., E. Engel and J.C. Haltiwanger (1995), "Plant-level adjustment and aggregate investment dynamics", *Brookings Papers on Economic Activity, Economic Studies Program*, Vol. 26(2), pp. 1-54.

fluctuations, may have greater explanatory power for the variation in investment. However, during tax reform periods, the effect of tax policy changes may dominate and hence should make it easier to identify their impact on investment. Following this reasoning, Cummins, Hassett, and Hubbard (1994, 1996) estimate the elasticity of capital stock with respect to the user cost of capital at between -0.5 and -1.0 for the US. ([55]) They also find evidence of statistically significant investment responses to tax changes in several OECD countries during years of tax reform.

Panel data at the asset, firm or plant level has also been used to address the issue of measurement error, and to achieve significant variability to identify the effect. For example, using microdata at the firm level for the US economy, Chirinko, Fazzari and Meyer (1999) find that the elasticity of investment with respect to the user cost of capital is approximately -0.25. ([56]) More recently, evidence based on industry level data for OECD countries estimates elasticities around the neoclassical benchmark of -1. ([57])

As is apparent, existing empirical studies differ in terms of the nature of the data, the underlying theoretical model, and the econometric estimation strategy. While the choice between aggregate and micro-level data is often dictated by availability, particularly in the context of cross-country studies, it is also affected by the purpose of the research. For instance, exploring the heterogeneous responses of industries or firms with respect to tax policy changes requires less aggregated data.

Nevertheless, a potential drawback of using firm level data is that it may not fully reflect the aggregate capital accumulation process for the economy as a whole. Substitution between capital and labour may take the form of expansion or contraction of more or less capital-intensive firms, or entry and exit of more or less capital-intensive firms, as well as substitution within existing firms.

IV.3. Accounting for the heterogeneity of capital assets

Capital assets are clearly heterogeneous. One important implication is that different types of investment might react differently to the tax incentives provided by the tax code. For instance, unlike assets with a shorter lifetime, long-lived assets might react significantly to temporary tax incentives when investment is sufficiently forward looking. ([58])

The issue of capital asset heterogeneity has been largely ignored by the empirical literature on taxation and investment, with few exceptions, usually focusing on broad categories of assets, mostly structures (long-lived assets) and machinery (relatively short-lived assets). ([59]) The issue that capital heterogeneity might significantly bias estimates of the effect of user cost on investment has become apparent with the surge of ICT investment. Indeed, Tevlin and Whelan (2003) find that the bias is sizeable, whereby the estimated user cost elasticity, purged of the relative price effect, for computer investment is three times larger than estimates for non-computing equipment. ([60])

Acknowledging that capital assets are heterogeneous implies that tax policy might potentially affect not just the accumulation, but also the composition and the allocation of capital. As mentioned in the previous paragraph, this could reflect differences in cost elasticity across asset type, but also differences in the impact of taxation on the user cost of various asset types. Following the seminal work of Harberger (1966) on the losses caused by misallocation of capital across uses due to non-uniform capital income taxes, the literature has focused on measuring the macroeconomic

([55]) Cummins, J.G., K.A. Hassett, and R.G. Hubbard (1996), "Tax reforms and investment: a cross-country comparison", *Journal of Public Economics*, Vol. 62, pp. 237-273. Cummins, J.G., K.A. Hassett and R.G. Hubbard (1994), "A reconsideration of investment behaviour using tax reforms as natural experiments", *Brookings Papers on Economic Activity, Economic Studies Program,* Vol. 25(2), pp. 1-74.

([56]) Chirinko, R.S., S.M. Fazzari, and A.P. Meyer (1999), "How responsive is business capital formation to its user cost? An exploration with micro data", *Journal of Public Economics*, Vol. 74, pp. 53-80.

([57]) See Vartia, L. (2008), "How do taxes affect investment and productivity? An industry-level analysis of OECD countries", *OECD Economics Department Working Papers*, No 656; and, Bond, S. and J. Xing (2013), "Corporate taxation and capital accumulation: Evidence from sectoral panel data for 14 OECD countries", *Working Paper Centre for Business Taxation, Said Business School, University of Oxford*, 10/15.

([58]) House, C. and M.D. Shapiro (2008), "Temporary investment tax incentives: theory with evidence from bonus depreciation", *American Economic Review*, Vol. 93(3), pp. 737-768.

([59]) Papers include: Schaller, H. (2006), "Estimating the long-run user cost elasticity", *Journal of Monetary Economics*, Vol. 53, pp. 725-736; Bond, S. and J. Xing (2013), op. cit.; Ramirez Verdugo, A. (2005), "Tax incentives and business investment: new evidence from Mexico", *MPRA Paper 2272*.

([60]) Tevlin, S. and K. Whelan (2003), "Explaining the investment boom of the 1990s", *Journal of Money, Credit, and Banking*, Vol. 35(1), pp. 1-22.

effects of the user-cost differentials observed for the US economy. ([61])

Welfare costs of differential capital taxes across asset types were estimated in the range of 0.10% to 0.15 % of GNP assuming an aggregate Cobb-Douglas production technology. ([62]) Other estimates based on general equilibrium models find that the inter-asset distortions are larger than the inter-sectoral (corporate vs non-corporate) and inter-industry (within the corporate sector) distortions, although the relative size of the effects is shown to depend on the value of the asset substitution elasticities between capital assets. ([63]) While the simulations rely on ad hoc assumptions for such elasticities, a sensitivity analysis indicates that if these are sufficiently large (above 0.4 %), the welfare costs of inter-asset distortions are of the order of magnitude reported above. The Cobb-Douglas benchmark (which corresponds to an elasticity of substitution of 1) would yield instead somewhat larger welfare impacts (around 0.18 % of GNP).

From a methodological point of view, these results suggest that partial equilibrium analyses focusing on the corporate sector can provide insightful indications on the size of the distortions from differential capital taxation. The latter should also be taken into account, on top of the distortions on aggregate variables usually considered, when evaluating the overall effects of taxation.

A cross-country analysis with industry level data

New evidence on the responsiveness of investment to changes in the tax-adjusted user cost of capital is provided for manufacturing industries in a sample of EU countries over the period 1991-2007 ([64]) ([65]).

The data on real investment and on price indices is taken from the EU KLEMS database. ([66]) Four asset categories are considered: information and communication technology (ICT) capital; industrial structures (i.e. non-residential buildings); transportation equipment; and other machinery and equipment. The tax rules used to calculate the cost of capital (for new investment financed with retained earnings) are taken from ZEW (2013). ([67])

Table IV.1: **Effective marginal tax rates by asset type**

	mean	st. dev.
ICT assets	43.3	13.14
Structures	39.7	12.1
Other machinery and equipment	29.2	14.3
Transportation equipment	35.1	13.6

Source: DG ECFIN calculations, based on ZEW(2013).

Table IV.2: **Demand elasticities by asset type**

	elasticity	standard error
ICT assets	-1.18	(0.06)
Structures	-0.58	(0.10)
Other machinery and equipment	-0.91	(0.05)
Transportation equipment	-0.59	(0.26)

Source: DG ECFIN.

Table IV.1 reports the effective marginal tax rates on the different assets. They are derived directly from the tax-adjusted cost of capital (net of economic depreciation) as a measure of the distortions from taxation on the scale of the investment in the corresponding asset. ([68]) As is apparent, marginal tax rates vary significantly

([61]) Harberger, A.C. (1966), "Efficiency effects of taxes on income from capital", in M. Krzyzaniak, ed., *Effects of corporation income tax*, Wayne State University Press.

([62]) Auerbach, A.J. (1983), "Corporate taxation in the United States", *Brookings Papers on Economic Activity*, Vol. 14(2), pp. 451-514.

([63]) Auerbach, A.J. (1989), "The deadweight loss from 'non-neutral' capital income taxation", *Journal of Public Economics*, Vol. 40(1), pp. 1-36. Fullerton, D. and Y. Kodrzycki Henderson (1989a), "A disaggregate equilibrium model of the tax distortions among assets, sectors, and industries", *International Economic Review*, Vol. 30(2), pp. 391-413. Fullerton, D. and Y. Kodrzycki Henderson, (1989b), "The marginal excess burden of different capital tax instruments", *The Review of Economics and Statistics*, Vol. 71(3), pp. 435-442. Jorgenson, D.W. (1996), *Investment — Tax policy and the cost of capital,* Vol. 2, MIT University Press.

([64]) Some evidence for the US has been recently provided in Liu, L. (2011), "Do taxes distort corporations' investment choices? Evidence from industry-level data", paper presented at the AEA annual conference 2012.

([65]) The countries are: Austria, Denmark, Finland, France, Germany, Ireland, Italy, the Netherlands, Spain, and the United Kingdom.

([66]) A description of the EU KLEMS in provided in O'Mahony, M. and M.P. Timmer (2009), "Output, input and productivity measures at the industry level: the EU KLEMS database", *Economic Journal*, Vol. 119(538), F374-F403.

([67]) ZEW (2013), "Effective tax rates at the industry level using the Devereux-Griffith methodology", report for the European Commission, DG Taxation and Customs Union.

([68]) Efficiency in the allocation of capital requires that the additional wealth generated by acquiring a marginal unit of capital asset, net

Box IV.1: Estimating the demand for capital assets

A system of demand equations for the four types of capital assets has been derived from a translog variable cost function. The static version of the translog share equation model is:

$$s_{it} = b_i + \sum_j b_{ij} \ln c_{jt} + b_{iy} \ln y_t + b_{iT} T \qquad (1)$$

where s_{it} denotes the share of the of capital asset i in variable cost in period T, c_{jt} is the tax-adjusted user cost of capital, y_t is the level of output, and T is a time trend. This general formulation does not impose homotheticity, and permits non-neutral technical change. The system of share equations represented in 1) can be nested in a dynamic framework using the general first order dynamic model proposed by Anderson and Blundell (1982, 1983) (1). The dynamic system can be written compactly as:

$$\Delta S_t = \Gamma \Delta X_t - M\left(S_{t-1} - B(\Theta) X_{t-1}\right) + \varepsilon_t \qquad (2)$$

where ΔS_t is a vector of first differences of the shares equations, ΔX_t is a vector of first differences of the regressors in 1), excluding the constant terms X_{t-1}, is a vector of lagged values of all regressors, Γ and M are appropriately dimensioned matrices of short run coefficients, $B(\Theta)$ is a matrix of steady-state coefficients, that is the parameters in (1), and ε_t is the error term.

The formulation in (2) allows for fully interrelated adjustment in the capital assets. In other words, it assumes that all factors are subject to lagged adjustment, without requiring that certain assets be predetermined (quasi-fixed) with respect to others, and it allows for testing the hypothesis of instantaneous adjustment underlying the static model.

To avoid singularity of the covariance matrix stemming from the adding up conditions on the share equations, estimation requires deleting one equation. Also, the short run coefficients are not identified unless a priori restrictions are imposed on the relevant matrix. Therefore, the restriction M=mI is imposed. In addition, a more parsimonious specification is adopted by constraining the corresponding coefficients in the matrices Γ and $B(\Theta)$ to be equal, which makes the system in 2) equivalent to the autoregressive model proposed by Berndt and Savin (1975). (2)

The estimated long run user cost elasticities are reported in the table. Since for the translog cost function those elasticities depend on the share equations, the values reported are calculated for the cross-sectional average of the shares in 2007, the last year in the sample. Please write the text in here.>

(1) Anderson, G.J. and R.W. Blundell, (1982). Estimation and Hypothesis Testing in Dynamic Singular Equation Systems, Econometrica, 50, 1559-1571. Anderson, G.J. and R.W. Blundell, (1983). Testing Restrictions in a Flexible Dynamic Demand System: an Application to Consumers' Expenditure in Canada, Review of Economic Studies, 50, 397-410.

(2) Berndt, E.R. and N.E. Savin, (1975). Estimation and Hypothesis Testing in Singular Equation Systems with Autoregressive Disturbances, Econometrica, 43, 937-958.

across asset types, with ICT assets bearing the largest burden, partly reflecting the combined effect of tax depreciation allowances and very short economic life.

Elasticities with respect to the user cost of capital are estimated using a system of interrelated factor demand equations derived from a translog cost function (see box IV.1).

Own price elasticities are reported in table IV.2. In absolute value, they range from 0.58 for industrial

of depreciation, be the same for all assets. From that, the effective marginal tax rate can be calculated as the difference between the social return (that is, the tax-adjusted user cost net of economic depreciation) and the real rate of return in the absence of taxes, relative to the social return. The real return used in the calculation if fixed at 5%.

structures to 1.18 for ICT assets. This corroborates the view that investment in new technologies reacts more strongly to changes in its user cost compared to more traditional asset types.

Substitution elasticities are of crucial importance in assessing the impacts of tax policy on the investment mix. In the estimates (not reported), they are in the range of half a percentage point for the largest asset categories, i.e. ICT, structures and other machinery and equipment.

Overall, compared to a counterfactual benchmark where marginal tax rates are equalised across assets (and set equal to the average), the observed patterns would show, on average, under-investment in ICT capital and over-investment in other machinery and equipment in the sample.

IV.4.Conclusion

After reviewing the relevant literature, this chapter has provided additional evidence on the responsiveness of capital accumulation to changes in the tax-adjusted user cost of capital. It shows that when heterogeneity in the composition of aggregate capital is explicitly accounted for, the effects of the tax-adjusted user cost on investment are significant and quantitatively sizeable.

Given the estimated substitution patterns and the fact that the tax burden is not equally distributed among asset categories, corporate taxation potentially leads to significant distortionary effects on the allocation of business investment across asset types at the margin by breaching the principle of neutrality. General equilibrium results available in the literature quantify the cost of such distortions as non-negligible.

Although in practice many other factors, primarily technology constraints, prevent the capital input mix being freely readjusted in response to changes in relative prices, the results have important implications for policy-makers, as they suggest that tax incentives to stimulate business investment might have significant efficiency and welfare consequences due to changes in the composition of aggregate variables.

In a macroeconomic perspective, taxation may play a significant role at the current juncture in supporting the recovery by stimulating investment. This is all the more true when looking at disaggregated investment flows by asset types. In this respect, the contribution of corporate taxes to growth might be particularly significant via its impact on the accumulation of ICT capital.

V. Recent DG ECFIN publications

1. Occasional Papers

European Economy. Occasional Papers. 167. December 2013
Economic Adjustment Programme for Ireland - Autumn 2013 Review
http://ec.europa.eu/economy_finance/publications/occasional_paper/2013/pdf/ocp167_en.pdf

European Economy. Occasional Papers. 166. December 2013
Progress towards meeting the economic criteria for EU accession: the EU Commission's 2013 assessments
http://ec.europa.eu/economy_finance/publications/occasional_paper/2013/pdf/ocp166_en.pdf

European Economy. Occasional Papers. 165. November 2013
Romania: Balance-of-Payments Assistance Programme 2013-2015
http://ec.europa.eu/economy_finance/publications/occasional_paper/2013/pdf/ocp165_en.pdf

European Economy. Occasional Papers. 164. November 2013
The Economic Adjustment Programme for Portugal. Eighth and Ninth Review
http://ec.europa.eu/economy_finance/publications/occasional_paper/2013/pdf/ocp164_en.pdf

European Economy. Occasional Papers. 163. November 2013
Financial Assistance Programme for the Recapitalisation of Financial Institutions in Spain. Fourth Review – Autumn 2013
http://ec.europa.eu/economy_finance/publications/occasional_paper/2013/pdf/ocp163_en.pdf

European Economy. Occasional Papers. 162. October 2013
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http://ec.europa.eu/economy_finance/publications/economic_paper/2013/pdf/ecp507_en.pdf

3. Other publications

Product Market Review 2013 Financing the real economy
http://ec.europa.eu/economy_finance/publications/european_economy/2013/pdf/ee8_en.pdf

4. Regular publications

Business and Consumer Surveys (harmonised surveys for different sectors of the economies in the European Union (EU) and the applicant countries)
http://ec.europa.eu/economy_finance/db_indicators/surveys/index_en.htm

Business Climate Indicator for the euro area (monthly indicator designed to deliver a clear and early assessment of the cyclical situation)
http://ec.europa.eu/economy_finance/db_indicators/surveys/documents/2013/bci_2013_11_en.pdf

Key indicators for the euro area (presents the most relevant economic statistics concerning the euro area)
http://ec.europa.eu/economy_finance/db_indicators/key_indicators/index_en.htm

Monthly and quarterly notes on the euro-denominated bond markets (looks at the volumes of debt issued, the maturity structures, and the conditions in the market)
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http://ec.europa.eu/economy_finance/db_indicators/competitiveness/index_en.htm

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